

**GEOTECHNICAL DESIGN REPORT  
BOOM BRIDGE OVER BOOMBRIDGE BROOK, US ROUTE 2  
GREENBUSH, MAINE  
MAINEDOT WIN 21727.01, BRIDGE NO. 3587**

by Haley & Aldrich, Inc.  
Portland, Maine

for Fuss & O'Neill, Inc.  
Manchester, New Hampshire

File No. 127991-003  
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Attention: Shannon Beaumont  
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Subject: Geotechnical Design Report  
Boom Bridge over Boombridge Brook, US Route 2  
Greenbush, Maine  
MaineDOT WIN 21727.01, Bridge No. 3587

Ladies and Gentlemen:

We are pleased to submit herewith our report entitled, *Geotechnical Design Report, Boom Bridge over Boombridge Brook, US Route 2, Greenbush, Maine, MaineDOT WIN 21727.01, Bridge No. 3587*. This Geotechnical Design Report (GDR) has been prepared in accordance with our scope of work, dated 29 March 2021 and authorized by you on 1 June 2021.

## Project Understanding

The existing bridge carries US Route 2 (two lanes) over Boombridge Brook immediately east of the Penobscot River in the town of Greenbush, Maine, as shown in Figure 1. Based on our review of the historic bridge plans dated 1938 (refer to Appendix C) and reports provided by MaineDOT, the existing four-span bridge structure was constructed in 1938 with a length of approximately 100 feet (ft; centerline) and width of approximately 33 ft. Other historic documents indicate that the bridge was widened in 1958 and underwent superstructure repair around 1979. The bridge is supported on approximately 18-ft-tall abutments and 20-ft-tall piers consisting of cast-in-place concrete structures supported on end-bearing piles on bedrock.

The single-span replacement bridge is proposed along the existing bridge alignment. The proposed abutments will be located immediately behind the existing abutments.

## Horizontal Coordinate System and Elevation Datum

Plan locations of test borings are reported as northing and easting coordinates relative to the Maine State Plane Coordinate System, North American Datum of 1983 (NAD 83), Maine 2000 Central Zone

(refer to Table I). Elevations referenced herein are in feet and reference the North American Vertical Datum of 1988 (NAVD 88).

## **Geologic Setting**

The project site is located within what is known as the New England Physiographic Province (region). Mapped surficial geologic units within the region consist of stream alluvium, which was deposited along the banks of the Beach Bridge Brook and Penobscot River valleys. These recent stream deposits typically consist of sand, gravel, and silt and varying amounts of organics, although this unit was not encountered in the recent test borings. These alluvial deposits overlie marine deposits consisting of silt, clay, and sand sediments of the Presumpscot Formation. This formation overlies glacial till comprised of a heterogeneous mix of sand, silt, and gravel. Glacial till was deposited directly by glacial ice and overlies bedrock.

Bedrock at the site is mapped as Silurian to Ordovician age rocks of the Vassalboro Formation. This formation consists of metamorphic rocks of sedimentary origin. Phyllite was encountered in all recent test borings drilled at the site.

## **Subsurface Explorations**

### **HISTORIC EXPLORATIONS BY OTHERS**

Subsurface explorations are shown on the historic plans for the original construction of the bridge (refer to Appendix C). However, no subsurface exploration logs were provided beyond what is shown on the historical plans. Subsurface conditions on the historic drawings present bedrock varying from elevation (El.) 89.3 to El. 84.3. We note that the datum on the historic plan set is unknown.

### **PRELIMINARY DESIGN PHASE EXPLORATIONS BY HALEY & ALDRICH (PHASE I)**

Haley & Aldrich, Inc. (Haley & Aldrich) conducted a preliminary design phase geotechnical exploration program at the site. The test borings were drilled by New England Boring Contractors (NEBC) of Hermon, Maine. Boring locations were laid out in the field by Haley & Aldrich by taping/pacing distances from existing site features. "As-drilled" locations of the borings were determined in the field by MaineDOT using global positioning system (GPS) survey equipment. Coordinate location data and ground surface elevation at exploration locations are provided on individual test boring logs presented in Appendix A and are summarized in Table I. Boring locations are shown on Figure 2.

A total of three test borings (BB-GBB-101, BB-GBB-101A, and BB-GBB-102) were drilled immediately behind the existing abutments. The three test borings were drilled using a truck-mounted Mobile B53 drill rig. Test borings were drilled to depths ranging from 22.0 to 57.1 ft below ground surface (BGS) using 4.0-inch (in.; HW-size) inside diameter (ID) steel casing and telescoping 3.0-in. (NW-size) ID steel casing inside the HW-size casing. Soil samples were collected continuously through the fill (except BB-GBB-101A), and thereafter at standard 5-ft intervals. Soil samples were collected by driving a 1-3/8-in. ID split spoon sampler with a 140-lb hammer dropped from a height of 30 in., as indicated on

the test boring logs. Boring BB-GBB-101A was performed to attempt to gather additional samples and data on the marine clay deposit.

The number of hammer blows required to advance the sampler through each 6-in. interval was recorded and is provided on the test boring logs. The uncorrected SPT N-value is defined as the total number of blows required to advance the sampler through the middle 12 in. of the 24-in. sampling interval. The energy-corrected SPT N-value ( $N_{60}$ ) is equal to the uncorrected N-value multiplied by the hammer efficiency factor divided by 0.6 (i.e., 60 percent theoretical hammer efficiency). Both the raw blow count data and the corrected N-values are shown on the boring logs.

One relatively undisturbed sample of marine clay was obtained from test boring BB-GBB-102 at a depth from 25.0 to 27.0 ft BGS. The sample was collected by advancing a 3-in. OD thin-wall Shelby Tube into the clay using a piston sampler. In-situ vane shear tests were attempted in all three borings within the marine clay deposit, but the vane was not able to be pushed into the deposit.

Soil samples obtained in the fill during explorations were screened with a photoionization detector (PID) to assess the presence of volatile organic compounds (VOCs). No elevated PID readings were detected in screened soil samples collected from these explorations.

Bedrock core samples were obtained from borings BB-GBB-101 and BB-GBB-102 using a 2.0-in. (NQ-size) ID diamond-tipped core barrel. Approximately 16.7 ft (BB-GBB-101) to 19 ft (BB-GBB-102) of rock core was recovered at each boring. Refer to Appendix A for details and photographs of the bedrock core.

Drilling and sampling were performed in accordance with MaineDOT specifications. The drill rig was equipped with an automatic hammer per MaineDOT requirements (Appendix A of MaineDOT Geotechnical Drilling Contract Specifications, revised June 2007). A theoretical hammer efficiency factor of 0.677 was used for the automatic hammer system based on hammer calibration performed on 27 March 2017.

All soil and bedrock samples were classified in accordance with MaineDOT classification system and were preserved in glass jars and wooden boxes. The samples that were not submitted for laboratory testing are available for review upon request. Soil and bedrock samples are being stored at the Haley & Aldrich laboratory facility in Portland, Maine.

## **FINAL DESIGN PHASE EXPLORATIONS BY HALEY & ALDRICH (PHASE II)**

Haley & Aldrich completed a final design phase subsurface exploration program at the site in June 2021. The final design phase subsurface investigation consisted of two test borings, designated BB-GBB-201 and BB-GBB-202.

The final design phase test borings were laid out in the field by Haley & Aldrich by taping/pacing distances from existing site features prior to the start of drilling. "As-drilled" test boring locations and ground surface elevations were determined in the field by MaineDOT using GPS survey equipment upon the completion of drilling and were provided to Haley & Aldrich. The final design phase test boring locations and ground surface elevations are summarized in Table I and are shown on Figure 2.

The final design phase borings were drilled by NEBC of Hermon, Maine using a Mobile Drill B-53 track-mounted drill rig. Test borings were advanced to depths ranging from approximately 42.3 to 45.0 ft BGS using similar means and methods to those used to drill the preliminary design phase test borings with the exception of telescoping casing. The hammer efficiency factor for the automatic hammer used was 0.867 (86.7 percent theoretical hammer efficiency) as shown on the test boring logs.

In-situ vane shear tests were typically conducted within the marine clay deposit in each test boring. Vane shear tests were conducted with a 55-millimeter (mm) by 110-mm Geonor rectangular vane attached to a 2-ft-long, 12-mm-diameter rod extension, attached to a string of 5/8-in. outside diameter (OD) hollow chrome-moly rods. At each in-situ vane shear test location, the vane was pushed (by hand) until the bottom of the vane was approximately 1 to 2 ft below the bottom of the borehole. The vane was then rotated at a rate of about 90 degrees per minute using a calibrated torque wrench. Results of the vane shear testing, including raw torque values and calibrated shear strengths, are provided on the individual test boring logs in Appendix A.

A total of three relatively undisturbed samples of marine clay were obtained from test borings BB-GBB-201 and BB-GBB-202. The samples were obtained by advancing a 3-in. OD thin-wall Shelby tube into the clay using a piston sampler.

Soil samples obtained in the fill during explorations were screened with a PID to assess the presence of VOCs. No elevated PID readings were detected in screened soil samples collected from these explorations.

Test borings were advanced approximately 10 ft into bedrock using a 2.0-in. (NQ-size), diamond-tipped core barrel.

Soil and bedrock samples were collected and preserved in glass jars and wooden boxes, respectively. The soil and bedrock samples that were not submitted for laboratory testing are currently being stored at the Haley & Aldrich laboratory facility in Portland, Maine and are available for review upon request.

All final design phase drilling and sampling activities were performed in accordance with MaineDOT requirements.

## **Generalized Subsurface Conditions**

The subsurface conditions encountered at the site consist of the following geologic units presented in order of increasing depth below ground surface: bituminous concrete, fill, marine silt deposit, marine clay deposit, glacial till, weathered bedrock, and bedrock. Refer to Table II for a summary of the soil units and bedrock encountered thicknesses at each test boring location. A general description of each soil unit and bedrock is provided separately, below. Detailed soil and bedrock descriptions are provided on the test boring logs in Appendix A.

| Geologic Unit       | Approximate Encountered Thickness (ft)                                                                                                                                                                                                                  | Generalized Description                                                                                                                                                                                                                                                                               |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bituminous Concrete | 0.6 to 1.0 ft                                                                                                                                                                                                                                           | <i>(encountered in test borings BB-GBB-101, BB-GBB-102, BB-GBB-201, and BB-GBB-202)</i>                                                                                                                                                                                                               |
| Fill                | 13.4 to 17.3                                                                                                                                                                                                                                            | Very loose to very dense fine to coarse SAND with varying amounts of gravel, silt, and clay (SW, SP, SM, SC, SP-SM); very soft SILT with some fine sand and trace clay (ML); and/or very loose clayey GRAVEL with little sand (GC-GM).<br><i>(encountered in each test boring except BB-GBB-101A)</i> |
| Marine Silt Deposit | 4.5                                                                                                                                                                                                                                                     | Medium stiff SILT with trace fine sand (ML).<br><i>(encountered in test boring BB-GBB-102)</i>                                                                                                                                                                                                        |
| Marine Clay Deposit | 8.8 to 13.7                                                                                                                                                                                                                                             | Soft to stiff silty CLAY with varying amounts of wood fragments (wood fragments encountered in borings BB-GBB-101 and BB-GBB-202) and fine sand (CL).<br><i>(encountered in each test boring)</i>                                                                                                     |
| Glacial Till        | 2.9 to 8.6                                                                                                                                                                                                                                              | Dense to very dense fine to coarse SAND with varying amounts of silt and gravel (SW).<br><i>(encountered in each test boring except BB-GBB-101A)</i>                                                                                                                                                  |
| Weathered Bedrock   | 1.1 to 2.2                                                                                                                                                                                                                                              | <i>(encountered in test borings BB-GBB-102, BB-GBB-201, and BB-GBB-202)</i>                                                                                                                                                                                                                           |
| Bedrock             | Top of bedrock surface encountered at depths ranging from approximately 32.5 to 38.1 ft BGS (El. 87.0 to El. 81.7) and slopes slightly upward from north to south and from west to east.<br><i>(encountered in each test boring except BB-GBB-101A)</i> |                                                                                                                                                                                                                                                                                                       |

Please note that the soil and bedrock descriptions provided on the test boring logs and summarized below do not represent actual field conditions other than at the specific test boring locations. The actual conditions will vary from those described and shown herein.

## BEDROCK CONDITIONS

Approximately 10 to 19 ft of bedrock was cored in the test borings. The sampled and recovered bedrock generally consisted of the following:

- Moderately hard to hard, fresh to moderately weathered, olive-grey to green, aphanitic, PHYLLITE, joints dipping at horizontal (secondary joints) to vertical (primary joints) angles very to moderately closely spaced, tight to open, smooth to rough, planar to undulating with calcite veins.

Rock quality designation (RQD) is a common parameter that is used to help assess the competency of sampled bedrock. RQD is defined as the sum of pieces of recovered bedrock greater than 4 in. in length divided by the total length of the bedrock core run. RQD values for the PHYLLITE encountered in the test borings drilled at the site ranged from 0 to 100 percent (average = 68 percent), indicating variable rock quality; from very poor to excellent.

Detailed bedrock core data and descriptions are provided on the logs in Appendix A. In addition, photographs of the recovered bedrock core samples are provided for reference in Appendix A.

## WATER ELEVATIONS

Water was observed during drilling at depths of 10.0 ft (El. 109.8), 8.3 ft (El. 111.7), and 13.4 ft (El. 106.1) in borings BB-GBB-102, BB-GBB-201, and BB-GBB-202 respectively. Water was not observed in BB-GBB-101. Groundwater levels can be expected to fluctuate, subject to seasonal variation, river levels, topography, and precipitation. Water levels encountered during construction may differ from those observed in the test borings or observation wells.

Flood levels in the brook, as provided by Fuss & O'Neill, are summarized below.

| Discharge                           | Headwater<br>(ft, NAVD 88) |
|-------------------------------------|----------------------------|
| Q <sub>1.1</sub>                    | El. 105.7                  |
| Q <sub>25</sub> without backwater   | El. 106.9                  |
| Q <sub>25</sub> on Penobscot River  | El. 122.0                  |
| Q <sub>50</sub> without backwater   | El. 107.1                  |
| Q <sub>50</sub> on Penobscot River  | El. 123.6                  |
| Q <sub>100</sub> without backwater  | El. 107.3                  |
| Q <sub>100</sub> on Penobscot River | El. 125.0                  |

## Laboratory Testing Program

Phase I and Phase II laboratory testing programs were conducted by Haley & Aldrich on representative soil and rock samples collected during the preliminary and final design phase subsurface exploration programs to aid in soil classification and estimation of engineering soil and rock properties. Laboratory testing was performed in accordance with applicable ASTM International (ASTM) testing procedures by GeoTesting Express, Inc. of Acton, Massachusetts. A summary of the lab testing results is provided below.

### Grain Size Analyses

| Test Boring No. | Soil Sample No. | Sample Depth (ft) | Percent Finer than #200 Sieve (%) | USCS Classification | Strata      |
|-----------------|-----------------|-------------------|-----------------------------------|---------------------|-------------|
| BB-GBB-101      | 4D              | 8.0 to 10.0       | 38                                | SM                  | Fill        |
| BB-GBB-101      | 5D              | 13.0 to 15.0      | 38                                | SM/SC               | Fill        |
| BB-GBB-102      | 5D              | 10.0 to 12.0      | 33                                | SM                  | Fill        |
| BB-GBB-102      | 6D              | 15.0 to 17.0      | 99                                | ML                  | Marine Silt |
| BB-GBB-201      | 4D              | 8.0 to 10.0       | 42                                | SM                  | Fill        |
| BB-GBB-201      | 5D/B            | 10.0 to 12.0      | 36                                | SM                  | Fill        |
| BB-GBB-202      | 4D              | 8.0 to 10.0       | 39                                | SM                  | Fill        |
| BB-GBB-202      | 5D              | 10.0 to 12.0      | 28                                | SM                  | Fill        |

Note: USCS = Unified Soil Classification System

### Atterberg Limits

| Test Boring No. | Soil Sample No. | Sample Depth (ft) | Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index | USCS Classification | Strata      |
|-----------------|-----------------|-------------------|----------------------|--------------|---------------|------------------|---------------------|-------------|
| BB-GBB-101      | 9D              | 25.0 to 27.0      | 30                   | 37           | 20            | 17               | CL                  | Marine Clay |
| BB-GBB-102      | 7D              | 20.0 to 22.0      | 35                   | 46           | 22            | 24               | CL                  | Marine Clay |
| BB-GBB-201      | 1U              | 22.0 to 24.0      | 33                   | 41           | 23            | 18               | CL                  | Marine Clay |
| BB-GBB-202      | 2U              | 27.0 to 29.0      | 24                   | 26           | 18            | 8                | CL                  | Marine Clay |

### Consolidated Undrained Triaxial

| Test Boring No. | Soil Sample No. | Sample Depth (ft) | $s_u$ (psf) | Initial Void Ratio | Initial Moisture Content (%) | $\gamma_T$ (pcf) | USCS Classification | Strata      |
|-----------------|-----------------|-------------------|-------------|--------------------|------------------------------|------------------|---------------------|-------------|
| BB-GBB-201      | 1U              | 22.0 to 24.0      | 1422        | 0.903              | 33                           | 119              | CL                  | Marine Clay |
| BB-GBB-202      | 2U              | 27.0 to 29.0      | 1005        | 0.769              | 24                           | 119              | CL                  | Marine Clay |

Notes: psf = pounds per square foot; pcf = pounds per cubic foot;  $s_u$  = undrained shear strength;  $\gamma_T$  = total unit weight

### One-Dimensional Consolidation

| Test Boring No. | Soil Sample No. | Sample Depth (ft) | $P_p$ (tsf) | RR    | CR    | $\gamma_T$ (pcf) | USCS Classification | Strata      |
|-----------------|-----------------|-------------------|-------------|-------|-------|------------------|---------------------|-------------|
| BB-GBB-201      | 1U              | 22.0 to 24.0      | 6.21        | 0.019 | 0.113 | 116              | CL                  | Marine Clay |
| BB-GBB-202      | 2U              | 27.0 to 29.0      | 3.12        | 0.010 | 0.079 | 127              | CL                  | Marine Clay |

Notes: tsf = tons per square foot; pcf = pounds per cubic foot;  $P_p$  = pre-consolidation pressure; RR = recompression ratio; CR = compression ratio;  $\gamma_T$  = total unit weight

### Rock Core Testing

| Test Boring No. | Rock Core No. | Sample Depth (ft) | Peak Compressive Stress (psi) | Young's Modulus (psi)   |
|-----------------|---------------|-------------------|-------------------------------|-------------------------|
| BB-GBB-101      | R2            | 40.6 to 40.99     | 21,091                        | 9,550,000 to 10,700,000 |
| BB-GBB-102      | R2            | 40.5 to 40.88     | 9,789                         | 8,890,000 to 12,200,000 |

Complete laboratory test results are provided in Appendix B.

## Geotechnical Design Recommendations

Geotechnical design recommendations, as discussed and provided herein, were developed in accordance with the following documents:

- AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications, Ninth Edition, 2020, referred to herein as AASHTO LRFD;
- AASHTO Guide Specifications for LRFD Seismic Bridge Design, Second Edition, 2011, referred to herein as Guide Specifications; and
- MaineDOT Bridge Design Guide (BDG), August 2003, with Interim Revisions through June 2018, referred to herein as Bridge Design Guide.

Engineering calculations that support the design recommendations outlined in this GDR are provided for reference in Appendix D.

### SEISMIC DESIGN/LIQUEFACTION CONSIDERATIONS

Site class was determined in accordance with AASHTO LRFD Section 3.10.3.1 using Methods B and C. In instances where SPT N-values were equal to 0 (i.e., weight of rod or weight of hammer), were greater than 100 blows per foot (bpf) or where bedrock was present, default values of 1 and 100 blows per foot (bpf) were used, respectively. Laboratory testing and/or field shear vanes were used for the undrained shear strength ( $S_u$ ) values for cohesive samples in Method C.

Based on the nature and thickness of the overburden soils and depth to bedrock at the site, as determined from the test borings, we recommend the site be considered "Site Class D." Spectral accelerations were determined based on the geographic site location and the recommended "Site Class D" designation using the United States Geological Survey (USGS) Seismic Design Web Service, which is based on the AASHTO-recommended response spectra for a 7 percent probability of exceedance in 75 years (approx. 1,000-year return period). The recommended seismic design parameters are summarized below.

| Design Parameter                                                                                      | Design Value |
|-------------------------------------------------------------------------------------------------------|--------------|
| Site factor for short-period range of acceleration response spectrum, $F_a =$                         | 1.6          |
| Site factor for long-period range of acceleration response spectrum, $F_v =$                          | 2.4          |
| Site factor at zero-period on acceleration response spectrum, $F_{pga} =$                             | 1.6          |
| Horizontal response spectral acceleration coefficient at 0.2-s period on rock, $S_s (g) =$            | 0.15         |
| Horizontal response spectral acceleration coefficient at 1.0-s period on rock, $S_1 (g) =$            | 0.045        |
| Peak seismic ground acceleration coefficient on rock, $PGA (g) =$                                     | 0.07         |
| Horizontal response spectral acceleration coefficient at 0.2-s period modified by $F_a, S_{D5} (g) =$ | 0.24         |
| Horizontal response spectral acceleration coefficient at 1.0-s period modified by $F_v, S_{D1} (g) =$ | 0.108        |
| Peak seismic ground acceleration coefficient modified by $F_{pga}, A_s (g) =$                         | 0.111        |

In accordance with AASHTO LRFD Section 3.10.6, the site falls within Seismic Zone 1 based on the calculated value of  $S_{D1}$  (i.e.,  $S_{D1} < 0.15 =$  Seismic Zone 1 from AASHTO LRFD Table 3.10.6.1).

In accordance with AASHTO LRFD Section 4.7.4.2, single-span bridges do not require seismic loads to be analyzed. However, we recommend that the requirements for superstructure connections and support lengths shall still apply in accordance with the requirements of AASHTO LRFD Sections 4.7.4.4 and 3.10.9.

The liquefaction susceptibility of the granular soils at the site was determined by calculating the ratio between the cyclic resistance ratio (CRR) of the in-situ soils at each sample location and equivalent uniform cyclic stress ratio (CSR) imposed by the design earthquake. This ratio was modified using a magnitude scaling factor (MSF) to account for earthquake magnitudes different from M 7.5 to obtain the factor of safety against liquefaction. Liquefaction of the in-situ granular soils will likely occur when the factor of safety is less than 1.0.

CRR is a function of clean sand-corrected SPT N-value, (N1)60-CS following the simplified methodology outlined by Youd and Idriss (2001). The CRR was estimated using raw SPT N-values that were corrected for various effects including overburden pressure, hammer energy, borehole diameter, drill rod length, sampling method, and fines content (estimated from field samples or obtained from the laboratory test results, where available). In cases where laboratory grain size analyses were available, that data was used in lieu of field observations/soil classifications made during drilling. Since the CRR calculated from (N1)60-CS using the simplified methodology is based on a M 7.5 earthquake, the CRR must be corrected to the design earthquake magnitude (M 5.6; see below) using the MSF (equal to 2.11).

The magnitude (M) for the design earthquake used to assess liquefaction susceptibility at the site was determined from earthquake deaggregation data obtained from the USGS in accordance with AASHTO Guide Specification Section 6.8. This data is based on a seismic event (earthquake) having a 7 percent probability of exceedance in 75 years (approximate 1,000-year return period). Based on our review of the USGS deaggregation data, we judged that the modal magnitude earthquake (M 5.6) was appropriate

for use in assessing liquefaction susceptibility for this site based on the large number of earthquakes that are significant to the deaggregation.

Since liquefaction is considered at the Extreme Event Limit State and AASHTO LRFD specifies that the overall goal in designing for any extreme event is to prevent structure collapse and protect life safety, calculated factors of safety greater than 1.0 are considered acceptable.

Based on the simplified liquefaction evaluation using the data from the recent borings, it is our opinion that the site soils are not liquefaction susceptible. The factor of safety in the samples from all the borings ranged from 2.0 to 5.6.

### APPROACH EMBANKMENTS

Subsurface soil conditions along the proposed bridge approach roadway alignment have the potential to affect the planning and design of the proposed embankments. Approximately 3.5 ft of fill will be required to meet proposed finish grades. Global embankment stability and settlement analyses were conducted to assess the feasibility of constructing the approach embankments using normal weight fill over the existing soils present at the site. The results of global embankment stability and settlement evaluations are discussed in the sections below.

#### Global Embankment Stability

A series of computer-assisted, two-dimensional global stability evaluations were performed using the computer program Slide2 by Rocscience to evaluate the likelihood of global stability failures at the site.

Static and pseudo-static seismic (pseudo-static) global stability evaluations were conducted transverse to the proposed bridge at Station 104+75 and longitudinal to the proposed bridge at Station 105+00 on the Abutment 1 side (south side).

Typical soil profiles were developed based on the subsurface conditions encountered in the Phase I and Phase II test borings completed at the site. Based on the nature and consistency of the collected soil samples and the SPT N-values measured during soil sampling, the following physical and strength properties were used to complete the global stability evaluations:

| Material           | Unit Weight<br>(pcf) | Friction Angle<br>(degrees) | Undrained<br>Shear Strength<br>(psf) |
|--------------------|----------------------|-----------------------------|--------------------------------------|
| Granular<br>Borrow | 125                  | 32                          | 0                                    |
| Riprap             | 140                  | 45                          | 0                                    |
| Existing Fill      | 120                  | 28                          | 0                                    |
| Marine Deposit     | 115                  | 0                           | 815                                  |
| Glacial Till       | 130                  | 36                          | 0                                    |
| Bedrock            | 160                  | infinite strength           |                                      |

In addition, a 250 psf live load surcharge (traffic) was assumed to act over the embankment width in both models (static and pseudo-static).

Please note that the factor of safety for the pseudo-static load case was calculated using a horizontal acceleration coefficient,  $k_h$ , of 0.0555 g (i.e., one-half of the acceleration coefficient,  $A_s$ ). A value of  $A_s/2$  was selected in accordance with AASHTO LRFD guidance in Section 11.6.5.2.2. The reduction from  $A_s$  is due to soil slope flexibility and the peak ground acceleration during an earthquake lasts only for a very short period of time.

The calculated global stability factors of safety values are summarized below.

| Type of Stability Analysis | Calculated Factor of Safety <sup>1</sup> |                              |
|----------------------------|------------------------------------------|------------------------------|
|                            | Station 105+00<br>Longitudinal           | Station 104+75<br>Transverse |
| Static                     | 1.4                                      | 1.3                          |
| Pseudo-Static              | 1.2                                      | 1.1                          |

Note:

<sup>1</sup> Calculated factors of safety shown for Spencer method of analysis.

The slope stability software used for these analyses models the approach embankments as an infinitely wide embankment. Since the embankments have finite width, it is our opinion that the calculated factors of safety summarized above are conservative. Therefore, actual factors of safety for a three-dimensional model would be somewhat higher than those presented above.

The minimum required factor of safety as specified by AASHTO LRFD is 1.3 for embankments under static conditions where subsurface conditions are well defined. The minimum required factor of safety for embankments subjected to pseudo-static loading is 1.1 in accordance with FHWA GEC No. 3 (FHWA-NHI-11-032).

We conclude that proposed embankment construction using normal-weight fill will have acceptable global stability factors of safety.

### Elastic and Consolidation Settlement

Settlement due to the placement of fill for the approach embankments was evaluated using the computer software program Settle3 5.0 by Rocscience. Results of the settlement analyses are summarized below:

| Location   | Elastic Settlement (in.) | Primary Consolidation Settlement (in.) | Secondary Consolidation Settlement (in.) | Total Settlement <sup>1</sup> (in.) |
|------------|--------------------------|----------------------------------------|------------------------------------------|-------------------------------------|
| Abutment 1 | 0.3                      | 0.4                                    | 0.1                                      | 0.8                                 |
| Abutment 2 | 0.1                      | 1.2                                    | 0.1                                      | 1.4                                 |

Note:

<sup>1</sup> Total settlement considers immediate, primary consolidation, and secondary consolidation settlement.

Based on the results of the stability and settlement evaluations, it is our opinion that the proposed approach embankments can be constructed conventionally using normal weight fill.

### BRIDGE FOUNDATION DESIGN RECOMMENDATIONS

The subsurface conditions encountered in the test borings primarily consist of existing fill, marine silt, marine clay, glacial till, and weathered rock overlying bedrock. The glacial till, weathered rock, and bedrock are considered suitable for support of the bridge superstructure. Based on the depth to the suitable foundation bearing strata and the subsurface data available, we consider piles driven to refusal on bedrock to be the most feasible foundation alternative. Piles would be approximately 25 to 30 ft long and driven through the overburden soils, including about 5 to 7 ft of existing fill, about 12 ft of marine silt or clay, 3 to 6 ft dense glacial till, and 1 to 3 ft of weathered rock.

### BRIDGE ABUTMENT FOUNDATION SUPPORT

Based on our discussions with Fuss & O'Neill, it is our understanding that the preferred bridge abutment foundation support alternative consists of HP14x89 or HP14x117 steel H-piles (H-piles). As discussed below and based on the subsurface conditions present at the site, the H-piles will likely need to be driven through the marine clay and glacial till strata to gain the majority of their resistance through end bearing in/on bedrock. Additional H-pile evaluations and recommendations are provided below.

### Downdrag

Downdrag occurs due to relative vertical displacement between a pile and the surrounding soil. In accordance with AASHTO LRFD Section 3.11.8, where the relative displacement exceeds 0.4 in., downdrag is likely to be fully developed. As discussed above, 0.8 to 1.4 in. of post-construction settlement is anticipated; therefore, full mobilization of downdrag forces on the piles is anticipated. For the downdrag evaluations, the pile displacement was assumed to be zero (i.e., end-bearing piles with no elastic pile compression). We have estimated that the pile-soil relative displacement exceeds 0.4 in. along the upper approximately 19 ft (Abutment 1) to 18 ft (Abutment 2) of the pile located below the bottom of the abutment pile cap to the bottom of the marine clay. Therefore, downdrag was assumed to be fully mobilized in those zones. The downdrag load was calculated using static analysis methods and the load factors shown below. The Beta method was used in cohesive and in cohesionless soils in accordance with guidance provided in AASHTO LRFD. The calculated downdrag loads are summarized in below.

| Substructure Location | Load Factor     | HP14x89 Factored Downdrag Load (kips) <sup>1</sup> | HP14x117 Factored Downdrag Load (kips) <sup>1</sup> |
|-----------------------|-----------------|----------------------------------------------------|-----------------------------------------------------|
| Abutment 1            | 1.05 (granular) | 26                                                 | 26                                                  |
| Abutment 2            | 1.40 (cohesive) | 23                                                 | 24                                                  |

Notes:

<sup>1</sup> The "box" area of the H-pile was used to compute the surface area of the pile subjected to downdrag loading.

## Corrosion and Deterioration

The geotechnical engineering design of the proposed piles included consideration of corrosion in accordance with AASHTO LRFD Section 10.7.5. Based on our visual review of the soil samples and our experience on similar projects with similar soil conditions, it is our opinion that the in-situ soils have low corrosive potential. Therefore, the net factored pile resistance recommended in the following sections of this GDR does not include a reduction in pile cross-sectional area for steel degradation.

## Axial Compression Pile Resistance

As discussed previously, it is our opinion that based on the subsurface soil conditions present at the site, the abutment piles will be driven to/into bedrock and resistance provided through predominantly a combination of skin friction in the glacial till stratum and end bearing resistance in bedrock.

## Structural Resistance

The structural axial resistance of the HP14x89 and HP14x117 steel H-piles was calculated in accordance with AASHTO LRFD Sections 6.9.2 and 6.9.4. The structural resistance factor (Section 6.5.4.2) for axial resistance of piles in compression and subject to damage due to severe driving where use of a pile tip is necessary is 0.50. In addition, resistance factors for Service and Extreme Limit State loading are 1.0. Therefore, the nominal and factored structural resistances of the HP14x89 and HP14x117 steel H-pile sections (with  $F_y = 50$  ksi) at the Service, Strength, and Extreme Event Limit States for the proposed substructures (Abutment No. 1 and Abutment No. 2) are summarized below.

| Steel H-pile Section | Nominal Structural Resistance (kips) | Factored Structural Resistance (kips) |                                      |                                    |
|----------------------|--------------------------------------|---------------------------------------|--------------------------------------|------------------------------------|
|                      |                                      | Service Limit State ( $\phi=1.0$ )    | Strength Limit State ( $\phi=0.50$ ) | Extreme Limit State ( $\phi=1.0$ ) |
| HP14x89              | 1,305                                | 1,305                                 | 652                                  | 1,305                              |
| HP14x117             | 1,720                                | 1,720                                 | 860                                  | 1,720                              |

We note that the structural resistance calculated only addresses axial resistance. If the piles are subjected to lateral loads, then the structural resistance under combined axial load and flexure should also be evaluated by others. The unbraced length used in the evaluation above from Sections 6.9.2 and 6.9.4 was assumed to be zero.

### Drivability Resistance

The engineering design of the proposed abutment piles also included consideration of drivability resistance in accordance with AASHTO LRFD Section 10.7.8. The drivability evaluations were conducted using the computer program GRL WEAP 14 developed by GRL Engineers, Inc. The drivability analyses were conducted to determine the following: 1) if the piles could be impact driven through the stiff to hard/very dense glacial till to bedrock; and 2) what nominal resistance could be achieved using hammer sizes typically used by local pile driving contractors without damaging or overstressing the piles while keeping the penetration resistance below 15 blows per inch (bpi), which is the upper limit of penetration resistance allowed by MaineDOT.

The drivability evaluations were conducted assuming that a Delmag D15 single acting diesel hammer with a maximum rated energy equal to 27 kip-ft will be used to install the piles. Drivability evaluations were completed at each proposed substructure location based on the subsurface conditions present at the site. The drivability resistances for the HP14x89 and HP14x117 steel H-piles at each substructure location are summarized below.

| Substructure Location | Steel H-pile Section | Drivability Resistance (kips) |                                |
|-----------------------|----------------------|-------------------------------|--------------------------------|
|                       |                      | Nominal                       | Factored ( $\phi_{dyn}=0.65$ ) |
| Abutment 1            | HP14x89              | 1004                          | 652                            |
| Abutment 2            |                      |                               |                                |
| Abutment 1            | HP14x117             | 1323                          | 860                            |
| Abutment 2            |                      |                               |                                |

We note that based on our drivability evaluation the piles will be able to drive through the overburden soils without exceeding the AASHTO LRFD limit of 45 kips per square inch (ksi; 90 percent of  $F_y$  for 50 ksi steel piles) and the MaineDOT penetration resistance limit of 15 bpi. The piles will encounter refusal on bedrock and will achieve the nominal drivability resistance noted above.

Please keep in mind that the drivability resistances summarized above are based on an assumed pile hammer size, assumed hammer efficiency, hammer assembly, and the assumption that the piles penetrate through the entire soil overburden and end bear in/on bedrock. If the actual, factored axial compressive pile loads vary or if the actual pile-hammer system used to install the piles is different than the assumed system, additional evaluations will be required to determine the nominal and factored drivability resistances that can be achieved at a reasonable penetration resistance without overstressing the piles.

### Summary and Recommended Axial Compressive Pile Resistance

The factored axial compressive pile resistance is controlled by the lesser of the Strength Limit State drivability and structural resistances since the piles will be installed using impact hammers and the

minimum nominal resistance will be confirmed using dynamic testing. The abutment factored resistances (structural and drivability) are summarized below.

| Substructure Location | Steel H-pile Section | Factored Structural Resistance (kips) | Factored Drivability Resistance (kips) | Governing Factored Resistance (kips) | Factored Downdrag Load (kips) | Net Factored Resistance (kips) |
|-----------------------|----------------------|---------------------------------------|----------------------------------------|--------------------------------------|-------------------------------|--------------------------------|
| Abutment 1            | HP14x89              | 652                                   | 652                                    | 652                                  | 26                            | 626                            |
| Abutment 2            |                      |                                       |                                        |                                      | 23                            | 629                            |
| Abutment 1            | HP14x117             | 860                                   | 860                                    | 860                                  | 26                            | 834                            |
| Abutment 2            |                      |                                       |                                        |                                      | 24                            | 836                            |

### Pile Embedment, Spacing, Clearance, and Pile Material

We recommend that minimum pile spacing, clearance, and embedment (into the abutment pile caps) meet the requirements of AASHTO LRFD Section 10.7.1.2. We also recommend that the piles be equipped with a pile tip in accordance with MaineDOT Standard Specification 501.048. Based on the potential for hard driving and sloping bedrock, we recommend the pile tip consist of a HP-77750-B manufactured by Associated Pipe & Fitting, or equivalent, fabricated from cast steel conforming to ASTM A148 Grade 90/60.

### Estimated Pile Lengths

As stated above, abutment piles will be driven to/into bedrock and the axial compressive pile resistance provided through a combination of side frictional resistance in the glacial till stratum and end bearing resistances in bedrock. Based on the proposed top of pile elevation and the variation in the top of bedrock surface across each abutment, recommended pile lengths delivered to the site are summarized below.

| Substructure Location | Proposed Top of Pile Elevation (ft, NAVD 88) | Est. Top of Bedrock Elevation (ft, NAVD 88) | Est. Pile Tip Elevation (ft, NAVD 88) | Approximate In-Place Pile Length (ft) | Recommended Delivered Pile Length (ft) |
|-----------------------|----------------------------------------------|---------------------------------------------|---------------------------------------|---------------------------------------|----------------------------------------|
| Abutment 1            | 112                                          | 87.0 to 86.7                                | 86.0 to 85.7                          | 26.0 to 26.3                          | 35                                     |
| Abutment 2            | 111                                          | 84.6 to 81.7                                | 83.6 to 80.7                          | 26.4 to 29.3                          | 35                                     |

Please note that the recommended delivered pile lengths presented above do not account for an additional pile length, equal to three pile diameters or 5 ft, whichever is greater to accommodate dynamic pile load test instrumentation that is required by Standard Specification Section 501.046 Dynamic Pile Tests. As stated in the following sections of this report, we recommend that a minimum of two piles at each abutment, located on opposite ends of each abutment, be dynamically tested during construction.

### Lateral Pile Resistance

At the request of Fuss & O'Neill, Haley & Aldrich developed soil profiles and soil and rock properties at the abutments for Fuss & O'Neill's use in lateral pile evaluations and bridge modeling. The recommended soil profiles and soil and rock properties at the retained side and stream side are summarized below.

#### Retained Side Lateral Soil Parameters:

| Stratum         | Type         | Stratum Top Elevation | Depth to Top (ft) | Unit Weight (pcf) | Undrained Shear Strength or Friction Angle (psf, deg.) | k or $\epsilon_{50}$ (pci, %) |
|-----------------|--------------|-----------------------|-------------------|-------------------|--------------------------------------------------------|-------------------------------|
| Granular Borrow | Cohesionless | 123                   | 0                 | 125               | 32                                                     | 50                            |
| Existing Fill   | Cohesionless | 120                   | 3                 | 120               | 28                                                     | 25                            |
| Marine Clay     | Cohesive     | 103.5                 | 19.5              | 115               | 1,000                                                  | 1                             |
| Glacial Till    | Cohesionless | 91.5                  | 31.5              | 130               | 36                                                     | 125                           |
| Bedrock         | Rock         | 85.5                  | 37.5              | -                 | -                                                      | -                             |

#### Stream Side Lateral Soil Parameters:

| Stratum       | Type         | Stratum Top Elevation | Depth to Top (ft) | Unit Weight (pcf) | Undrained Shear Strength or Friction Angle (psf, deg.) | k or $\epsilon_{50}$ (pci, %) |
|---------------|--------------|-----------------------|-------------------|-------------------|--------------------------------------------------------|-------------------------------|
| Riprap        | Cohesionless | 114                   | 0                 | 140               | 45                                                     | 125                           |
| Existing Fill | Cohesionless | 111                   | 3                 | 120               | 28                                                     | 25                            |
| Marine Clay   | Cohesive     | 103.5                 | 10.5              | 115               | 1,000                                                  | 1                             |
| Glacial Till  | Cohesionless | 91.5                  | 22.5              | 130               | 36                                                     | 125                           |
| Bedrock       | Rock         | 85.5                  | 28.5              | -                 | -                                                      | -                             |

Lateral soil springs for the soil acting against abutments were also calculated for Fuss & O'Neill's use in the bridge finite element model. Refer to the calculations presented in Appendix D.

## **FROST PROTECTION**

The minimum depth of embedment/cover for footings or other below-grade structures was evaluated in accordance with Section 5.2.1 of the MaineDOT BDG. Based on a design freezing index equal to 1,800 freezing degree days, we recommend that walls or other foundations bear a minimum of 6 ft below the lowest adjacent ground surface exposed to freezing. However, in accordance with MaineDOT BDG Section 5.4.2.8 and discussions with MaineDOT, the bottom of the integral abutment pile cap should be a minimum of 4 ft below the adjacent ground surface.

## **Construction Considerations**

The purpose of this section of the report is to provide comments and recommendations on items related to excavation, earthwork, and other geotechnical aspects of the proposed construction. Since it identifies potential construction issues related to foundations and earthwork, the information in this section is intended to aid personnel who monitor the construction activities. Prospective Contractors for this project should evaluate construction issues based on their own knowledge and experience in the Greenbush, Maine area taking into consideration their proposed construction means, methods, and procedures.

## **DYNAMIC PILE LOAD TESTING PROGRAM**

The Contractor will be required to confirm the minimum required nominal pile resistances in the field using dynamic testing methods. The piles should be driven to a nominal resistance equal to the maximum factored axial compressive pile load divided by a resistance factor equal to 0.65 in accordance with AASHTO LRFD Table 10.5.5.2.3-1. We recommend that Contractor perform one dynamic pile load test with 24-hour (minimum) restrike test at each substructure location (two total) to evaluate hammer system efficiencies, driving stresses in the pile, and the nominal resistance of the piles. We recommend that the dynamic testing be completed prior to production pile driving and that CAPWAP analysis be performed on each pile installed during the dynamic test program (four total). The CAPWAP results will be used to finalize driving criteria for the production piles to assure that the piles achieve the necessary resistance without being overstressed.

## **DRIVEN PILES**

Although not observed in the recent borings, cobbles and boulders may be present in the existing fill and glacial till soils at the site. If encountered, the presence of cobbles and boulders could impact installation of sheetpile cofferdams and driving piles.

## CONSTRUCTION DEWATERING

Based on the water levels observed during drilling, we anticipate groundwater may be encountered during excavation for the abutment footings since the bottom of excavation will be below the measured water levels. Because of this, we anticipate that temporary dewatering will be needed to complete the excavation and subgrade preparation “in-the-dry” and could likely be accomplished by passively pumping from open sumps and temporary ditches located at the base of the excavations. Sumps should be provided with filters suitable to prevent pumping of fine-grained soil particles.

The Contractor should be responsible for controlling all surface runoff, infiltration, and water from other sources at all times during excavation. Rainwater or snowmelt should be directed away from exposed foundation-bearing surfaces. Dewatering should be performed as required to maintain the undisturbed nature of soil surfaces and enable all final excavation, foundation construction, and backfilling to be completed “in-the-dry.”

Dewatering should be performed in accordance with all applicable regulations. Dewatering effluent should be treated as required by applicable state and local regulations.

## SUBMITTAL REVIEWS

The Contract Drawings and special provisions should be written so that the requirements of the documents are consistent with the design intent of the geotechnical recommendations outlined herein. The special provisions should require that the Contractor and the Contractor’s engineer perform necessary analyses and submit the results to MaineDOT for review. We recommend that Haley & Aldrich be allowed to review the geotechnical-related submittals to ensure that the Contractor’s analyses/submittals are in accordance with the intent of the design as summarized herein. This will enable us to ensure compliance with the design concepts, assumptions, and special provisions, and to facilitate design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

## CONSTRUCTION MONITORING

The geotechnical design and earthwork recommendations contained herein are based on the known and predictable behavior of a properly engineered and constructed foundation. Monitoring of the foundation construction activities is required to enable the geotechnical engineer to confirm that procedures and techniques used by the Contractor during construction are appropriate and will not impact the design of the bridge. Therefore, we recommend that an individual representing MaineDOT, qualified by geotechnical training and experience, be present at the site to provide monitoring during the foundation construction activities listed below.

- Dynamic testing of driven test piles.
- Installation of production driven piles.
- Placement and compaction of compacted fills.

## **Limitations and Closure**

This report is prepared for the exclusive use of Fuss & O'Neill and MaineDOT relative to the subject project. There are no intended beneficiaries other than Fuss & O'Neill and MaineDOT. Haley & Aldrich shall owe no duty whatsoever to any other person or entity on account of the Agreement or the report. Use of this report by any person or entity other than Fuss & O'Neill and MaineDOT for any purpose whatsoever is expressly forbidden unless such other person or entity obtains written authorization from Fuss & O'Neill and Haley & Aldrich. Use of the report by such other person or entity without the written authorization of Fuss & O'Neill and Haley & Aldrich shall be at such other person's or entity's sole risk and shall be without legal exposure or liability to Haley & Aldrich.

Use of this report by any person or entity, including by Fuss & O'Neill, for a purpose other than relative to the subject project is expressly prohibited unless such person or entity obtains written authorization from Haley & Aldrich indicating that the report is adequate for such other use. Use of this report by any other person or entity for such other purpose without written authorization by Haley & Aldrich shall be at such person's or entity's sole risk and shall be without legal exposure or liability to Haley & Aldrich.

The information provided herein is based, in part, upon the data obtained from the referenced subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations then appear, it may be necessary to reevaluate the recommendations of this report.

It is our understanding that this report will be included as a reference document in the documents that will be provided to the prospective Contractors for bidding. Please note that the recommendations included herein are superseded by the information contained in the Contract Documents and that the information contained in the Contract Documents takes precedence over the information provided in this report.

## Closure

We appreciate the opportunity to provide geotechnical engineering services on this project. Please do not hesitate to call if you have any questions or comments.

Sincerely yours,  
**HALEY & ALDRICH, INC.**



Erin A. Force, P.E.  
Project Manager



John G. DiGenova, P.E.  
Associate

### Enclosures:

Table I –Subsurface Exploration Location Data  
Table II – Subsurface Exploration Subsurface Data

Figure 1 – Project Locus  
Figure 2 – Boring Location Plan  
Figure 3 – Interpretive Subsurface Profile

Appendix A – Test Boring Logs  
Appendix B – Laboratory Test Results  
Appendix C – Historic Bridge Drawings  
Appendix D – Geotechnical Design Calculations



## References

Hooke, Roger LeB, Metcalfe, Elizabet, and Wiesner, Robin, 2016, *Surficial geology of the Greenbush quadrangle, Maine*: Maine Geological Survey, Open-File Map 15-6, map, scale 1:24,000.

Osberg, Philip H., Hussey, Arthur M., II, and Boone, Gary M. (editors), 1985, Bedrock geologic map of Maine: Maine Geological Survey, 1 plate, correlation chart, tectonic inset map, metamorphic inset map, color geologic map, cross sections, scale 1:500,000.

Youd, T.L. et al. (2001), "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils," *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 127, No. 10, Oct.

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## TABLES

**TABLE I**

Subsurface Exploration Location Data  
 Boom Bridge over Boombridge Brook, US Route 2  
 MaineDOT WIN 021727.00, Bridge No. 3587  
 Greenbush, Maine

| Phase       | Test Boring No. <sup>1</sup> | Ground Surface Elevation <sup>2,3</sup> | Station <sup>4</sup> | Offset Distance & Direction <sup>4</sup> | Coordinates <sup>5</sup> |           |
|-------------|------------------------------|-----------------------------------------|----------------------|------------------------------------------|--------------------------|-----------|
|             |                              |                                         |                      |                                          | Northing                 | Easting   |
| Preliminary | BB-GBB-101                   | 119.5                                   | 105+9.7              | 8.4 L                                    | 566,341                  | 1,761,485 |
|             | BB-GBB-101A                  | 119.5                                   | 105+4.6              | 8.2 L                                    | 566,336                  | 1,761,483 |
|             | BB-GBB-102                   | 119.8                                   | 106+11               | 9.5 R                                    | 566,428                  | 1,761,539 |
| Final       | BB-GBB-201                   | 120.0                                   | 104+96.4             | 8.8 R                                    | 566,322                  | 1,761,495 |
|             | BB-GBB-202                   | 119.5                                   | 106+23.2             | 9.0 L                                    | 566,446                  | 1,761,526 |

**Notes:**

<sup>1</sup> Test boring locations are shown on Figure 2, Boring Location Plan.

<sup>2</sup> Ground surface elevations at test boring locations were determined in the field by MaineDOT using GPS survey equipment.

<sup>3</sup> Elevations are measured in feet and reference the North American Vertical Datum of 1988 (NAVD 88).

<sup>4</sup> Station and offset information determined by Haley & Aldrich.

<sup>5</sup> As-drilled coordinates of test borings were determined by MaineDOT using GPS survey equipment, are measured in feet and reference NAD83, Maine 2000 Central Zone coordinate system.

|              | Individual  | Date      |
|--------------|-------------|-----------|
| Prepared By: | T. Jones    | 7/2/2021  |
| Checked By:  | M. Brassard | 2/1/2022  |
| Reviewed By: | E. Force    | 3/30/2022 |

**TABLE II**

Subsurface Exploration Subsurface Data  
 Boom Bridge over Boombridge Brook, US Route 2  
 MaineDOT WIN 021727.00, Bridge No. 3587  
 Greenbush, Maine

| Phase       | Test Boring No. <sup>1</sup> | Ground Surface Elevation <sup>2,3</sup> | Approximate Strata Thickness <sup>4,5,6</sup> (ft) |      |                |       |              |                | Approximate Top of Bedrock Depth (ft) | Approximate Elevation of Top of Bedrock <sup>2,3</sup> | Approximate Bottom of Exploration Depth (ft) | Approximate Elevation of Bottom of Exploration <sup>2,3</sup> |
|-------------|------------------------------|-----------------------------------------|----------------------------------------------------|------|----------------|-------|--------------|----------------|---------------------------------------|--------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------|
|             |                              |                                         | Bituminous Concrete                                | Fill | Marine Deposit |       | Glacial Till | Weathered Rock |                                       |                                                        |                                              |                                                               |
|             |                              |                                         |                                                    |      | Silt           | Clay  |              |                |                                       |                                                        |                                              |                                                               |
| Preliminary | BB-GBB-101                   | 119.5                                   | 0.8                                                | 17.2 | NE             | 9.4   | 5.1          | NE             | 32.5                                  | 87.0                                                   | 49.2                                         | 70.3                                                          |
|             | BB-GBB-101A                  | 119.5                                   | --                                                 | --   | --             | >2.0* | --           | --             | --                                    | --                                                     | 22.0                                         | 97.5                                                          |
|             | BB-GBB-102                   | 119.8                                   | 0.6                                                | 13.4 | 4.5            | 8.8   | 8.6          | 2.2            | 38.1                                  | 81.7                                                   | 57.1                                         | 62.7                                                          |
| Final       | BB-GBB-201                   | 120.0                                   | 0.8                                                | 14.4 | NE             | 13.7  | 2.9          | 1.5            | 33.3                                  | 86.7                                                   | 42.3                                         | 77.7                                                          |
|             | BB-GBB-202                   | 119.5                                   | 1.0                                                | 17.3 | NE             | 10.3  | 5.2          | 1.1            | 34.9                                  | 84.6                                                   | 45.0                                         | 74.5                                                          |

## Notes:

<sup>1</sup> Test boring locations are shown on Figure 2, Boring Location Plan.

<sup>2</sup> Ground surface elevations at test boring locations were determined in the field by MaineDOT using GPS survey equipment.

<sup>3</sup> Elevations are measured in feet and reference the North American Vertical Datum of 1988 (NAVD 88).

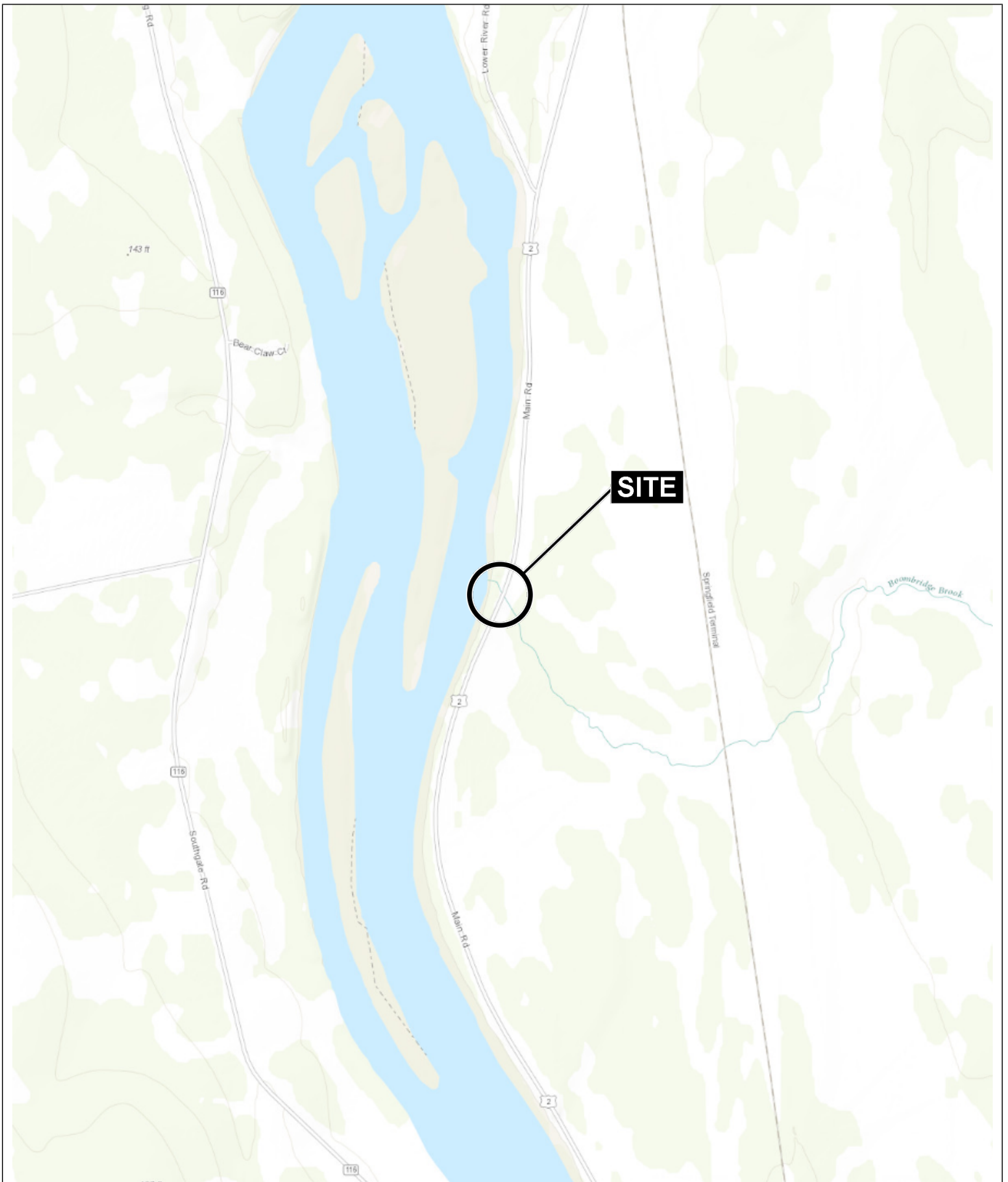
<sup>4</sup> "NE" indicates stratum was not encountered in test boring.

<sup>5</sup> \*BB-GBB-101A was advanced to the marine clay deposit and field vanes and collection of tube samples attempted.

<sup>6</sup> "--" indicates test boring was not drilled deep enough to determine presence of stratum or test boring was not sampled to determine strata thickness.

|              | Individual  | Date      |
|--------------|-------------|-----------|
| Prepared By: | T. Jones    | 7/2/2021  |
| Checked By:  | M. Brassard | 2/2/2022  |
| Reviewed By: | E. Force    | 3/30/2022 |

## FIGURES



MAP SOURCE: ESRI

SITE COORDINATES: 45°3'10"N, 68°39'23"W

**HALEY  
ALDRICH**

BOOM BRIDGE OVER BOOMBRIDGE BROOK US ROUTE 2  
GREENBUSH, MAINE  
WIN 21727.00, BRIDGE NO. 3587



## PROJECT LOCUS

APPROXIMATE SCALE: 1 IN = 2000 FT  
APRIL 2022

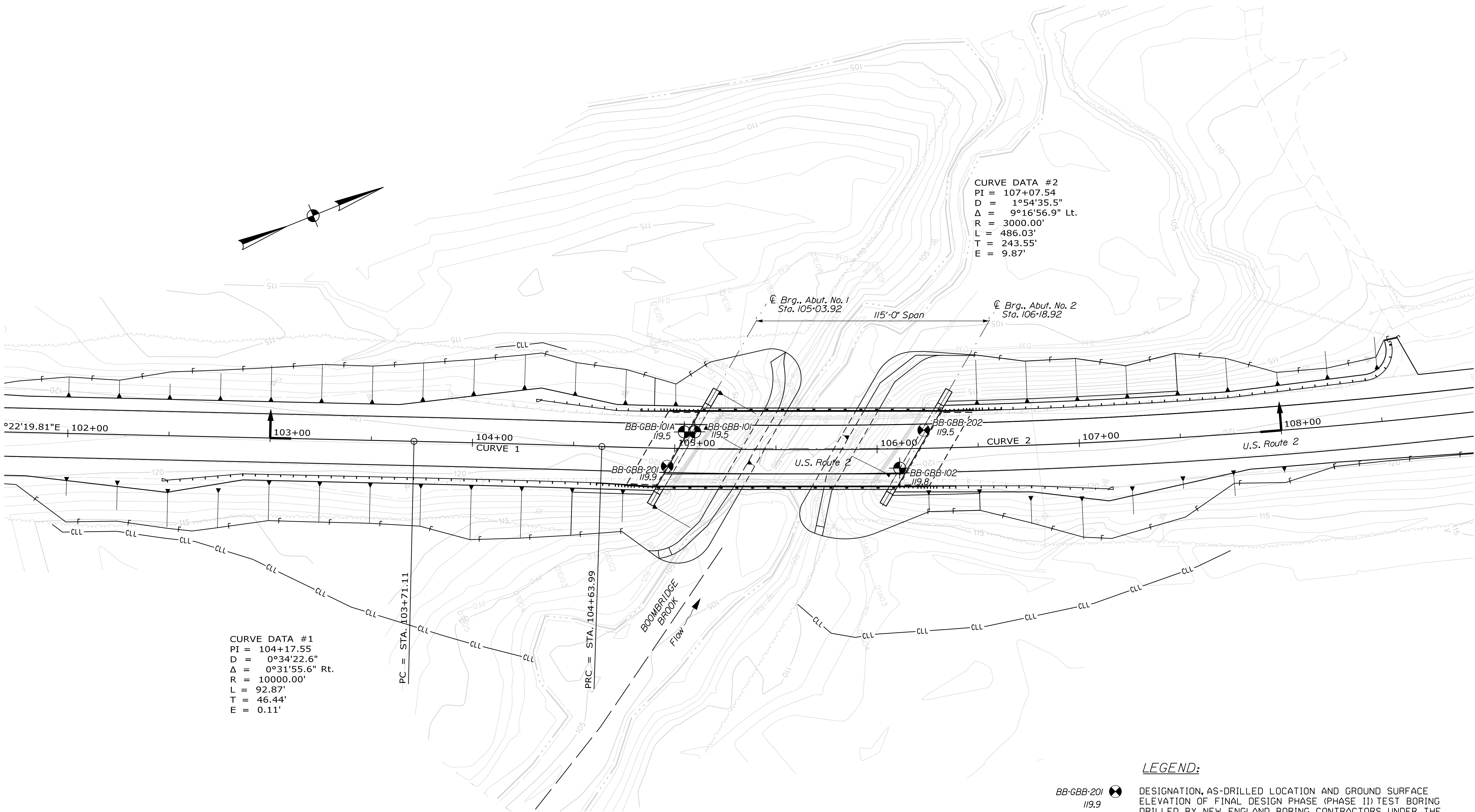
**FIGURE 1**

Date:3/31/2022

Username:

Division:

Filename: ... \CAD\004\_GeoPlan.dgn



CURVE DATA #1  
PI = 104+17.55  
D = 0°34'22.6"  
Δ = 0°31'55.6" Rt.  
R = 10000.00'  
L = 92.87'  
T = 46.44'  
E = 0.11'

CURVE DATA #2  
PI = 107+07.54  
D = 1°54'35.5"  
Δ = 9°16'56.9" Lt.  
R = 3000.00'  
L = 486.03'  
T = 243.55'  
E = 9.87'

NOTES:

- EXISTING AND PROPOSED SITE CONDITIONS, THE LOCATION AND ORIENTATION OF EXISTING SITE FEATURES, AND THE LOCATION AND ORIENTATION OF THE PROPOSED BRIDGE STRUCTURE ARE TAKEN FROM ELECTRONIC MICROSTATION FILES PROVIDED BY FUSS & O'NEILL, INC.
- THE PLAN LOCATIONS OF AND GROUND SURFACE ELEVATIONS AT TEST BORINGS SHOWN WERE DETERMINED UPON THE COMPLETION OF DRILLING BY THE MAINE DEPARTMENT OF TRANSPORTATION USING GPS SURVEY EQUIPMENT.
- ELEVATIONS ARE IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
- TEST BORINGS WERE MONITORED IN THE FIELD BY A HALEY & ALDRICH, INC. GEOLOGIST OR GEOTECHNICAL ENGINEER.
- REFER TO APPENDIX A FOR TEST BORING LOGS AND ROCK CORE PHOTOGRAPHS.

LEGEND:

BB-GBB-201  
119.9

BB-GBB-102  
119.8

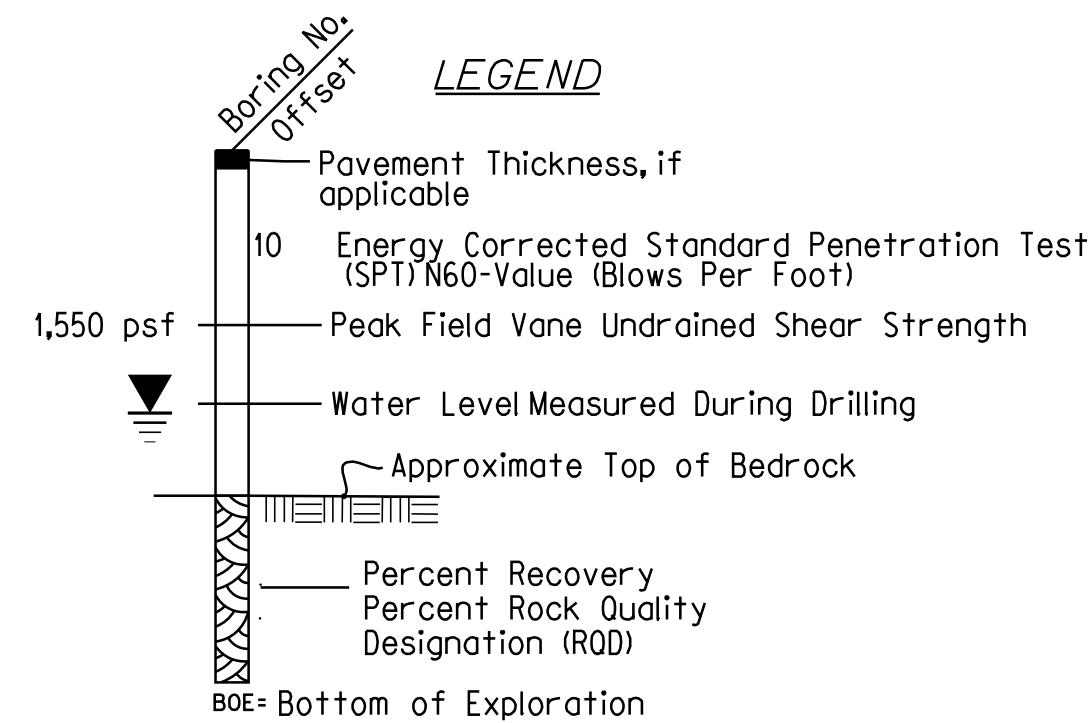
DESIGNATION, AS-DRILLED LOCATION AND GROUND SURFACE ELEVATION OF FINAL DESIGN PHASE (PHASE II) TEST BORING DRILLED BY NEW ENGLAND BORING CONTRACTORS UNDER THE DIRECTION OF HALEY & ALDRICH IN JUNE 2021 (PHASE II TEST BORINGS).

DESIGNATION, AS-DRILLED LOCATION AND GROUND SURFACE ELEVATION OF PRELIMINARY DESIGN PHASE (PHASE I) TEST BORING DRILLED BY NEW ENGLAND BORING CONTRACTORS UNDER THE DIRECTION OF HALEY & ALDRICH IN MARCH 2017 (PHASE I TEST BORINGS).

DESIGNATION, LOCATION, AND ORIENTATION OF INTERPRETIVE SUBSURFACE PROFILE; (SEE FIGURE 3)

HALEY  
ALDRICH

|                                                                  |                 |             |
|------------------------------------------------------------------|-----------------|-------------|
| STATE OF MAINE<br>DEPARTMENT OF TRANSPORTATION                   | SIGNATURE       |             |
|                                                                  | P.E. NUMBER     |             |
|                                                                  | DATE            |             |
| BOOM BRIDGE<br>BOOMBRIDGE BROOK<br>GREENBUSH<br>PENOBSCOT COUNTY | PROJ. MANAGER   | M. WIGHT    |
|                                                                  | CHECKED         | REVIEWED    |
|                                                                  | DESIGNED        | DETAILED    |
|                                                                  | REVISIONS 1     | REVISIONS 2 |
|                                                                  | REVISIONS 3     | REVISIONS 4 |
| BORING LOCATION PLAN                                             | FIELD CHANGES   |             |
|                                                                  | SHEET NUMBER    |             |
|                                                                  | 2               |             |
|                                                                  | OF 3            |             |
|                                                                  | BRIDGE NO. 3587 |             |
|                                                                  | WIN             |             |
|                                                                  | 21727.01        |             |
|                                                                  | BRIDGE PLANS    |             |



5. REFER TO APPENDIX A FOR TEST BORING LOGS AND ROCK CORE PHOTOGRAPHS.



## **APPENDIX A**

### **Test Boring Logs**

| Maine Department of Transportation<br>Soil/Rock Exploration Log<br>US CUSTOMARY UNITS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                       |                    | Project: US Route 2 over Beach Bridge Brook<br>Location: Greenbush, Maine |               | Boring No.: BB-GBB-101<br>WIN: 21727.00 |              |             |                                                                                                                                                                                                                                                  |                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------|---------------|-----------------------------------------|--------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| Driller: New England Boring Contractors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                    | Elevation (ft.): 119.5                                                                                                                |                    | Auger ID/OD: --                                                           |               |                                         |              |             |                                                                                                                                                                                                                                                  |                                                      |
| Operator: B. Enos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    | Datum: NAVD88                                                                                                                         |                    | Sampler: Split Spoon 1.375 in. ID                                         |               |                                         |              |             |                                                                                                                                                                                                                                                  |                                                      |
| Logged By: K. Russ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    | Rig Type: Mobile B53                                                                                                                  |                    | Hammer Wt./Fall: SS-140#/30/HW-140#/30                                    |               |                                         |              |             |                                                                                                                                                                                                                                                  |                                                      |
| Date Start/Finish: 3-17-17/3-17-17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    | Drilling Method: HW Drive; NW Spun                                                                                                    |                    | Core Barrel: NQ-2.0 in. ID                                                |               |                                         |              |             |                                                                                                                                                                                                                                                  |                                                      |
| Boring Location: 1761485E, 566341N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    | Casing ID/OD: HW-4.0 in. ID/NW-3.0 in. ID                                                                                             |                    | Water Level*: Not Observed                                                |               |                                         |              |             |                                                                                                                                                                                                                                                  |                                                      |
| Hammer Efficiency Factor: 0.677                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> |                    |                                                                           |               |                                         |              |             |                                                                                                                                                                                                                                                  |                                                      |
| Definitions:<br>D = Split Spoon Sample<br>MD = Unsuccessful Split Spoon Sample Attempt<br>U = Thin Wall Tube Sample<br>MU = Unsuccessful Thin Wall Tube Sample Attempt<br>V = Field Vane Shear Test, PP = Pocket Penetrometer<br>MV = Unsuccessful Field Vane Shear Test Attempt<br>R = Rock Core Sample<br>SSA = Solid Stem Auger<br>HSA = Hollow Stem Auger<br>RC = Roller Cone<br>WOH = Weight of 140lb. Hammer<br>WOR/C = Weight of Rods or Casing<br>WO1P = Weight of One Person<br>S <sub>u</sub> = Peak/Remolded Field Vane Undrained Shear Strength (psf)<br>S <sub>u(lab)</sub> = Lab Vane Undrained Shear Strength (psf)<br>q <sub>p</sub> = Unconfined Compressive Strength (ksf)<br>N-uncorrected = Raw Field SPT N-value<br>Hammer Efficiency Factor = Rig Specific Annual Calibration Value<br>N <sub>60</sub> = SPT N-uncorrected Corrected for Hammer Efficiency<br>N <sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected<br>T <sub>v</sub> = Pocket Torvane Shear Strength (psf)<br>WC = Water Content, percent<br>LL = Liquid Limit<br>PL = Plastic Limit<br>PI = Plasticity Index<br>G = Grain Size Analysis<br>C = Consolidation Test |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             |                                                                                                                                                                                                                                                  |                                                      |
| Depth (ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Sample Information |                                                                                                                                       |                    |                                                                           |               |                                         |              | Graphic Log | Visual Description and Remarks                                                                                                                                                                                                                   | Laboratory Testing Results/AASHTO and Unified Class. |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Sample No.         | Pen./Rec. (in.)                                                                                                                       | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%)                             | N-uncorrected | N <sub>60</sub>                         | Casing Blows |             |                                                                                                                                                                                                                                                  |                                                      |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                                                                                                                                       |                    |                                                                           |               |                                         | HW Drive     | 118.7       | -BITUMINOUS CONCRETE-                                                                                                                                                                                                                            | G#410684<br>A-4(0)<br>SM                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             | Note: Frozen soils beneath pavement.                                                                                                                                                                                                             |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1D                 | 24/13                                                                                                                                 | 2.0 - 4.0          | 24/16/12/7                                                                | 28            | 32                                      |              |             | Brown, dry, dense, fine to coarse SAND, little fine gravel, trace coarse gravel<br>-FILL-(SW)<br>PID Reading=0.0ppm                                                                                                                              |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             |                                                                                                                                                                                                                                                  |                                                      |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2D                 | 24/12                                                                                                                                 | 4.0 - 6.0          | 5/6/6/7                                                                   | 12            | 14                                      |              | 115.3       | Light to reddish-brown, dry, medium dense, fine SAND, trace silt<br>-FILL-(SP-SM)<br>PID Reading=0.0ppm                                                                                                                                          |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             | Light to reddish-brown, dry, loose, fine SAND, trace silt<br>-FILL-(SP-SM)<br>PID Reading=0.0ppm                                                                                                                                                 |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3D                 | 24/13                                                                                                                                 | 6.0 - 8.0          | 4/4/2/3                                                                   | 6             | 7                                       |              |             | Note: Silt increasing with depth.                                                                                                                                                                                                                |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             | Light to reddish-brown, moist, loose, Silty fine SAND, trace medium to coarse sand, trace gravel<br>-FILL-(SM)<br>PID Reading=0.0ppm                                                                                                             |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4D                 | 24/4                                                                                                                                  | 8.0 - 10.0         | 4/2/2/3                                                                   | 4             | 5                                       |              |             | No Recovery, sample taken from tip of solid-stem auger<br>Light reddish-brown, moist, very loose, fine sand, some silt (SM)<br>-FILL-(SM)<br>PID Reading=0.0ppm                                                                                  |                                                      |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | MD                 | 24/0                                                                                                                                  | 10.0 - 12.0        | 3/2/1/2                                                                   | 3             | 3                                       |              | 107.0       |                                                                                                                                                                                                                                                  |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             | Olive-grey, wet, loose, Silty or Clayey fine to medium SAND, some gravel, trace coarse sand<br>-FILL-(SM/SC)<br>PID Reading=0.0ppm                                                                                                               | G#410685<br>A-4(0)<br>SM/SC                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             | Olive-grey, wet, loose, Clayey fine SAND, little coarse to medium sand<br>-FILL-(SC)<br>PID Reading=0.0ppm                                                                                                                                       |                                                      |
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 6D                 | 24/7                                                                                                                                  | 15.0 - 17.0        | 1/2/2/3                                                                   | 4             | 5                                       | 30           |             | Note: Drill wash return from 15.0 to 20.0 ft contains wood, clayey fine to coarse sand, trace gravel. Clay content increasing with depth.                                                                                                        |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 36           |             |                                                                                                                                                                                                                                                  |                                                      |
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| 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7D                 | 24/8                                                                                                                                  | 20.0 - 22.0        | 4/4/6/6                                                                   | 10            | 11                                      | 43           |             | Olive-grey, wet, stiff, Silty CLAY, trace fine sand, contains wood<br>-MARINE DEPOSIT-(CL)<br>Note: Drill wash return from 20.0 to 23.0 ft contains clay and wood.<br>Note: 3 tube sample attempts and 1 field vane attempt at 23.0 ft, refusal. |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 54           |             |                                                                                                                                                                                                                                                  |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 59           |             |                                                                                                                                                                                                                                                  |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 8D                 | 24/24                                                                                                                                 | 23.0 - 25.0        | 1/2/3/3                                                                   | 5             | 6                                       | 64           |             | Olive-grey, wet, medium stiff, Silty CLAY, contains fragments of wood<br>-MARINE DEPOSIT-(CL)<br>Note: Drill wash return from 23.0 to 25.0 ft contains clay and                                                                                  |                                                      |
| 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 64           |             |                                                                                                                                                                                                                                                  |                                                      |
| Remarks:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             |                                                                                                                                                                                                                                                  |                                                      |
| Stratification lines represent approximate boundaries between soil types; transitions may be gradual.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             | Page 1 of 2                                                                                                                                                                                                                                      |                                                      |
| * Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             | Boring No.: BB-GBB-101                                                                                                                                                                                                                           |                                                      |

| Maine Department of Transportation<br>Soil/Rock Exploration Log<br>US CUSTOMARY UNITS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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                                                                                                                                                                                                                                                            |              | Boring No.: BB-GBB-101<br>WIN: 21727.00 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| Driller: New England Boring Contractors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                 | Elevation (ft.): 119.5                                                                                                                                                                                       |                                                |                                                                           | Auger ID/OD: --                                                                                                                                                                               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| Operator: B. Enos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                 | Datum: NAVD88                                                                                                                                                                                                |                                                |                                                                           | Sampler: Split Spoon 1.375 in. ID                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                                         |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                 |                                                       |  |  |  |  |  |                 |             |                                |                                                       |            |                 |                    |                                                |               |                 |              |    |       |       |                            |         |   |   |    |      |  |                                                                                                                                             |                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |     |      |             |             |    |    |    |      |  |                                                                                                                                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |         |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
| Logged By: K. Russ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| Date Start/Finish: 3-17-17/3-17-17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                 | Drilling Method: HW Drive; NW Spun                                                                                                                                                                           |                                                |                                                                           | Core Barrel: NQ-2.0 in. ID                                                                                                                                                                                                                                                                                                                                                                                                                                |              |                                         |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                 |                                                       |  |  |  |  |  |                 |             |                                |                                                       |            |                 |                    |                                                |               |                 |              |    |       |       |                            |         |   |   |    |      |  |                                                                                                                                             |                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |     |      |             |             |    |    |    |      |  |                                                                                                                                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |         |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
| Boring Location: 1761485E, 566341N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                 | Casing ID/OD: HW-4.0 in. ID/NW-3.0 in. ID                                                                                                                                                                    |                                                |                                                                           | Water Level*: Not Observed                                                                                                                                                                                                                                                                                                                                                                                                                                |              |                                         |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                 |                                                       |  |  |  |  |  |                 |             |                                |                                                       |            |                 |                    |                                                |               |                 |              |    |       |       |                            |         |   |   |    |      |  |                                                                                                                                             |                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |     |      |             |             |    |    |    |      |  |                                                                                                                                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |         |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
| Hammer Efficiency Factor: 0.677                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                 | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>                                                                        |                                                |                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |              |                                         |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| Definitions:<br>D = Split Spoon Sample<br>MD = Unsuccessful Split Spoon Sample Attempt<br>U = Thin Wall Tube Sample<br>MU = Unsuccessful Thin Wall Tube Sample Attempt<br>V = Field Vane Shear Test, PP = Pocket Penetrometer<br>MV = Unsuccessful Field Vane Shear Test Attempt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                    |                 | R = Rock Core Sample<br>SSA = Solid Stem Auger<br>HSA = Hollow Stem Auger<br>RC = Roller Cone<br>WOH = Weight of 140 lb. Hammer<br>WOR/C = Weight of Rods or Casing<br>WO1P = Weight of One Person           |                                                |                                                                           | S <sub>u</sub> = Peak/Remolded Field Vane Undrained Shear Strength (psf)<br>S <sub>u(lab)</sub> = Lab Vane Undrained Shear Strength (psf)<br>q <sub>p</sub> = Unconfined Compressive Strength (ksf)<br>N-uncorrected = Raw Field SPT N-value<br>Hammer Efficiency Factor = Rig Specific Annual Calibration Value<br>N <sub>60</sub> = SPT N-uncorrected Corrected for Hammer Efficiency<br>N <sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected |              |                                         |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                 |                                                       |  |  |  |  |  |                 |             |                                |                                                       |            |                 |                    |                                                |               |                 |              |    |       |       |                            |         |   |   |    |      |  |                                                                                                                                             |                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |     |      |             |             |    |    |    |      |  |                                                                                                                                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |         |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
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                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                 | T <sub>y</sub> = Pocket Torvane Shear Strength (psf)<br>WC = Water Content, percent<br>LL = Liquid Limit<br>PL = Plastic Limit<br>PI = Plasticity Index<br>G = Grain Size Analysis<br>C = Consolidation Test |                                                |                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |              |                                         |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| <table><tr><th rowspan="2">Depth (ft.)</th><th colspan="7">Sample Information</th><th rowspan="2">Elevation (ft.)</th><th rowspan="2">Graphic Log</th><th rowspan="2">Visual Description and Remarks</th><th rowspan="2">Laboratory Testing Results/ AASHTO and Unified Class.</th></tr><tr><th>Sample No.</th><th>Pen./Rec. (in.)</th><th>Sample Depth (ft.)</th><th>Blows (16 in.) Shear Strength (psf) or RQD (%)</th><th>N-uncorrected</th><th>N<sub>60</sub></th><th>Casing Blows</th></tr><tr><td rowspan="3">25</td><td>9D MV</td><td>24/12</td><td>25.0 - 27.0<br/>25.6 - 26.0</td><td>2/3/3/3</td><td>6</td><td>7</td><td>48</td><td rowspan="4">92.1</td><td rowspan="4"></td><td>wood.<br/>Note: Attempted field vane at 25.0 ft, refusal.<br/>Olive-grey, wet, medium stiff, Silty CLAY, trace fine sand -MARINE DEPOSIT-(CL)</td><td rowspan="4">#410688<br/>CL<br/>LL=37, PL=20<br/>PI=17<br/>WC=30</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td rowspan="3">30</td><td>10D</td><td>24/7</td><td>30.0 - 32.0</td><td>19/19/20/21</td><td>39</td><td>44</td><td>79</td><td rowspan="4">87.0</td><td rowspan="4"></td><td>Olive-grey, wet, dense, fine to coarse SAND, trace silt, trace fine to coarse gravel<br/>-GLACIAL TILL-(SW)<br/>Note: Drill wash return from 30.0 to 32.5 ft contains fine to coarse sand, trace gravel and silt.</td><td rowspan="4"></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td rowspan="3">35</td><td>R1</td><td>60/60</td><td>34.2 - 39.2</td><td>RQD = 75%</td><td></td><td></td><td>NQ Core</td><td rowspan="4">70.3</td><td rowspan="4"></td><td>Top of Bedrock at El. 87.0<br/>Note: Drove HW to 32.5 ft, spun NW to 34.2 ft, clean out and begin rock core at 34.2 ft.<br/>Olive-grey to greenish-grey, aphanitic PHYLLITE. Hard to moderately hard, fresh to moderately weathered. Joints dipping at low to high angles, very close to close, tight to open, some &lt;0.06 in. silt infilling. Two moderately weathered zones from 35.5 to 35.9 ft and 37.7 to 37.9 ft, frequent calcite veins.<br/>Rock Mass Quality=Fair<br/>Recovery=100%<br/>-VASSALBORO FORMATION-<br/>R1 Core Times (min:sec): 34.2-35.2' (1: 44); 35.2'-36.2' (1:13); 36.2-37.2' (1:18); 37.2-38.2' (1:29); 38.2-39.2' (1:55)<br/>Similar to R1, except fresh, joints dipping at low to moderate angles with secondary high angle joints, occasional to frequent calcite veins.<br/>Rock Mass Quality=Good<br/>Recovery=100%<br/>-VASSALBORO FORMATION-<br/>R2 Core Times (min:sec): 39.2-40.2' (1:18); 40.2-41.2' (1:24); 41.2-42.2' (1:24); 42.2-43.2' (1:24); 43.2-44.2' (1:21)<br/>Similar to R2, except joints close to moderately spaced, frequent calcite veins.<br/>Rock Mass Quality=Excellent<br/>Recovery=100%<br/>-VASSALBORO FORMATION-<br/>R3 Core Times (min:sec): 44.2-45.2' (1: 22); 45.2-46.2' (1:15); 46.2-47.2' (1:27); 47.2-48.2' (1:39); 48.2-49.2' (1:31)</td><td rowspan="4">R2:<br/>qp=21,091 psi</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td rowspan="3">40</td><td>R2</td><td>60/60</td><td>39.2 - 44.2</td><td>RQD = 90%</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td rowspan="3">45</td><td>R3</td><td>60/63</td><td>44.2 - 49.2</td><td>RQD = 100%</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>50</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> |                    |                 |                                                                                                                                                                                                              |                                                |                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |              |                                         |             | Depth (ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Sample Information                              |                                                       |  |  |  |  |  | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (16 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N <sub>60</sub> | Casing Blows | 25 | 9D MV | 24/12 | 25.0 - 27.0<br>25.6 - 26.0 | 2/3/3/3 | 6 | 7 | 48 | 92.1 |  | wood.<br>Note: Attempted field vane at 25.0 ft, refusal.<br>Olive-grey, wet, medium stiff, Silty CLAY, trace fine sand -MARINE DEPOSIT-(CL) | #410688<br>CL<br>LL=37, PL=20<br>PI=17<br>WC=30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 30 | 10D | 24/7 | 30.0 - 32.0 | 19/19/20/21 | 39 | 44 | 79 | 87.0 |  | Olive-grey, wet, dense, fine to coarse SAND, trace silt, trace fine to coarse gravel<br>-GLACIAL TILL-(SW)<br>Note: Drill wash return from 30.0 to 32.5 ft contains fine to coarse sand, trace gravel and silt. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 35 | R1 | 60/60 | 34.2 - 39.2 | RQD = 75% |  |  | NQ Core | 70.3 |  | Top of Bedrock at El. 87.0<br>Note: Drove HW to 32.5 ft, spun NW to 34.2 ft, clean out and begin rock core at 34.2 ft.<br>Olive-grey to greenish-grey, aphanitic PHYLLITE. Hard to moderately hard, fresh to moderately weathered. Joints dipping at low to high angles, very close to close, tight to open, some <0.06 in. silt infilling. Two moderately weathered zones from 35.5 to 35.9 ft and 37.7 to 37.9 ft, frequent calcite veins.<br>Rock Mass Quality=Fair<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R1 Core Times (min:sec): 34.2-35.2' (1: 44); 35.2'-36.2' (1:13); 36.2-37.2' (1:18); 37.2-38.2' (1:29); 38.2-39.2' (1:55)<br>Similar to R1, except fresh, joints dipping at low to moderate angles with secondary high angle joints, occasional to frequent calcite veins.<br>Rock Mass Quality=Good<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R2 Core Times (min:sec): 39.2-40.2' (1:18); 40.2-41.2' (1:24); 41.2-42.2' (1:24); 42.2-43.2' (1:24); 43.2-44.2' (1:21)<br>Similar to R2, except joints close to moderately spaced, frequent calcite veins.<br>Rock Mass Quality=Excellent<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R3 Core Times (min:sec): 44.2-45.2' (1: 22); 45.2-46.2' (1:15); 46.2-47.2' (1:27); 47.2-48.2' (1:39); 48.2-49.2' (1:31) | R2:<br>qp=21,091 psi |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 40 | R2 | 60/60 | 39.2 - 44.2 | RQD = 90% |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 45 | R3 | 60/63 | 44.2 - 49.2 | RQD = 100% |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 50 |  |  |  |  |  |  |  |  |  |  |  |
| Depth (ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Visual Description and Remarks                  | Laboratory Testing Results/ AASHTO and Unified Class. |  |  |  |  |  |                 |             |                                |                                                       |            |                 |                    |                                                |               |                 |              |    |       |       |                        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(in.) | Sample Depth (ft.)                                                                                                                                                                                           | Blows (16 in.) Shear Strength (psf) or RQD (%) | N-uncorrected                                                             | N <sub>60</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                           | Casing Blows |                                         |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                 |                                                       |  |  |  |  |  |                 |             |                                |                                                       |            |                 |                    |                                                |               |                 |              |    |       |       |                            |         |   |   |    |      |  |                                                                                                                                             |                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |     |      |             |             |    |    |    |      |  |                                                                                                                                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |         |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
| 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9D MV              | 24/12           | 25.0 - 27.0<br>25.6 - 26.0                                                                                                                                                                                   | 2/3/3/3                                        | 6                                                                         | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 48           | 92.1                                    |             | wood.<br>Note: Attempted field vane at 25.0 ft, refusal.<br>Olive-grey, wet, medium stiff, Silty CLAY, trace fine sand -MARINE DEPOSIT-(CL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | #410688<br>CL<br>LL=37, PL=20<br>PI=17<br>WC=30 |                                                       |  |  |  |  |  |                 |             |                                |                                                       |            |                 |                    |                                                |               |                 |              |    |       |       |                            |         |   |   |    |      |  |                                                                                                                                             |                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |     |      |             |             |    |    |    |      |  |                                                                                                                                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |         |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
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| 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10D                | 24/7            | 30.0 - 32.0                                                                                                                                                                                                  | 19/19/20/21                                    | 39                                                                        | 44                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 79           | 87.0                                    |             | Olive-grey, wet, dense, fine to coarse SAND, trace silt, trace fine to coarse gravel<br>-GLACIAL TILL-(SW)<br>Note: Drill wash return from 30.0 to 32.5 ft contains fine to coarse sand, trace gravel and silt.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                 |                                                       |  |  |  |  |  |                 |             |                                |                                                       |            |                 |                    |                                                |               |                 |              |    |       |       |                            |         |   |   |    |      |  |                                                                                                                                             |                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |     |      |             |             |    |    |    |      |  |                                                                                                                                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |         |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
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| 35                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | R1                 | 60/60           | 34.2 - 39.2                                                                                                                                                                                                  | RQD = 75%                                      |                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           | NQ Core      | 70.3                                    |             | Top of Bedrock at El. 87.0<br>Note: Drove HW to 32.5 ft, spun NW to 34.2 ft, clean out and begin rock core at 34.2 ft.<br>Olive-grey to greenish-grey, aphanitic PHYLLITE. Hard to moderately hard, fresh to moderately weathered. Joints dipping at low to high angles, very close to close, tight to open, some <0.06 in. silt infilling. Two moderately weathered zones from 35.5 to 35.9 ft and 37.7 to 37.9 ft, frequent calcite veins.<br>Rock Mass Quality=Fair<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R1 Core Times (min:sec): 34.2-35.2' (1: 44); 35.2'-36.2' (1:13); 36.2-37.2' (1:18); 37.2-38.2' (1:29); 38.2-39.2' (1:55)<br>Similar to R1, except fresh, joints dipping at low to moderate angles with secondary high angle joints, occasional to frequent calcite veins.<br>Rock Mass Quality=Good<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R2 Core Times (min:sec): 39.2-40.2' (1:18); 40.2-41.2' (1:24); 41.2-42.2' (1:24); 42.2-43.2' (1:24); 43.2-44.2' (1:21)<br>Similar to R2, except joints close to moderately spaced, frequent calcite veins.<br>Rock Mass Quality=Excellent<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R3 Core Times (min:sec): 44.2-45.2' (1: 22); 45.2-46.2' (1:15); 46.2-47.2' (1:27); 47.2-48.2' (1:39); 48.2-49.2' (1:31) | R2:<br>qp=21,091 psi                            |                                                       |  |  |  |  |  |                 |             |                                |                                                       |            |                 |                    |                                                |               |                 |              |    |       |       |                            |         |   |   |    |      |  |                                                                                                                                             |                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |     |      |             |             |    |    |    |      |  |                                                                                                                                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |         |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |    |       |             |            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
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| Stratification lines represent approximate boundaries between soil types; transitions may be gradual.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| * 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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| Page 2 of 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            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| <b>Maine Department of Transportation</b><br>Soil/Rock Exploration Log<br>US CUSTOMARY UNITS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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BB-GBB-101A<br><b>WIN:</b> 21727.00 |             |                                |                                                       |             |                    |  |  |  |  |  |  |  |             |                                |                                                       |            |                 |                    |                                               |               |                 |              |                 |   |  |  |  |  |  |  |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  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| <b>Driller:</b> New England Boring Contractors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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               |             |                                |                                                       |             |                    |  |  |  |  |  |  |  |             |                                |                                                       |            |                 |                    |                                               |               |                 |              |                 |   |  |  |  |  |  |  |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  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| <b>Operator:</b> B. Enos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                 |                            | <b>Datum:</b> NAVD88                                                                                                                         |               |                 |              | <b>Sampler:</b> Split Spoon 1.375 in. ID               |             |                                |                                                       |             |                    |  |  |  |  |  |  |  |             |                                |                                                       |            |                 |                    |                                               |               |                 |              |                 |   |  |  |  |  |  |  |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |       |       |                            |         |   |   |  |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Logged By:</b> K. Russ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                 |                            | <b>Rig Type:</b> Mobile B53                                                                                                                  |               |                 |              | <b>Hammer Wt./Fall:</b> SS-140#/30/HW-NW140#/30        |             |                                |                                                       |             |                    |  |  |  |  |  |  |  |             |                                |                                                       |            |                 |                    |                                               |               |                 |              |                 |   |  |  |  |  |  |  |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 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| <b>Date Start/Finish:</b> 3-17-17/3-17-17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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               |             |                                |                                                       |             |                    |  |  |  |  |  |  |  |             |                                |                                                       |            |                 |                    |                                               |               |                 |              |                 |   |  |  |  |  |  |  |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  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| <b>Boring Location:</b> 1761483E, 566336N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                 |                            | <b>Casing ID/OD:</b> HW-4.0 in. ID                                                                                                           |               |                 |              | <b>Water Level*:</b> Not Observed                      |             |                                |                                                       |             |                    |  |  |  |  |  |  |  |             |                                |                                                       |            |                 |                    |                                               |               |                 |              |                 |   |  |  |  |  |  |  |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |       |       |                            |         |   |   |  |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Hammer Efficiency Factor:</b> 0.677                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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               |             |                                |                                                       |             |                    |  |  |  |  |  |  |  |             |                                |                                                       |            |                 |                    |                                               |               |                 |              |                 |   |  |  |  |  |  |  |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  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| <div>Definitions:<br/>D = Split Spoon Sample<br/>MD = Unsuccessful Split Spoon Sample Attempt<br/>U = Thin Wall Tube Sample<br/>MU = Unsuccessful Thin Wall Tube Sample Attempt<br/>V = Field Vane Shear Test, PP = Pocket Penetrometer<br/>MV = Unsuccessful Field Vane Shear Test Attempt</div> <div>R = Rock Core Sample<br/>SSA = Solid Stem Auger<br/>HSA = Hollow Stem Auger<br/>RC = Roller Cone<br/>WOH = Weight of 140lb. Hammer<br/>WOR/C = Weight of Rods or Casing<br/>WO1P = Weight of One Person</div> <div>S<sub>u</sub> = Peak/Remolded Field Vane Undrained Shear Strength (psf)<br/>S<sub>u</sub>(lab) = Lab Vane Undrained Shear Strength (psf)<br/>q<sub>u</sub> = Unconfined Compressive Strength (ksf)<br/>N-uncorrected = Raw Field SPT N-value<br/>Hammer Efficiency Factor = Rig Specific Annual Calibration Value<br/>N<sub>60</sub> = SPT N-uncorrected Corrected for Hammer Efficiency<br/>N<sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected</div> <div>T<sub>v</sub> = Pocket Torvane Shear Strength (psf)<br/>WC = Water Content, percent<br/>LL = Liquid Limit<br/>PL = Plastic Limit<br/>PI = Plasticity Index<br/>G = Grain Size Analysis<br/>C = Consolidation Test</div>                                                                                                                                                                                                                                                     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| <table><tr><th rowspan="2">Depth (ft.)</th><th colspan="8">Sample Information</th><th rowspan="2">Graphic Log</th><th rowspan="2">Visual Description and Remarks</th><th rowspan="2">Laboratory Testing Results/ AASHTO and Unified Class.</th></tr><tr><th>Sample No.</th><th>Pen./Rec. (in.)</th><th>Sample Depth (ft.)</th><th>Blows (6 in.) 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(in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N <sub>60</sub> | Casing Blows | Elevation (ft.) | 0 |  |  |  |  |  |  | HW Push |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 20 | 1D MV | 24/17 | 20.0 - 22.0<br>20.6 - 21.0 | 3/4/4/5 | 8 | 9 |  | 99.5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 25 |  |  |  |  |  |  |  |  |  |  |  |  |
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               | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |             |                    |  |  |  |  |  |  |  |             |                                |                                                       |            |                 |                    |                                               |               |                 |              |                 |   |  |  |  |  |  |  |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  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| Stratification lines represent approximate boundaries between soil types; transitions may be gradual.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| * 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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               |             | Page 1 of 1                    |                                                       |             |                    |  |  |  |  |  |  |  |             |                                |                                                       |            |                 |                    |                                               |               |                 |              |                 |   |  |  |  |  |  |  |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  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| <b>Boring No.:</b> BB-GBB-101A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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| Maine Department of Transportation<br>Soil/Rock Exploration Log<br>US CUSTOMARY UNITS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                       |                    | Project: US Route 2 over Beach Bridge Brook<br>Location: Greenbush, Maine |               | Boring No.: BB-GBB-102<br>WIN: 21727.00 |              |             |                                                                                                                                                                                           |                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------|---------------|-----------------------------------------|--------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| Driller: New England Boring Contractors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                    | Elevation (ft.): 119.8                                                                                                                |                    | Auger ID/OD: --                                                           |               |                                         |              |             |                                                                                                                                                                                           |                                                      |
| Operator: B. Enos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    | Datum: NAVD88                                                                                                                         |                    | Sampler: Split Spoon 1.375 in. ID                                         |               |                                         |              |             |                                                                                                                                                                                           |                                                      |
| Logged By: K. Russ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    | Rig Type: Mobile B53                                                                                                                  |                    | Hammer Wt./Fall: SS-140#/30/HW-NW140#/30                                  |               |                                         |              |             |                                                                                                                                                                                           |                                                      |
| Date Start/Finish: 3-16-17/3-16-17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    | Drilling Method: HW Drive; NW Spun                                                                                                    |                    | Core Barrel: NQ-2.0 in. ID                                                |               |                                         |              |             |                                                                                                                                                                                           |                                                      |
| Boring Location: 1761539E, 566428N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    | Casing ID/OD: HW-4.0 in. ID/NW-3.0 in. ID                                                                                             |                    | Water Level*: 10.0                                                        |               |                                         |              |             |                                                                                                                                                                                           |                                                      |
| Hammer Efficiency Factor: 0.677                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> |                    |                                                                           |               |                                         |              |             |                                                                                                                                                                                           |                                                      |
| Definitions:<br>D = Split Spoon Sample<br>MD = Unsuccessful Split Spoon Sample Attempt<br>U = Thin Wall Tube Sample<br>MU = Unsuccessful Thin Wall Tube Sample Attempt<br>V = Field Vane Shear Test, PP = Pocket Penetrometer<br>MV = Unsuccessful Field Vane Shear Test Attempt<br>R = Rock Core Sample<br>SSA = Solid Stem Auger<br>HSA = Hollow Stem Auger<br>RC = Roller Cone<br>WOH = Weight of 140lb. Hammer<br>WOR/C = Weight of Rods or Casing<br>WO1P = Weight of One Person<br>S <sub>u</sub> = Peak/Remolded Field Vane Undrained Shear Strength (psf)<br>S <sub>u(lab)</sub> = Lab Vane Undrained Shear Strength (psf)<br>q <sub>p</sub> = Unconfined Compressive Strength (ksf)<br>N-uncorrected = Raw Field SPT N-value<br>Hammer Efficiency Factor = Rig Specific Annual Calibration Value<br>N <sub>60</sub> = SPT N-uncorrected Corrected for Hammer Efficiency<br>N <sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected<br>T <sub>v</sub> = Pocket Torvane Shear Strength (psf)<br>WC = Water Content, percent<br>LL = Liquid Limit<br>PL = Plastic Limit<br>PI = Plasticity Index<br>G = Grain Size Analysis<br>C = Consolidation Test |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             |                                                                                                                                                                                           |                                                      |
| Depth (ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Sample Information |                                                                                                                                       |                    |                                                                           |               |                                         |              | Graphic Log | Visual Description and Remarks                                                                                                                                                            | Laboratory Testing Results/AASHTO and Unified Class. |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Sample No.         | Pen./Rec. (in.)                                                                                                                       | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%)                             | N-uncorrected | N <sub>60</sub>                         | Casing Blows |             |                                                                                                                                                                                           |                                                      |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                                                                                                                                       |                    |                                                                           |               |                                         | HW Drive     | 119.2       | -BITUMINOUS CONCRETE-                                                                                                                                                                     |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1D                 | 24/10                                                                                                                                 | 1.0 - 3.0          | 123/153/75/103                                                            | 228           | 257                                     |              |             | Brown, dry, very dense, fine to coarse SAND, some gravel, trace silt, well graded<br>-FILL-(SW)<br>PID Readings=0.0ppm                                                                    |                                                      |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2D                 | 24/9                                                                                                                                  | 4.0 - 6.0          | 7/6/6/6                                                                   | 12            | 14                                      |              |             | Brown, dry, medium dense, fine SAND, trace silt, trace medium to coarse sand, trace fine to coarse gravel, poorly graded<br>-FILL-(SP)<br>PID Readings=0.0ppm                             |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3D                 | 24/13                                                                                                                                 | 6.0 - 8.0          | 6/3/2/4                                                                   | 5             | 6                                       |              |             | Brown, dry, loose, fine SAND, trace silt, trace medium sand, poorly graded<br>-FILL-(SP)<br>PID Readings=0.0ppm                                                                           |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4D                 | 24/3                                                                                                                                  | 8.0 - 10.0         | 2/1/2/1                                                                   | 3             | 3                                       |              |             | Brown, dry, very loose, fine SAND, trace silt, trace medium sand, poorly graded<br>-FILL-(SP)<br>PID Readings=0.0ppm                                                                      |                                                      |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 5D                 | 24/12                                                                                                                                 | 10.0 - 12.0        | 3/9/6/2                                                                   | 15            | 17                                      | 70           | 108.0       | Brown, wet, medium dense, fine SAND, some silt, trace medium to coarse sand, poorly graded<br>-FILL-(SM)<br>PID Readings=0.0ppm                                                           | G#410686<br>A-2-4(0)<br>SM                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 57           |             |                                                                                                                                                                                           |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 41           |             | Olive-grey, wet, medium dense, fine SAND, some clay, poorly graded<br>-FILL-(SC)<br>Note: Drill wash return from 10.0 to 15.0 ft contains clayey fine sand with occasional gravel layers. |                                                      |
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 6D                 | 24/19                                                                                                                                 | 15.0 - 17.0        | 3/2/3/3                                                                   | 5             | 6                                       | 46           | 105.8       | Olive-brown, wet, medium stiff, SILT, trace fine sand, mottled<br>-MARINE DEPOSIT-(ML)                                                                                                    | G#410687<br>A-4(0)<br>ML                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 40           |             |                                                                                                                                                                                           |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 54           |             | Note: Drill wash return from 15.0 to 20.0 ft contains silt to clay with depth, trace gravel and sand.                                                                                     |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 70           |             |                                                                                                                                                                                           |                                                      |
| 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7D                 | 24/24                                                                                                                                 | 20.0 - 22.0        | 2/3/2/2                                                                   | 5             | 6                                       | 58           | 101.3       | Olive-grey, wet, medium stiff, Silty CLAY, trace fine sand<br>-MARINE DEPOSIT-(CL)                                                                                                        | #410689<br>CL<br>LL=46, PL=22<br>PI=24<br>WC=35      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 51           |             |                                                                                                                                                                                           |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 58           |             |                                                                                                                                                                                           |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 63           |             | Note: Drill wash return from 20.0 to 25.0 ft contains olive-grey silty clay.                                                                                                              |                                                      |
| 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                                                       |                    |                                                                           |               |                                         | 60           |             |                                                                                                                                                                                           |                                                      |
| Remarks:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             |                                                                                                                                                                                           |                                                      |
| Stratification lines represent approximate boundaries between soil types; transitions may be gradual.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             | Page 1 of 3                                                                                                                                                                               |                                                      |
| * Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                                                                                                                                       |                    |                                                                           |               |                                         |              |             | Boring No.: BB-GBB-102                                                                                                                                                                    |                                                      |

| Maine Department of Transportation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                            | Project: US Route 2 over Beach Bridge Brook    |               | Boring No.: BB-GBB-102 |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------|---------------|------------------------|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Soil/Rock Exploration Log<br>US CUSTOMARY UNITS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            | Location: Greenbush, Maine                     |               | WIN: 21727.00          |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| Driller: New England Boring Contractors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    | Elevation (ft.): 119.8                                                                                                                |                            | Auger ID/OD: --                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| Operator: B. Enos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    | Datum: NAVD88                                                                                                                         |                            | Sampler: Split Spoon 1.375 in. ID              |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| Logged By: K. Russ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    | Rig Type: Mobile B53                                                                                                                  |                            | Hammer Wt./Fall: SS-140#/30/HW-                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| Date Start/Finish: 3-16-17/3-16-17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    | Drilling Method: HW Drive; NW Spun                                                                                                    |                            | Core Barrel: NQ-2.0 in. ID                     |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| Boring Location: 1761539E, 566428N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    | Casing ID/OD: HW-4.0 in. ID/NW-3.0 in. ID                                                                                             |                            | Water Level*: 10.0                             |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| Hammer Efficiency Factor: 0.677                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> |                            |                                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| <div> <div> Definitions:<br/> D = Split Spoon Sample<br/> MD = Unsuccessful Split Spoon Sample Attempt<br/> U = Thin Wall Tube Sample<br/> MU = Unsuccessful Thin Wall Tube Sample Attempt<br/> V = Field Vane Shear Test, PP = Pocket Penetrometer<br/> MV = Unsuccessful Field Vane Shear Test Attempt </div> <div> R = Rock Core Sample<br/> SSA = Solid Stem Auger<br/> HSA = Hollow Stem Auger<br/> RC = Roller Cone<br/> WOH = Weight of 140 lb. Hammer<br/> WOR/C = Weight of Rods or Casing<br/> WO1P = Weight of One Person </div> <div> S<sub>u</sub> = Peak/Remolded Field Vane Undrained Shear Strength (psf)<br/> S<sub>u(lab)</sub> = Lab Vane Undrained Shear Strength (psf)<br/> q<sub>p</sub> = Unconfined Compressive Strength (ksf)<br/> N-uncorrected = Raw Field SPT N-value<br/> Hammer Efficiency Factor = Rig Specific Annual Calibration Value<br/> N<sub>60</sub> = SPT N-uncorrected Corrected for Hammer Efficiency<br/> N<sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected </div> <div> T<sub>y</sub> = Pocket Torvane Shear Strength (psf)<br/> WC = Water Content, percent<br/> LL = Liquid Limit<br/> PL = Plastic Limit<br/> PI = Plasticity Index<br/> G = Grain Size Analysis<br/> C = Consolidation Test </div> </div> |                    |                                                                                                                                       |                            |                                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| Depth (ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Sample Information |                                                                                                                                       |                            |                                                |               |                        |              | Visual Description and Remarks                                                      | Laboratory Testing Results/ AASHTO and Unified Class.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Sample No.         | Pen./Rec. (in.)                                                                                                                       | Sample Depth (ft.)         | Blows (16 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N <sub>60</sub>        | Casing Blows |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1U                 | 24/23                                                                                                                                 | 25.0 - 27.0                |                                                |               |                        | 57           |    | Note: Attempted field vane shear test at 27.0 ft, refusal at 27.3 ft.<br>Olive-grey, wet, dense, Silty fine SAND, trace medium to coarse sand, trace fine to coarse gravel, loosely bonded<br>-GLACIAL TILL-(SM)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | R2:<br>qp=9,789 psi |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            |                                                |               |                        | 63           |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8D<br>MV           | 24/12                                                                                                                                 | 27.0 - 29.0<br>27.6 - 28.0 | 2/11/28/20                                     | 39            | 44                     | 87           |    | Note: Split-spoon refusal at 27.0 ft, refusal at 27.3 ft.<br>Olive-grey, moist, very dense, fine to coarse SAND, trace silt, trace fine to coarse gravel, moderately bonded<br>-GLACIAL TILL-(SW)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            |                                                |               |                        | 170          |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                            |                                                |               |                        | 162          |   | Olive-grey, moist, very dense, fine to coarse SAND, trace silt, trace fine to coarse gravel, moderately bonded<br>-GLACIAL TILL-(SW)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9D                 | 24/13                                                                                                                                 | 30.0 - 32.0                | 20/32/19/19                                    | 51            | 58                     | 45           |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            |                                                |               |                        | 35           |  | Olive-grey, wet, very dense, fine to coarse SAND, trace silt, trace fine to coarse gravel, moderately bonded<br>-GLACIAL TILL-(SW)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            |                                                |               |                        | 46           |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            |                                                |               |                        | 75           |  | Note: Split-spoon refusal at 35.9 ft. Advance roller bit to 38.0 ft.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            |                                                |               |                        | 91           |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| 35                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 10D                | 11/6                                                                                                                                  | 35.0 - 35.9                | 11/50(5.0)                                     |               |                        | NW<br>Spun   |  | Note: Weathered bedrock in spoon tip.<br>-WEATHERED BEDROCK-<br>Top of Bedrock at El. 81.7<br>Note: Spun NW casing to 38.3 ft, begin rock core at 38.3 ft.<br>Olive-grey, aphanitic PHYLLITE. Moderately hard, fresh. Joints vertical to high angle, spacing not discernable, tight, no infilling, smooth and planar joint surfaces.<br>-ROCK MASS QUALITY=Very Poor<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R1 Core Times (min:sec): 38.3-39.3' (3:03); 39.3-40.3' (3:29);<br>Similar to R1, except joints dipping at low and high angles, close to moderately spaced.<br>Rock Mass Quality=Excellent<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R2 Core Times (min:sec): 40.5-41.5' (3:15); 41.5-42.5' (1:27)<br>42.5-43.5' (1:24); 43.5-44.5' (1:42)<br>Similar to R1, except joints dipping at low to high angles, extremely close to very close, <0.13 in. silt infilling on some joint surfaces.<br>Rock Mass Quality=Poor<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R3 Core Times (min:sec): 44.9-45.9' (2:15); 45.9-46.9' (2:36) |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 11D<br>R1          | 1/1<br>26/26                                                                                                                          | 38.0 - 38.1<br>38.3 - 40.5 | 58(1.0)<br>RQD = 15%                           |               |                        | NQ Core      |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | R2                 | 53/53                                                                                                                                 | 40.5 - 44.9                | RQD = 100%                                     |               |                        |              |  | Note: Split-spoon refusal at 35.9 ft. Advance roller bit to 38.0 ft.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            |                                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            |                                                |               |                        |              |  | Note: Weathered bedrock in spoon tip.<br>-WEATHERED BEDROCK-<br>Top of Bedrock at El. 81.7<br>Note: Spun NW casing to 38.3 ft, begin rock core at 38.3 ft.<br>Olive-grey, aphanitic PHYLLITE. Moderately hard, fresh. Joints vertical to high angle, spacing not discernable, tight, no infilling, smooth and planar joint surfaces.<br>-ROCK MASS QUALITY=Very Poor<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R1 Core Times (min:sec): 38.3-39.3' (3:03); 39.3-40.3' (3:29);<br>Similar to R1, except joints dipping at low and high angles, close to moderately spaced.<br>Rock Mass Quality=Excellent<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R2 Core Times (min:sec): 40.5-41.5' (3:15); 41.5-42.5' (1:27)<br>42.5-43.5' (1:24); 43.5-44.5' (1:42)<br>Similar to R1, except joints dipping at low to high angles, extremely close to very close, <0.13 in. silt infilling on some joint surfaces.<br>Rock Mass Quality=Poor<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R3 Core Times (min:sec): 44.9-45.9' (2:15); 45.9-46.9' (2:36) |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            |                                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | R3                 | 26/26                                                                                                                                 | 44.9 - 47.1                | RQD = 50%                                      |               |                        |              |  | Note: Weathered bedrock in spoon tip.<br>-WEATHERED BEDROCK-<br>Top of Bedrock at El. 81.7<br>Note: Spun NW casing to 38.3 ft, begin rock core at 38.3 ft.<br>Olive-grey, aphanitic PHYLLITE. Moderately hard, fresh. Joints vertical to high angle, spacing not discernable, tight, no infilling, smooth and planar joint surfaces.<br>-ROCK MASS QUALITY=Very Poor<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R1 Core Times (min:sec): 38.3-39.3' (3:03); 39.3-40.3' (3:29);<br>Similar to R1, except joints dipping at low and high angles, close to moderately spaced.<br>Rock Mass Quality=Excellent<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R2 Core Times (min:sec): 40.5-41.5' (3:15); 41.5-42.5' (1:27)<br>42.5-43.5' (1:24); 43.5-44.5' (1:42)<br>Similar to R1, except joints dipping at low to high angles, extremely close to very close, <0.13 in. silt infilling on some joint surfaces.<br>Rock Mass Quality=Poor<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R3 Core Times (min:sec): 44.9-45.9' (2:15); 45.9-46.9' (2:36) |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            |                                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | R4                 | 60/60                                                                                                                                 | 47.1 - 52.1                | RQD = 88%                                      |               |                        |              |  | Note: Weathered bedrock in spoon tip.<br>-WEATHERED BEDROCK-<br>Top of Bedrock at El. 81.7<br>Note: Spun NW casing to 38.3 ft, begin rock core at 38.3 ft.<br>Olive-grey, aphanitic PHYLLITE. Moderately hard, fresh. Joints vertical to high angle, spacing not discernable, tight, no infilling, smooth and planar joint surfaces.<br>-ROCK MASS QUALITY=Very Poor<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R1 Core Times (min:sec): 38.3-39.3' (3:03); 39.3-40.3' (3:29);<br>Similar to R1, except joints dipping at low and high angles, close to moderately spaced.<br>Rock Mass Quality=Excellent<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R2 Core Times (min:sec): 40.5-41.5' (3:15); 41.5-42.5' (1:27)<br>42.5-43.5' (1:24); 43.5-44.5' (1:42)<br>Similar to R1, except joints dipping at low to high angles, extremely close to very close, <0.13 in. silt infilling on some joint surfaces.<br>Rock Mass Quality=Poor<br>Recovery=100%<br>-VASSALBORO FORMATION-<br>R3 Core Times (min:sec): 44.9-45.9' (2:15); 45.9-46.9' (2:36) |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                                                                                                                                       |                            |                                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                                                                                                                                       |                            |                                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| Remarks:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                       |                            |                                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| Stratification lines represent approximate boundaries between soil types; transitions may be gradual.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                                                       |                            |                                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| Page 2 of 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |                                                                                                                                       |                            |                                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |
| Boring No.: BB-GBB-102                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |                                                                                                                                       |                            |                                                |               |                        |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |

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| <div>Maine Department of Transportation</div> <div>Soil/Rock Exploration Log<br/>US CUSTOMARY UNITS</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |  |  |  | Project: US Route 2 over Beach Bridge Brook |  |  |                                           |  |  |  | Boring No.: BB-GBB-102 |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |  |  |  | Location: Greenbush, Maine                  |  |  |                                           |  |  |  | WIN: 21727.00          |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Driller: New England Boring Contractors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  |  |  |                                             |  |  | Elevation (ft.): 119.8                    |  |  |  |                        |  |  |  |  | Auger ID/OD: --                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Operator: B. Enos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |                                             |  |  | Datum: NAVD88                             |  |  |  |                        |  |  |  |  | Sampler: Split Spoon 1.375 in. ID                                                                                                                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Logged By: K. Russ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |  |  |  |                                             |  |  | Rig Type: Mobile B53                      |  |  |  |                        |  |  |  |  | Hammer Wt./Fall: SS-140#/30/HW-                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Date Start/Finish: 3-16-17/3-16-17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |  |  |  |                                             |  |  | Drilling Method: HW Drive; NW Spun        |  |  |  |                        |  |  |  |  | Core Barrel: NQ-2.0 in. ID                                                                                                                                                                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Boring Location: 1761539E, 566428N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |  |  |  |                                             |  |  | Casing ID/OD: HW-4.0 in. ID/NW-3.0 in. ID |  |  |  |                        |  |  |  |  | Water Level*: 10.0                                                                                                                                                                                                  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Hammer Efficiency Factor: 0.677                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  | Hammer Type:                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <div>Definitions:<br/>D = Split Spoon Sample<br/>MD = Unsuccessful Split Spoon Sample Attempt<br/>U = Thin Wall Tube Sample<br/>MU = Unsuccessful Thin Wall Tube Sample Attempt<br/>V = Field Vane Shear Test, PP = Pocket Penetrometer<br/>MV = Unsuccessful Field Vane Shear Test Attempt</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  | <div>R = Rock Core Sample<br/>SSA = Solid Stem Auger<br/>HSA = Hollow Stem Auger<br/>RC = Roller Cone<br/>WOH = Weight of 140 lb. Hammer<br/>WOR/C = Weight of Rods or Casing<br/>WO1P = Weight of One Person</div> |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | <div>S<sub>u</sub> = Peak/Remolded Field Vane Undrained Shear Strength (psf)<br/>S<sub>u(lab)</sub> = Lab Vane Undrained Shear Strength (psf)<br/>q<sub>p</sub> = Unconfined Compressive Strength (ksf)<br/>N-uncorrected = Raw Field SPT N-value<br/>Hammer Efficiency Factor = Rig Specific Annual Calibration Value<br/>N<sub>60</sub> = SPT N-uncorrected Corrected for Hammer Efficiency<br/>N̄<sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected</div> |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | <div>T<sub>v</sub> = Pocket Torvane Shear Strength (psf)<br/>WC = Water Content, percent<br/>LL = Liquid Limit<br/>PL = Plastic Limit<br/>PI = Plasticity Index<br/>G = Grain Size Analysis<br/>C = Consolidation Test</div> |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sample Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <div><div>Depth (ft.)</div><div>Sample No.</div><div>Pen./Rec. (in.)</div><div>Sample Depth (ft.)</div><div>Blows (/6 in.)<br/>Shear Strength (psf) or RQD (%)</div><div>N-uncorrected</div><div>N<sub>60</sub></div><div>Casing Blows</div><div>Elevation (ft.)</div><div>Graphic Log</div><div>Visual Description and Remarks</div><div>Laboratory Testing Results/<br/>AASHTO Unified Class.</div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <div><div>50</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div>Similar to R3, except joints dipping at low to moderate angles,<br/>extremely close to moderate, tight to open, planar and smooth to rough, few calcite veins.<br/>Rock Mass Quality=Good<br/>Recovery=100%<br/>-VASSALBORO FORMATION-<br/>R4 Core Times (min:sec): 47.1-48.1' (1:37); 48.1-49.1' (1:17); 49.1-50.1' (1:23); 50.1-51.1' (1:34); 51.1-52.1' (1:24)<br/>Similar to R1, except joints dipping at low to moderate angles, extremely close to moderate, single moderately weathered &lt;.025 in. silt infilled zone from 53.1 to 53.2 ft, few calcite veins.<br/>Rock Mass Quality=Good<br/>Recovery=100%<br/>-VASSALBORO FORMATION-<br/>R5 Core Times (min:sec): 52.1-53.1' (2:08); 53.1-54.1' (1:43); 54.1-55.1' (1:25); 55.1-56.1' (1:14); 56.1-57.1' (1:34)<br/><br/>Bottom of Exploration at 57.1 feet below ground surface.</div><div></div></div> |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <div><div>55</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <div><div>60</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <div><div>65</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <div><div>70</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <div><div>75</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Remarks:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <div>Stratification lines represent approximate boundaries between soil types; transitions may be gradual.</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <div>Boring No.: BB-GBB-102</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |                                             |  |  |                                           |  |  |  |                        |  |  |  |  |                                                                                                                                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| <p>Stratification lines represent approximate boundaries between soil types; transitions may be gradual.</p> <p>* 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.</p> | <p>Page 1 of 2</p> <p><b>Boring No.:</b> BB-GBB-201</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|

| <b>Maine Department of Transportation</b><br>Soil/Rock Exploration Log<br>US CUSTOMARY UNITS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                    |                 |                                                                                                                                              | <b>Project:</b> US Route 2 Bridge over Boombridge Brook<br><b>Location:</b> Greenbush, Maine |                                             | <b>Boring No.:</b> BB-GBB-201<br><b>WIN:</b> 21727.00 |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------|---------------|-----------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| <b>Driller:</b> New England Boring Contractors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                 | <b>Elevation (ft.):</b> 120.0                                                                                                                |                                                                                              | <b>Auger ID/OD:</b> --                      |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| <b>Operator:</b> T. Shaeffer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                    |                 | <b>Datum:</b> NAVD 88                                                                                                                        |                                                                                              | <b>Sampler:</b> Split-Spoon 1.375 in. ID    |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| <b>Logged By:</b> J. Fletcher                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                 | <b>Rig Type:</b> Mobile B-53 Track                                                                                                           |                                                                                              | <b>Hammer Wt./Fall:</b> SS-140#/30; HW-140# |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| <b>Date Start/Finish:</b> 6-15-2021/6-16-2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                 | <b>Drilling Method:</b> HW Drive                                                                                                             |                                                                                              | <b>Core Barrel:</b> NQ-2.0 in. ID           |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| <b>Boring Location:</b> 1761495E, 566322N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |                 | <b>Casing ID/OD:</b> HW-4.0 in. ID                                                                                                           |                                                                                              | <b>Water Level*:</b> 8.3 ft                 |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| <b>Hammer Efficiency Factor:</b> 0.867                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |                 | <b>Hammer Type:</b> Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> |                                                                                              |                                             |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| Definitions:<br>D = Split Spoon Sample<br>MD = Unsuccessful Split Spoon Sample Attempt<br>U = Thin Wall Tube Sample<br>MU = Unsuccessful Thin Wall Tube Sample Attempt<br>V = Field Vane Shear Test, PP = Pocket Penetrometer<br>MV = Unsuccessful Field Vane Shear Test Attempt<br>R = Rock Core Sample<br>SSA = Solid Stem Auger<br>HSA = Hollow Stem Auger<br>RC = Roller Cone<br>WOH = Weight of 140 lb. Hammer<br>WOR/C = Weight of Rods or Casing<br>WO1P = Weight of One Person<br>S <sub>u</sub> = Peak/Remolded Field Vane Undrained Shear Strength (psf)<br>S <sub>u(lab)</sub> = Lab Vane Undrained Shear Strength (psf)<br>q <sub>p</sub> = Unconfined Compressive Strength (ksf)<br>N-uncorrected = Raw Field SPT N-value<br>Hammer Efficiency Factor = Rig Specific Annual Calibration Value<br>N <sub>60</sub> = SPT N-uncorrected Corrected for Hammer Efficiency<br>N <sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected<br>T <sub>y</sub> = Pocket Torvane Shear Strength (psf)<br>WC = Water Content, percent<br>LL = Liquid Limit<br>PL = Plastic Limit<br>PI = Plasticity Index<br>G = Grain Size Analysis<br>C = Consolidation Test |                    |                 |                                                                                                                                              |                                                                                              |                                             |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| Depth (ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Sample Information |                 |                                                                                                                                              |                                                                                              |                                             |                                                       |               | Elevation (ft.) | Graphic Log | Visual Description and Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Laboratory Testing Results/ AASHTO and Unified Class. |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Sample No.         | Pen./Rec. (in.) | Sample Depth (ft.)                                                                                                                           | Blows (16 in.) Shear Strength (psf) or RQD (%)                                               | N-uncorrected                               | N <sub>60</sub>                                       | Casing Blows  |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 9D V1              | 24/24           | 25.0 - 27.0                                                                                                                                  | push thru vane Su=1,550/465 psf                                                              |                                             |                                                       | HW            |                 |             | Grey, wet, stiff, Silty CLAY -MARINE DEPOSIT-(CL) 55x110 mm vane raw torque readings: 400/120 in-lbs 380/70 in-lbs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | WC=33 CL                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | V2                 |                 | 25.6 - 26.0                                                                                                                                  | Su=1,475/270 psf                                                                             |                                             |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                 | 26.6 - 27.0                                                                                                                                  |                                                                                              |                                             |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                 |                                                                                                                                              |                                                                                              |                                             |                                                       | 59            |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 10D                | 24/8            | 30.0 - 32.0                                                                                                                                  | 12/12/13/8                                                                                   | 25                                          | 36                                                    | 33            |                 |             | Olive-grey, wet, dense, fine to medium SAND, little gravel -GLACIAL TILL-(SW)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                 |                                                                                                                                              |                                                                                              |                                             |                                                       | 34            | 88.2            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                 |                                                                                                                                              |                                                                                              |                                             |                                                       | 82            |                 |             | -WEATHERED ROCK-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | R1                 | 20/12           | 33.5 - 35.2                                                                                                                                  | RQD = 0%                                                                                     |                                             |                                                       | 73 RC NQ CORE | 86.7            |             | Top of Bedrock El. 86.7 Advanced roller cone to 33.5 ft and begin NQ rock core. R1: Olive-grey to green, aphanitic, PHYLLITE, hard to moderately hard, fresh to slightly weathered. Highly fractured. Rock Quality=Very Poor Recovery=60% -VASSALBORO FORMATION- R1 Core Times (min:sec): 33.5-34.5' (1:25); 34.5=35.2' (1:47) Note: Lost 130 gallons water. R2: Olive-grey to green, aphanitic, PHYLLITE, hard to moderately hard, freshly weathered. Joints dipping at high angles, moderately close, tight, planar, smooth, calcite veins. Rock Quality=Excellent Recovery=101% -VASSALBORO FORMATION- R2 Core Times (min:sec): 35.2-36.2' (1:59); 36.2-37.2' (1:56); 37.2-38.5' (1:34) Note: First attempt to core failed due to cave-in. At 38.5 ft, 6-in. of cave-in material. R3: Olive-grey to green, aphanitic, PHYLLITE, hard to moderately hard, fresh. Primary joints dipping at high angles. Secondary joints horizontal, close to moderately close, planar, open to tight, calcite veins. Rock Quality=Fair Recovery=100% -VASSALBORO FORMATION- R3 Core Times (min:sec): 38.5-39.5' (1:37); 39.5-40.5' (1:30); 40.5-41.5' (1:22); 41.5-42.3' (1:21) Note: Lost 180 gallons water. |                                                       |
| 35                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | R2                 | 39.6/40         | 35.2 - 38.5                                                                                                                                  | RQD = 100%                                                                                   |                                             |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | R3                 | 46/46           | 38.5 - 42.3                                                                                                                                  | RQD = 61%                                                                                    |                                             |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
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| 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                 |                                                                                                                                              |                                                                                              |                                             |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
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| 45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                 |                                                                                                                                              |                                                                                              |                                             |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
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| <b>Remarks:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                 |                                                                                                                                              |                                                                                              |                                             |                                                       |               |                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| 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<br>Soil/Rock Exploration Log<br>US CUSTOMARY UNITS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |                 |                            | Project: US Route 2 Bridge over Boombridge<br>Brook<br>Location: Greenbush, Maine                                                     |               | Boring No.: BB-GBB-202                  |              |             |                                                                                                                                                                                               |                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------|--------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| Driller: New England Boring Contractors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |                 |                            | Elevation (ft.): 119.5                                                                                                                |               | Auger ID/OD: --                         |              |             |                                                                                                                                                                                               |                                                      |
| Operator: T. Shaeffer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |                 |                            | Datum: NAVD 88                                                                                                                        |               | Sampler: Split-Spoon 1.375 in. ID       |              |             |                                                                                                                                                                                               |                                                      |
| Logged By: J. Fletcher                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |                 |                            | Rig Type: Mobile B-53 Track                                                                                                           |               | Hammer Wt./Fall: SS-140#/30; HW-140#/30 |              |             |                                                                                                                                                                                               |                                                      |
| Date Start/Finish: 6-14-2021/6-15-2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |                 |                            | Drilling Method: HW Drive                                                                                                             |               | Core Barrel: NQ-2.0 in. ID              |              |             |                                                                                                                                                                                               |                                                      |
| Boring Location: 1761526E, 566446N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |                 |                            | Casing ID/OD: HW-4.0 in. ID                                                                                                           |               | Water Level*: 13.4 ft                   |              |             |                                                                                                                                                                                               |                                                      |
| Hammer Efficiency Factor: 0.867                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                 |                            | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> |               |                                         |              |             |                                                                                                                                                                                               |                                                      |
| <div> <div> Definitions:<br/> D = Split Spoon Sample<br/> MD = Unsuccessful Split Spoon Sample Attempt<br/> U = Thin Wall Tube Sample<br/> MU = Unsuccessful Thin Wall Tube Sample Attempt<br/> V = Field Vane Shear Test, PP = Pocket Penetrometer<br/> MV = Unsuccessful Field Vane Shear Test Attempt </div> <div> R = Rock Core Sample<br/> SSA = Solid Stem Auger<br/> HSA = Hollow Stem Auger<br/> RC = Roller Cone<br/> WOH = Weight of 140lb. Hammer<br/> WOR/C = Weight of Rods or Casing<br/> WO1P = Weight of One Person </div> <div> S<sub>u</sub> = Peak/Remolded Field Vane Undrained Shear Strength (psf)<br/> S<sub>u</sub>(lab) = Lab Vane Undrained Shear Strength (psf)<br/> q<sub>p</sub> = Unconfined Compressive Strength (ksf)<br/> N-uncorrected = Raw Field SPT N-value<br/> Hammer Efficiency Factor = Rig Specific Annual Calibration Value<br/> N<sub>60</sub> = SPT N-uncorrected Corrected for Hammer Efficiency<br/> N<sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected </div> <div> T<sub>v</sub> = Pocket Torvane Shear Strength (psf)<br/> WC = Water Content, percent<br/> LL = Liquid Limit<br/> PL = Plastic Limit<br/> PI = Plasticity Index<br/> G = Grain Size Analysis<br/> C = Consolidation Test </div> </div> |                    |                 |                            |                                                                                                                                       |               |                                         |              |             |                                                                                                                                                                                               |                                                      |
| Depth (ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Sample Information |                 |                            |                                                                                                                                       |               |                                         |              | Graphic Log | Visual Description and Remarks                                                                                                                                                                | Laboratory Testing Results/AASHTO and Unified Class. |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Sample No.         | Pen./Rec. (in.) | Sample Depth (ft.)         | Blows (6 in.) Shear Strength (psf) or RQD (%)                                                                                         | N-uncorrected | N <sub>60</sub>                         | Casing Blows |             |                                                                                                                                                                                               |                                                      |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                 |                            |                                                                                                                                       |               |                                         | HW           | 118.5       | -BITUMINOUS CONCRETE-                                                                                                                                                                         |                                                      |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1D                 | 24/15           | 2.0 - 4.0                  | 9/8/9/7                                                                                                                               | 17            | 25                                      |              | 115.2       | Brown-grey, dry, medium dense, fine to medium SAND, little gravel, trace silt<br>-FILL-(SW) PID Reading=0.0 ppm                                                                               |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2D                 | 24/13           | 4.0 - 6.0                  | 7/4/3/2                                                                                                                               | 7             | 10                                      |              |             | Light brown, moist, loose, fine SAND, trace medium sand, trace silt<br>-FILL-(SP) PID Reading = 0.0 ppm<br>Light brown, moist, loose, fine SAND, trace silt<br>-FILL-(SP) PID Reading=0.0 ppm |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3D                 | 24/19           | 6.0 - 8.0                  | 2/2/3/2                                                                                                                               | 5             | 7                                       |              |             | Brown, wet, very loose, Silty fine SAND, trace medium to coarse sand<br>-FILL-(SM) PID Reading=0.0 ppm                                                                                        | G#625332<br>A-4(0), SM                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4D                 | 24/7            | 8.0 - 10.0                 | 4/2/1/4                                                                                                                               | 3             | 4                                       |              |             | Brown, wet, loose, fine SAND, some silt, trace medium to coarse sand<br>-FILL-(SM) PID Reading=0.0 ppm                                                                                        | G#625333<br>A-2-4(0), SM                             |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 5D                 | 24/5            | 10.0 - 12.0                | 6/2/2/2                                                                                                                               | 4             | 6                                       |              | 106.4       | Brown, wet, loose, fine SAND, some silt, trace medium to coarse sand<br>-FILL-(SM) PID Reading=0.0 ppm                                                                                        |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6D                 | 24/14           | 12.0 - 14.0                | WOH/1/3/5                                                                                                                             | 4             | 6                                       |              |             | Olive-grey, wet, loose, Clayey fine to medium SAND<br>-FILL-(SC) PID Reading=0.0 ppm                                                                                                          |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 7D                 | 24/4*           | 15.0 - 17.0                | 3/1/WOH/WOH                                                                                                                           | 1             | 1                                       |              |             | Grey, wet, very loose, Clayey GRAVEL, little sand<br>-FILL-(GC-GM) PID Reading=0.0 ppm<br>Note: No recovery on 2-in. spoon.<br>*Note: 3-in. diameter split-spoon.                             |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8D<br>MV           | 24/5*           | 17.0 - 19.0<br>17.6 - 18.0 | 4/1/2/1                                                                                                                               | 3             | 4                                       |              | 101.2       | Note: Attempted field vane shear test at 17.0 ft, no penetration.<br>Note: Encountered gravel, no recovery 2-in. diameter spoon.<br>*Note: 3-in. diameter split-spoon.                        |                                                      |
| 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1U                 | 24/24           | 19.5 - 21.5                |                                                                                                                                       |               |                                         |              |             | Grey, wet, soft, Silty CLAY, trace wood, trace wash from 7D<br>-MARINE DEPOSIT-(CL)                                                                                                           |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                 |                            |                                                                                                                                       |               |                                         |              |             |                                                                                                                                                                                               |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                 |                            |                                                                                                                                       |               |                                         |              |             |                                                                                                                                                                                               |                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                 |                            |                                                                                                                                       |               |                                         |              |             |                                                                                                                                                                                               |                                                      |
| 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |                 |                            |                                                                                                                                       |               |                                         |              |             |                                                                                                                                                                                               |                                                      |

Remarks:

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.

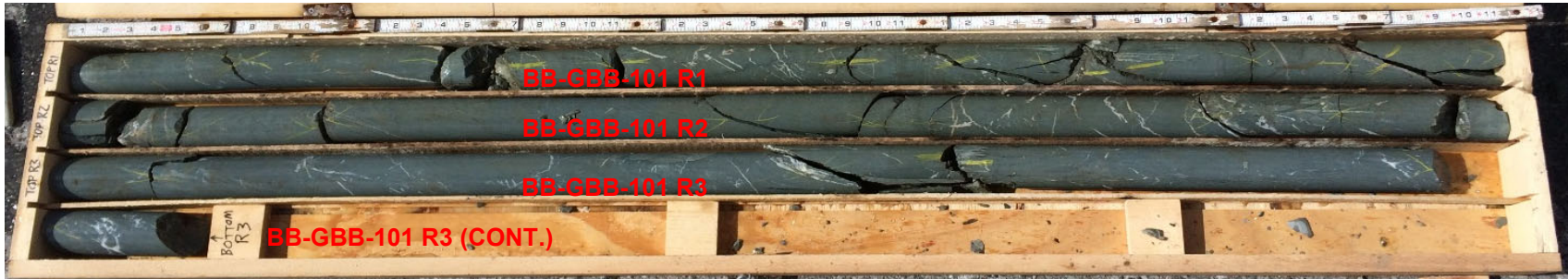
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Boring No.: BB-GBB-202

| Maine Department of Transportation<br>Soil/Rock Exploration Log<br>US CUSTOMARY UNITS                                                                                                                                                                                            |                    |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Project: US Route 2 Bridge over Boombridge Brook<br>Location: Greenbush, Maine |                                      | Boring No.: BB-GBB-202<br>WIN: 21727.00 |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------|-----------------------------------------|--------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|--|
| Driller: New England Boring Contractors                                                                                                                                                                                                                                          |                    |                 | Elevation (ft.): 119.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                | Auger ID/OD: --                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| Operator: T. Shaeffer                                                                                                                                                                                                                                                            |                    |                 | Datum: NAVD 88                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                | Sampler: Split-Spoon 1.375 in. ID    |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| Logged By: J. Fletcher                                                                                                                                                                                                                                                           |                    |                 | Rig Type: Mobile B-53 Track                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                | Hammer Wt./Fall: SS-140#/30; HW-140# |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| Date Start/Finish: 6-14-2021/6-15-2021                                                                                                                                                                                                                                           |                    |                 | Drilling Method: HW Drive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                | Core Barrel: NQ-2.0 in. ID           |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| Boring Location: 1761526E, 566446N                                                                                                                                                                                                                                               |                    |                 | Casing ID/OD: HW-4.0 in. ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                | Water Level*: 13.4 ft                |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| Hammer Efficiency Factor: 0.867                                                                                                                                                                                                                                                  |                    |                 | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                |                                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| Definitions:<br>D = Split Spoon Sample<br>MD = Unsuccessful Split Spoon Sample Attempt<br>U = Thin Wall Tube Sample<br>MU = Unsuccessful Thin Wall Tube Sample Attempt<br>V = Field Vane Shear Test, PP = Pocket Penetrometer<br>MV = Unsuccessful Field Vane Shear Test Attempt |                    |                 | R = Rock Core Sample<br>SSA = Solid Stem Auger<br>HSA = Hollow Stem Auger<br>RC = Roller Cone<br>WOH = Weight of 140 lb. Hammer<br>WOR/C = Weight of Rods or Casing<br>WO1P = Weight of One Person<br>S <sub>u</sub> = Peak/Remolded Field Vane Undrained Shear Strength (psf)<br>S <sub>u(lab)</sub> = Lab Vane Undrained Shear Strength (psf)<br>q <sub>p</sub> = Unconfined Compressive Strength (ksf)<br>N-uncorrected = Raw Field SPT N-value<br>Hammer Efficiency Factor = Rig Specific Annual Calibration Value<br>N <sub>60</sub> = SPT N-uncorrected Corrected for Hammer Efficiency<br>N <sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected<br>T <sub>y</sub> = Pocket Torvane Shear Strength (psf)<br>WC = Water Content, percent<br>LL = Liquid Limit<br>PL = Plastic Limit<br>PI = Plasticity Index<br>G = Grain Size Analysis<br>C = Consolidation Test |                                                                                |                                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| Depth (ft.)                                                                                                                                                                                                                                                                      | Sample Information |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                |                                      |                                         |              | Visual Description and Remarks                                                      | Laboratory Testing Results/AASHTO and Unified Class.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                          |  |
|                                                                                                                                                                                                                                                                                  | Sample No.         | Pen./Rec. (in.) | Sample Depth (ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Blows (16 in.) Shear Strength (psf) or RQD (%)                                 | N-uncorrected                        | N <sub>60</sub>                         | Casing Blows |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| 25                                                                                                                                                                                                                                                                               | 9D V1              | 24/24           | 25.0 - 27.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | push thru vane Su=815/455 psf                                                  |                                      |                                         | HW           |    | Grey, wet, medium stiff to stiff, Silty CLAY<br>-MARINE DEPOSIT-(CL)<br>55x110 mm vane raw torque readings:<br>210/40 in-lbs<br>420/160 in-lbs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | C#IP-2<br>CU#2-1<br>Su=1005 psf<br>LL=26<br>PL=18<br>PI=8<br>WC=24<br>CL |  |
|                                                                                                                                                                                                                                                                                  | V2                 |                 | 25.6 - 26.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Su=1,630/620 psf                                                               |                                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
|                                                                                                                                                                                                                                                                                  | 2U                 | 24/20           | 27.0 - 29.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                |                                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| 30                                                                                                                                                                                                                                                                               | 10D                | 24/7            | 30.0 - 32.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 30/24/26/23                                                                    | 50                                   | 72                                      |              |   | Grey, wet, very dense, fine to medium SAND, little fine gravel, trace silt<br>-GLACIAL TILL-(SW)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                          |  |
|                                                                                                                                                                                                                                                                                  |                    |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                |                                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
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| 35                                                                                                                                                                                                                                                                               | R1                 | 24/20           | 35.0 - 37.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | RQD = 38%                                                                      |                                      |                                         | NQ CORE      |  | Note: Drill action and wash indicate weathered rock at 33.8 ft.<br>-WEATHERED ROCK-<br>Note: Drill action and wash indicate bedrock at 34.9 ft.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
|                                                                                                                                                                                                                                                                                  | R2                 | 36/24           | 37.0 - 40.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | RQD = 50%                                                                      |                                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
|                                                                                                                                                                                                                                                                                  |                    |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                |                                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| 40                                                                                                                                                                                                                                                                               | R3                 | 44/43           | 40.0 - 43.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | RQD = 63%                                                                      |                                      |                                         |              |  | Top of Bedrock El. 84.6<br>Note: Advanced roller cone to 35.0 ft, begin NQ rock core.<br>R1: Olive-grey to green, aphanitic, PHYLLITE, moderately hard to hard, fresh to moderately weathered. Joints dipping at moderate to high angles, very close to close, tight to open. 1/16th in. thick silty clay infilling on joint at 35 ft.<br>Rock Quality=Poor<br>Recovery=83%<br>-VASSALBORO FORMATION-<br>R1 Core Times (min:sec): 35.0-36.0' (2:52); 36.0-37.0' (3:07)<br>Note: Lost 110 gallons water.<br>R2: Similar to R1, except one calcite vein. Highly fractured at top of run.<br>Rock Quality=Poor<br>Recovery=67%<br>-VASSALBORO FORMATION-<br>R2 Core Times (min:sec): 37.0-38.0' (3:46); 38.0-39.0' (3:16); 39.0-40.0' (1:53)<br>Note: Lost 190 gallons water.<br>R3: Similar to R2, except no calcite vein, highly weathered zone from 42.9 to 43.2 ft.<br>Rock Quality=Fair<br>Recovery=98%<br>-VASSALBORO FORMATION-<br>R3 Core Times (min:sec): 40.0-41.0' (2:13); 41.0-42.0' (2:19); 42.0-43.0' (2:19); 43.0-43.7' (2:03)<br>R4: Olive-grey to green, aphanitic, PHYLLITE, moderately hard to hard, slightly weathered. Horizontal joints, undulating, rough, open, moderately spaced.<br>Rock Quality=Excellent<br>Recovery=100% |                                                                          |  |
|                                                                                                                                                                                                                                                                                  | R4                 | 15.6/15.6       | 43.7 - 45.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | RQD = 100%                                                                     |                                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
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| 45                                                                                                                                                                                                                                                                               |                    |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                |                                      |                                         |              |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
|                                                                                                                                                                                                                                                                                  |                    |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                |                                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
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| 50                                                                                                                                                                                                                                                                               |                    |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                |                                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| <b>Remarks:</b><br><br>                                                                                                                                                                                                                                                          |                    |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                |                                      |                                         |              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |  |
| 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.

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------------|-------------------------------|-------------------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------|------------------------|-------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------|--|
| <div>Maine Department of Transportation</div> <div>Soil/Rock Exploration Log</div> <div>US CUSTOMARY UNITS</div>                                                                                                                                                                 |                       |                            |                               |                                                                   |                          | <div>Project:</div> US Route 2 Bridge over Boombridge Brook                                                                                                                                                                                                                                                                                                                                    |                         | <div>Boring No.:</div> BB-GBB-202 |                        |                                           |                                                               |                                                                              |  |
|                                                                                                                                                                                                                                                                                  |                       |                            |                               |                                                                   |                          | <div>Location:</div> Greenbush, Maine                                                                                                                                                                                                                                                                                                                                                          |                         | <div>WIN:</div> 21727.00          |                        |                                           |                                                               |                                                                              |  |
| <div>Driller:</div> New England Boring Contractors                                                                                                                                                                                                                               |                       |                            |                               | <div>Elevation (ft.)</div> 119.5                                  |                          | <div>Auger ID/OD:</div> --                                                                                                                                                                                                                                                                                                                                                                     |                         |                                   |                        |                                           |                                                               |                                                                              |  |
| <div>Operator:</div> T. Shaeffer                                                                                                                                                                                                                                                 |                       |                            |                               | <div>Datum:</div> NAVD 88                                         |                          | <div>Sampler:</div> Split-Spoon 1.375 in. ID                                                                                                                                                                                                                                                                                                                                                   |                         |                                   |                        |                                           |                                                               |                                                                              |  |
| <div>Logged By:</div> J. Fletcher                                                                                                                                                                                                                                                |                       |                            |                               | <div>Rig Type:</div> Mobile B-53 Track                            |                          | <div>Hammer Wt./Fall:</div> SS-140#/30; HW-140#/#                                                                                                                                                                                                                                                                                                                                              |                         |                                   |                        |                                           |                                                               |                                                                              |  |
| <div>Date Start/Finish:</div> 6-14-2021/6-15-2021                                                                                                                                                                                                                                |                       |                            |                               | <div>Drilling Method:</div> HW Drive                              |                          | <div>Core Barrel:</div> NQ-2.0 in. ID                                                                                                                                                                                                                                                                                                                                                          |                         |                                   |                        |                                           |                                                               |                                                                              |  |
| <div>Boring Location:</div> 1761526E, 566446N                                                                                                                                                                                                                                    |                       |                            |                               | <div>Casing ID/OD:</div> HW-4.0 in. ID                            |                          | <div>Water Level*:</div> 13.4 ft                                                                                                                                                                                                                                                                                                                                                               |                         |                                   |                        |                                           |                                                               |                                                                              |  |
| <div>Hammer Efficiency Factor:</div> 0.867                                                                                                                                                                                                                                       |                       |                            |                               |                                                                   |                          | <div>Hammer Type:</div> Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>                                                                                                                                                                                                                                               |                         |                                   |                        |                                           |                                                               |                                                                              |  |
| Definitions:<br>D = Split Spoon Sample<br>MD = Unsuccessful Split Spoon Sample Attempt<br>U = Thin Wall Tube Sample<br>MU = Unsuccessful Thin Wall Tube Sample Attempt<br>V = Field Vane Shear Test, PP = Pocket Penetrometer<br>MV = Unsuccessful Field Vane Shear Test Attempt |                       |                            |                               |                                                                   |                          | R = Rock Core Sample<br>SSA = Solid Stem Auger<br>HSA = Hollow Stem Auger<br>RC = Roller Cone<br>WOH = Weight of 140 lb. Hammer<br>WOR/C = Weight of Rods or Casing<br>WO1P = Weight of One Person                                                                                                                                                                                             |                         |                                   |                        |                                           |                                                               |                                                                              |  |
|                                                                                                                                                                                                                                                                                  |                       |                            |                               |                                                                   |                          | Su = Peak/Remolded Field Vane Undrained Shear Strength (psf)<br>Su(lab) = Lab Vane Undrained Shear Strength (psf)<br>qp = Unconfined Compressive Strength (ksf)<br>N-uncorrected = Raw Field SPT N-value<br>Hammer Efficiency Factor = Rig Specific Annual Calibration Value<br>N60 = SPT N-uncorrected Corrected for Hammer Efficiency<br>N60v = (Hammer Efficiency Factor/60%)*N-uncorrected |                         |                                   |                        |                                           |                                                               |                                                                              |  |
|                                                                                                                                                                                                                                                                                  |                       |                            |                               |                                                                   |                          | Tv = Pocket Torvane Shear Strength (psf)<br>WC = Water Content, percent<br>LL = Liquid Limit<br>PL = Plastic Limit<br>PI = Plasticity Index<br>G = Grain Size Analysis<br>C = Consolidation Test                                                                                                                                                                                               |                         |                                   |                        |                                           |                                                               |                                                                              |  |
| <div>Sample Information</div>                                                                                                                                                                                                                                                    |                       |                            |                               |                                                                   |                          |                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                   |                        |                                           |                                                               | <div>Laboratory Testing Results/AASHTO and Unified Class.</div>              |  |
| <div>Depth (ft.)</div>                                                                                                                                                                                                                                                           | <div>Sample No.</div> | <div>Pen./Rec. (in.)</div> | <div>Sample Depth (ft.)</div> | <div>Blows (/6 in.)<br/>Shear Strength (psf)<br/>or RQD (%)</div> | <div>N-uncorrected</div> | <div>N60</div>                                                                                                                                                                                                                                                                                                                                                                                 | <div>Casing Blows</div> | <div>Elevation (ft.)</div>        | <div>Graphic Log</div> | <div>Visual Description and Remarks</div> |                                                               |                                                                              |  |
| 50                                                                                                                                                                                                                                                                               |                       |                            |                               |                                                                   |                          |                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                   |                        |                                           | -VASSALBORO FORMATION-                                        | 45.0'<br><div>Bottom of Exploration at 45.0 feet below ground surface.</div> |  |
|                                                                                                                                                                                                                                                                                  |                       |                            |                               |                                                                   |                          |                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                   |                        |                                           | R4 Core Times (min:sec): 43.7-44.7' (2:17); 44.7-45.0' (2:05) |                                                                              |  |
|                                                                                                                                                                                                                                                                                  |                       |                            |                               |                                                                   |                          |                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                   |                        |                                           |                                                               |                                                                              |  |
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|                                                                                                                                                                                                                                                                                  |                       |                            |                               |                                                                   |                          |                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                   |                        |                                           |                                                               |                                                                              |  |
|                                                                                                                                                                                                                                                                                  |                       |                            |                               |                                                                   |                          |                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                   |                        |                                           |                                                               |                                                                              |  |
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| 75                                                                                                                                                                                                                                                                               |                       |                            |                               |                                                                   |                          |                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                   |                        |                                           |                                                               |                                                                              |  |
| <div>Remarks:</div>                                                                                                                                                                                                                                                              |                       |                            |                               |                                                                   |                          |                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                   |                        |                                           |                                                               |                                                                              |  |
| Stratification lines represent approximate boundaries between soil types; transitions may be gradual.                                                                                                                                                                            |                       |                            |                               |                                                                   |                          |                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                   |                        |                                           |                                                               | Page 3 of 3                                                                  |  |
| * Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.                                                                                    |                       |                            |                               |                                                                   |                          |                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                   |                        |                                           |                                                               | Boring No.: BB-GBB-202                                                       |  |



| BORING ID  | CORE ID | CORE RUN DEPTH (FT) | CORE RUN EL. <sup>NOTE 1</sup> | RECOVERY |     | RQD <sup>NOTE 2</sup> |     |
|------------|---------|---------------------|--------------------------------|----------|-----|-----------------------|-----|
|            |         |                     |                                | IN.      | %   | IN.                   | %   |
| BB-GBB-101 | R1      | 34.2 TO 39.2        | 85.3 TO 80.3                   | 60       | 100 | 45                    | 75  |
| BB-GBB-101 | R2      | 39.2 TO 44.2        | 80.3 TO 75.3                   | 60       | 100 | 54                    | 90  |
| BB-GBB-101 | R3      | 44.2 TO 49.2        | 75.3 TO 70.3                   | 63       | 105 | 60                    | 100 |

**NOTES:**

1. ELEVATIONS ARE MEASURED IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
2. "RQD" INDICATES ROCK QUALITY DESIGNATION (PERCENT OF ROCK PIECES RECOVERED EQUAL TO OR GREATER THAN 4 IN. IN LENGTH).



UNDERGROUND  
ENGINEERING &  
ENVIRONMENTAL  
SOLUTIONS

BOOM BRIDGE OVER BOOMBRIDGE BROOK, US ROUTE 2  
GREENBUSH, MAINE

**PHOTOGRAPH OF  
BEDROCK CORE  
BORING: BB-GBB-101**

FILE NO. 127991-003

April 2022



| BORING ID  | CORE ID | CORE RUN DEPTH (FT) | CORE RUN EL. <sup>NOTE 1</sup> | RECOVERY |     | RQD <sup>NOTE 2</sup> |     |
|------------|---------|---------------------|--------------------------------|----------|-----|-----------------------|-----|
|            |         |                     |                                | IN.      | %   | IN.                   | %   |
| BB-GBB-102 | R1      | 38.3 TO 40.5        | 81.5 TO 79.3                   | 26       | 100 | 4                     | 15  |
| BB-GBB-102 | R2      | 40.5 TO 44.9        | 79.3 TO 74.9                   | 53       | 100 | 53                    | 100 |
| BB-GBB-102 | R3      | 44.9 TO 47.1        | 74.9 TO 72.7                   | 26       | 100 | 13                    | 50  |
| BB-GBB-102 | R4      | 47.1 TO 52.1        | 72.7 TO 67.7                   | 60       | 100 | 53                    | 88  |
| BB-GBB-102 | R5      | 52.1 TO 57.1        | 67.7 TO 62.7                   | 60       | 100 | 52                    | 87  |

**NOTES:**

1. ELEVATIONS ARE MEASURED IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
2. "RQD" INDICATES ROCK QUALITY DESIGNATION (PERCENT OF ROCK PIECES RECOVERED EQUAL TO OR GREATER THAN 4 IN. IN LENGTH).



UNDERGROUND  
ENGINEERING &  
ENVIRONMENTAL  
SOLUTIONS

BOOM BRIDGE OVER BOOMBRIDGE BROOK, US ROUTE 2  
GREENBUSH, MAINE

**PHOTOGRAPH OF  
BEDROCK CORE  
BORING: BB-GBB-102**

FILE NO. 127991-003

April 2022



| BORING ID  | CORE ID | CORE RUN DEPTH (FT) | CORE RUN EL. <sup>NOTE 1</sup> | RECOVERY |     | RQD <sup>NOTE 2</sup> |     |
|------------|---------|---------------------|--------------------------------|----------|-----|-----------------------|-----|
|            |         |                     |                                | IN.      | %   | IN.                   | %   |
| BB-GBB-202 | R1      | 35.0 TO 37.0        | 84.5 TO 82.5                   | 20       | 83  | 9                     | 38  |
| BB-GBB-202 | R2      | 37.0 TO 40.0        | 82.5 TO 79.5                   | 24       | 67  | 18                    | 50  |
| BB-GBB-202 | R3      | 40.0 TO 43.7        | 79.5 TO 75.8                   | 43       | 98  | 28                    | 63  |
| BB-GBB-202 | R4      | 43.7 TO 45.0        | 75.8 TO 74.5                   | 15.6     | 100 | 15.6                  | 100 |
| BB-GBB-201 | R1      | 33.5 TO 35.2        | 86.5 TO 84.8                   | 12       | 60  | 0                     | 0   |
| BB-GBB-201 | R2      | 35.2 TO 38.5        | 84.8 TO 81.5                   | 40       | 101 | 39.6                  | 100 |
| BB-GBB-201 | R3      | 38.5 TO 42.3        | 81.5 TO 77.7                   | 46       | 100 | 28                    | 61  |

**NOTES:**

1. ELEVATIONS ARE MEASURED IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
2. "RQD" INDICATES ROCK QUALITY DESIGNATION (PERCENT OF ROCK PIECES RECOVERED EQUAL TO OR GREATER THAN 4 IN. IN LENGTH).



UNDERGROUND  
ENGINEERING &  
ENVIRONMENTAL  
SOLUTIONS

BOOM BRIDGE OVER BOOMBRIDGE BROOK, US ROUTE 2  
GREENBUSH, MAINE

**PHOTOGRAPH OF  
BEDROCK CORE  
BORING: BB-GBB-202 and BB-GBB-201**

FILE NO. 127991-003

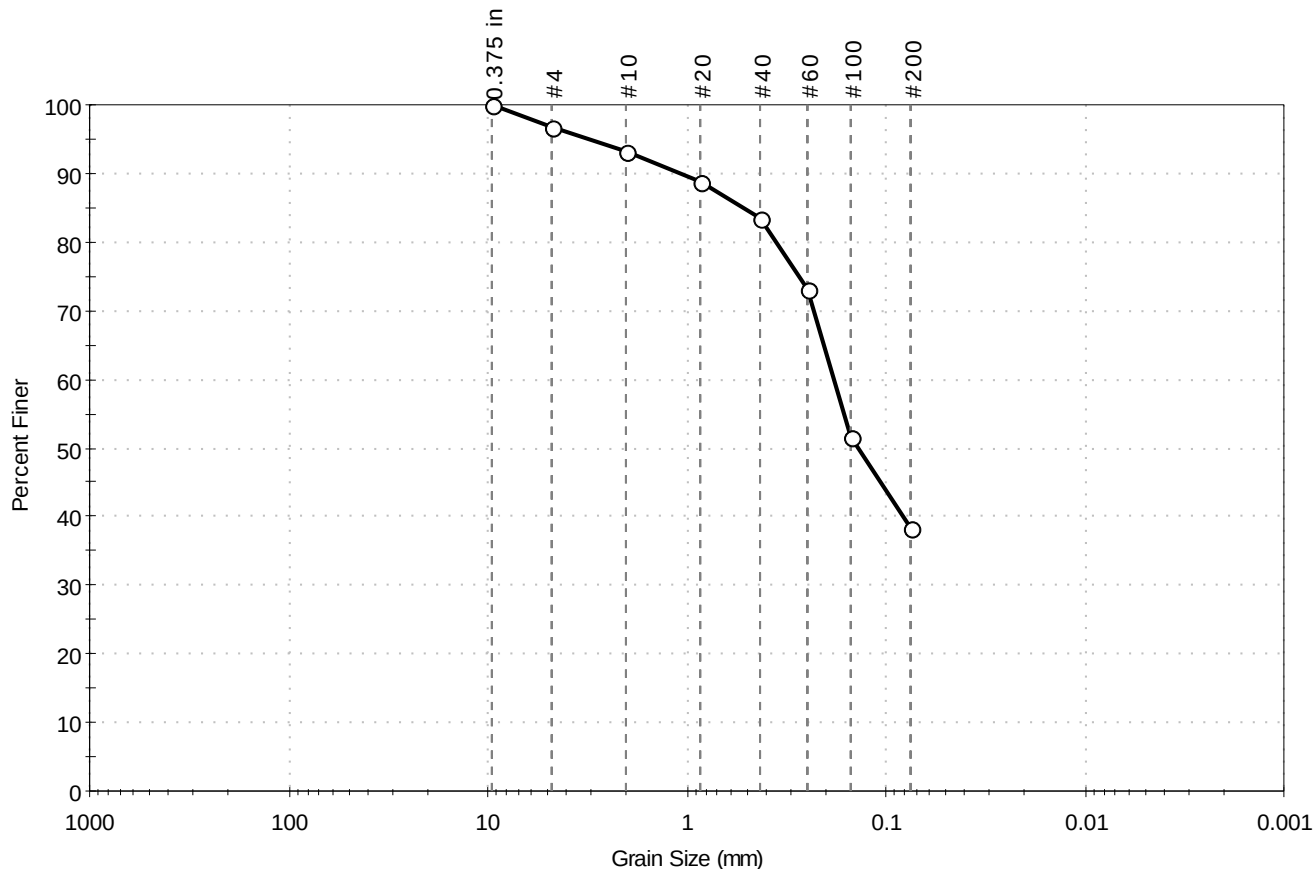
April 2022

## **APPENDIX B**

### **Laboratory Test Results**

|                     |                                    |              |            |
|---------------------|------------------------------------|--------------|------------|
| Client:             | Haley & Aldrich, Inc.              |              |            |
| Project:            | Rt 2 over Beach Bridge Brook       |              |            |
| Location:           | Greenbush, ME                      | Project No:  | GTX-306390 |
| Boring ID:          | BB-GBB-101                         | Sample Type: | bag        |
| Sample ID:          | 4D                                 | Test Date:   | 05/09/17   |
| Depth :             | 8-10                               | Test Id:     | 410684     |
| Test Comment:       | ---                                |              |            |
| Visual Description: | Moist, dark olive brown silty sand |              |            |
| Sample Comment:     | ---                                |              |            |

## Particle Size Analysis - ASTM D422



| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
|----------|----------|--------|--------------------|
| ---      | 3.2      | 58.4   | 38.4               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| 0.375 in   | 9.50           | 100           |               |          |
| #4         | 4.75           | 97            |               |          |
| #10        | 2.00           | 93            |               |          |
| #20        | 0.85           | 89            |               |          |
| #40        | 0.42           | 83            |               |          |
| #60        | 0.25           | 73            |               |          |
| #100       | 0.15           | 52            |               |          |
| #200       | 0.075          | 38            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

### Coefficients

|                             |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.5179 mm | D <sub>30</sub> = N/A |
| D <sub>60</sub> = 0.1829 mm | D <sub>15</sub> = N/A |
| D <sub>50</sub> = 0.1379 mm | D <sub>10</sub> = N/A |
| C <sub>u</sub> = N/A        | C <sub>c</sub> = N/A  |

### Classification

ASTM N/A

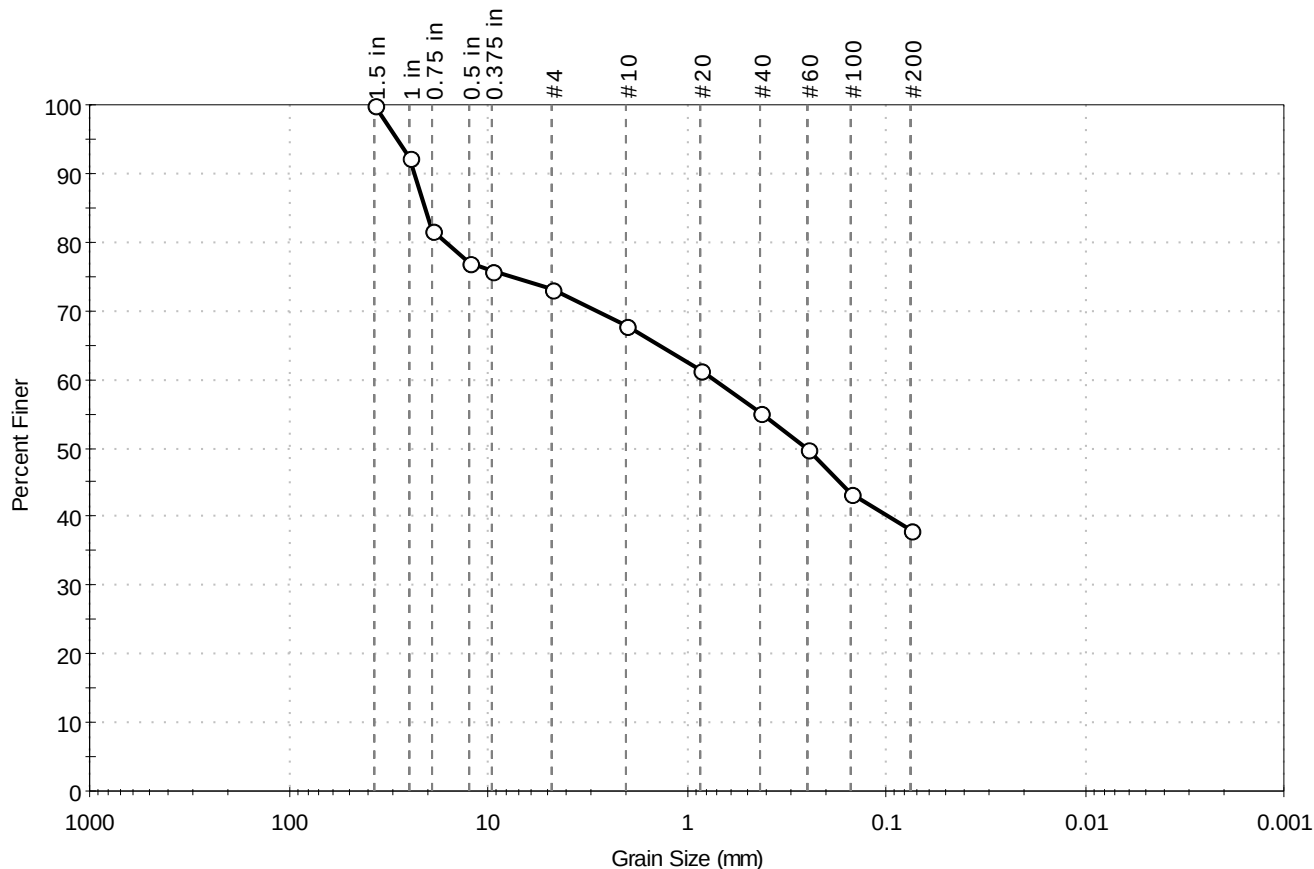
AASHTO Silty Soils (A-4 (0))

### Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR  
Sand/Gravel Hardness : HARD

|                     |                                      |              |            |
|---------------------|--------------------------------------|--------------|------------|
| Client:             | Haley & Aldrich, Inc.                |              |            |
| Project:            | Rt 2 over Beach Bridge Brook         |              |            |
| Location:           | Greenbush, ME                        | Project No:  | GTX-306390 |
| Boring ID:          | BB-GBB-101                           | Sample Type: | bag        |
| Sample ID:          | 5D                                   | Test Date:   | 05/09/17   |
| Depth :             | 13-15                                | Test Id:     | 410685     |
| Test Comment:       | ---                                  |              |            |
| Visual Description: | Moist, olive clayey sand with gravel |              |            |
| Sample Comment:     | ---                                  |              |            |

## Particle Size Analysis - ASTM D422



| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
|----------|----------|--------|--------------------|
| ---      | 26.9     | 35.0   | 38.1               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| 1.5 in     | 37.50          | 100           |               |          |
| 1 in       | 25.00          | 92            |               |          |
| 0.75 in    | 19.00          | 82            |               |          |
| 0.5 in     | 12.50          | 77            |               |          |
| 0.375 in   | 9.50           | 76            |               |          |
| #4         | 4.75           | 73            |               |          |
| #10        | 2.00           | 68            |               |          |
| #20        | 0.85           | 61            |               |          |
| #40        | 0.42           | 55            |               |          |
| #60        | 0.25           | 50            |               |          |
| #100       | 0.15           | 43            |               |          |
| #200       | 0.075          | 38            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

### Coefficients

|                              |                       |
|------------------------------|-----------------------|
| D <sub>85</sub> = 20.6847 mm | D <sub>30</sub> = N/A |
| D <sub>60</sub> = 0.7325 mm  | D <sub>15</sub> = N/A |
| D <sub>50</sub> = 0.2529 mm  | D <sub>10</sub> = N/A |
| C <sub>u</sub> = N/A         | C <sub>c</sub> = N/A  |

### Classification

ASTM N/A

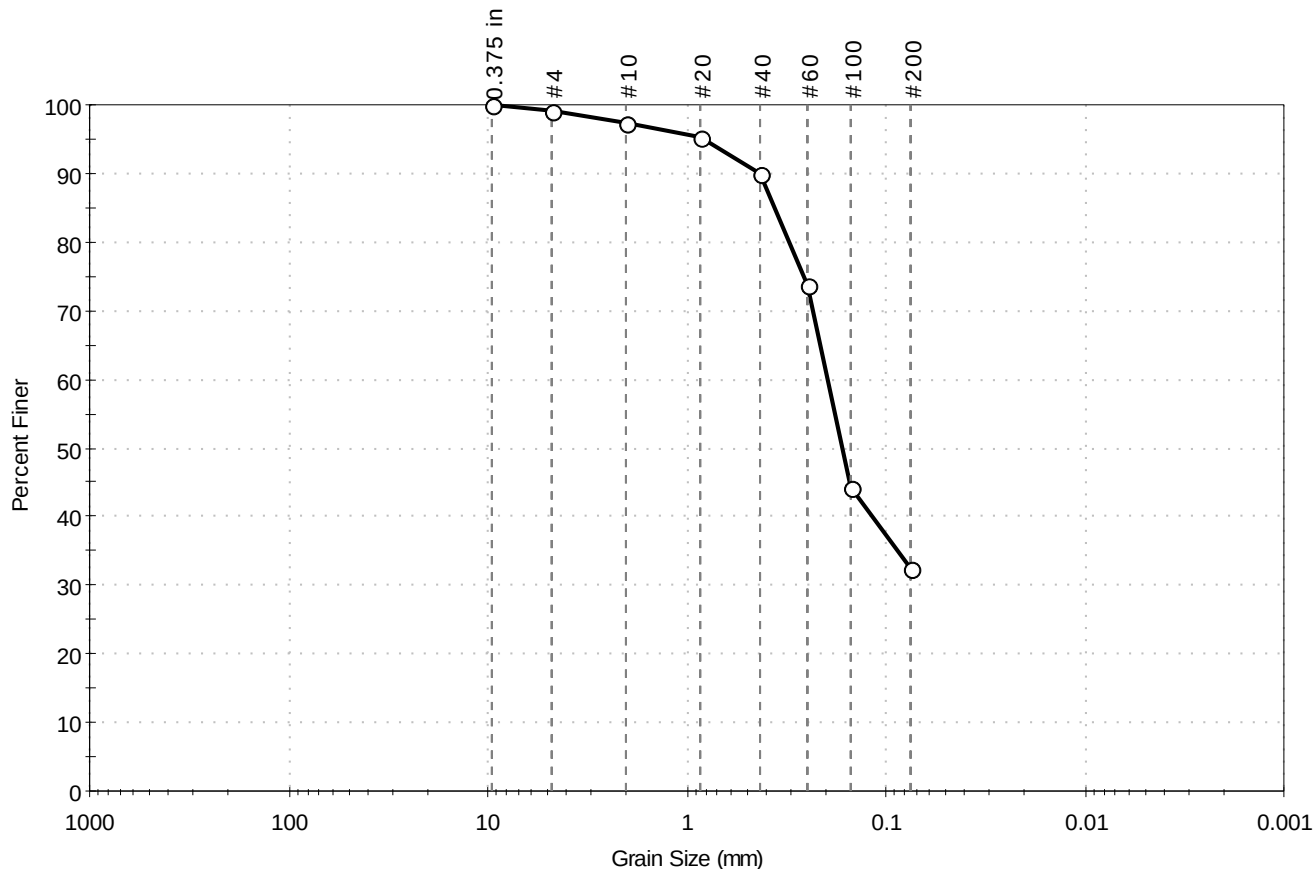
AASHTO Silty Soils (A-4 (0))

### Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR  
Sand/Gravel Hardness : HARD

|                     |                                    |              |            |
|---------------------|------------------------------------|--------------|------------|
| Client:             | Haley & Aldrich, Inc.              |              |            |
| Project:            | Rt 2 over Beach Bridge Brook       |              |            |
| Location:           | Greenbush, ME                      | Project No:  | GTX-306390 |
| Boring ID:          | BB-GBB-102                         | Sample Type: | bag        |
| Sample ID:          | 5D                                 | Test Date:   | 05/09/17   |
| Depth :             | 10-12                              | Test Id:     | 410686     |
| Test Comment:       | ---                                |              |            |
| Visual Description: | Moist, dark olive brown silty sand |              |            |
| Sample Comment:     | ---                                |              |            |

## Particle Size Analysis - ASTM D422



| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
|----------|----------|--------|--------------------|
| ---      | 0.7      | 66.7   | 32.6               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| 0.375 in   | 9.50           | 100           |               |          |
| #4         | 4.75           | 99            |               |          |
| #10        | 2.00           | 97            |               |          |
| #20        | 0.85           | 95            |               |          |
| #40        | 0.42           | 90            |               |          |
| #60        | 0.25           | 74            |               |          |
| #100       | 0.15           | 44            |               |          |
| #200       | 0.075          | 33            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

### Coefficients

|                             |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.3618 mm | D <sub>30</sub> = N/A |
| D <sub>60</sub> = 0.1968 mm | D <sub>15</sub> = N/A |
| D <sub>50</sub> = 0.1654 mm | D <sub>10</sub> = N/A |
| C <sub>u</sub> = N/A        | C <sub>c</sub> = N/A  |

### Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

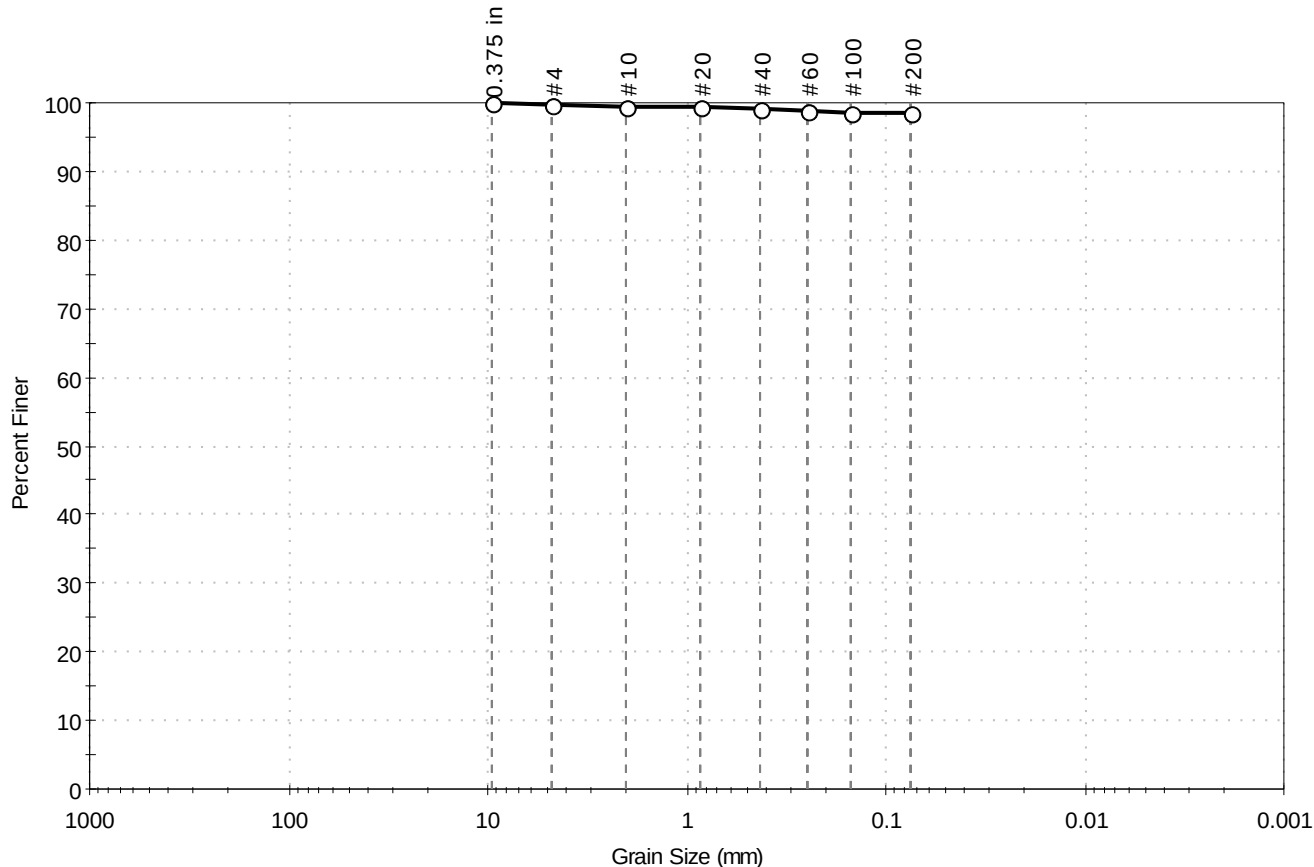
### Sample / Test Description

Sand/Gravel Particle Shape : **ROUNDED**  
 Sand/Gravel Hardness : **HARD**



|                     |                              |              |            |
|---------------------|------------------------------|--------------|------------|
| Client:             | Haley & Aldrich, Inc.        | Project No:  | GTX-306390 |
| Project:            | Rt 2 over Beach Bridge Brook |              |            |
| Location:           | Greenbush, ME                |              |            |
| Boring ID:          | BB-GBB-102                   | Sample Type: | bag        |
| Sample ID:          | 6D                           | Test Date:   | 05/09/17   |
| Depth :             | 15-17                        | Test Id:     | 410687     |
| Test Comment:       | ---                          |              |            |
| Visual Description: | Moist, gray clay             |              |            |
| Sample Comment:     | ---                          |              |            |

## Particle Size Analysis - ASTM D422



| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
|----------|----------|--------|--------------------|
| ---      | 0.2      | 1.3    | 98.5               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| 0.375 in   | 9.50           | 100           |               |          |
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 100           |               |          |
| #20        | 0.85           | 99            |               |          |
| #40        | 0.42           | 99            |               |          |
| #60        | 0.25           | 99            |               |          |
| #100       | 0.15           | 99            |               |          |
| #200       | 0.075          | 98            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

### Coefficients

|                       |                       |
|-----------------------|-----------------------|
| D <sub>85</sub> = N/A | D <sub>30</sub> = N/A |
| D <sub>60</sub> = N/A | D <sub>15</sub> = N/A |
| D <sub>50</sub> = N/A | D <sub>10</sub> = N/A |
| C <sub>u</sub> = N/A  | C <sub>c</sub> = N/A  |

### Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

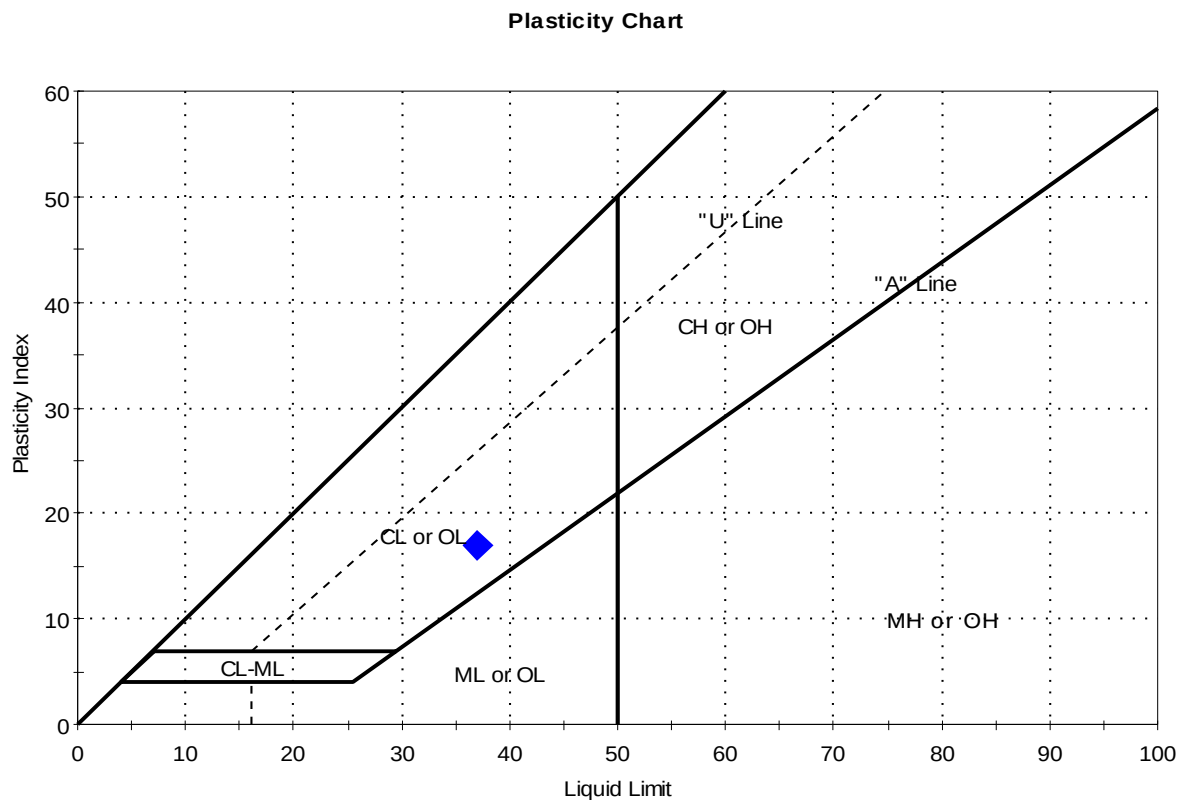
### Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

|                     |                              |              |            |
|---------------------|------------------------------|--------------|------------|
| Client:             | Haley & Aldrich, Inc.        | Project No:  | GTX-306390 |
| Project:            | Rt 2 over Beach Bridge Brook |              |            |
| Location:           | Greenbush, ME                |              |            |
| Boring ID:          | BB-GBB-101                   | Sample Type: | bag        |
| Sample ID:          | 9D                           | Test Date:   | 05/09/17   |
| Depth :             | 25-27                        | Test Id:     | 410688     |
| Test Comment:       | ---                          | Tested By:   | cam        |
| Visual Description: | Moist, olive clay            | Checked By:  | jsc        |
| Sample Comment:     | ---                          |              |            |

## Atterberg Limits - ASTM D4318



| Symbol | Sample ID | Boring   | Depth | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification |
|--------|-----------|----------|-------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | 9D        | B-BBG-10 | 25-27 | 30                          | 37           | 20            | 17               | 0.6             |                     |

Sample Prepared using the WET method

Dry Strength: VERY HIGH

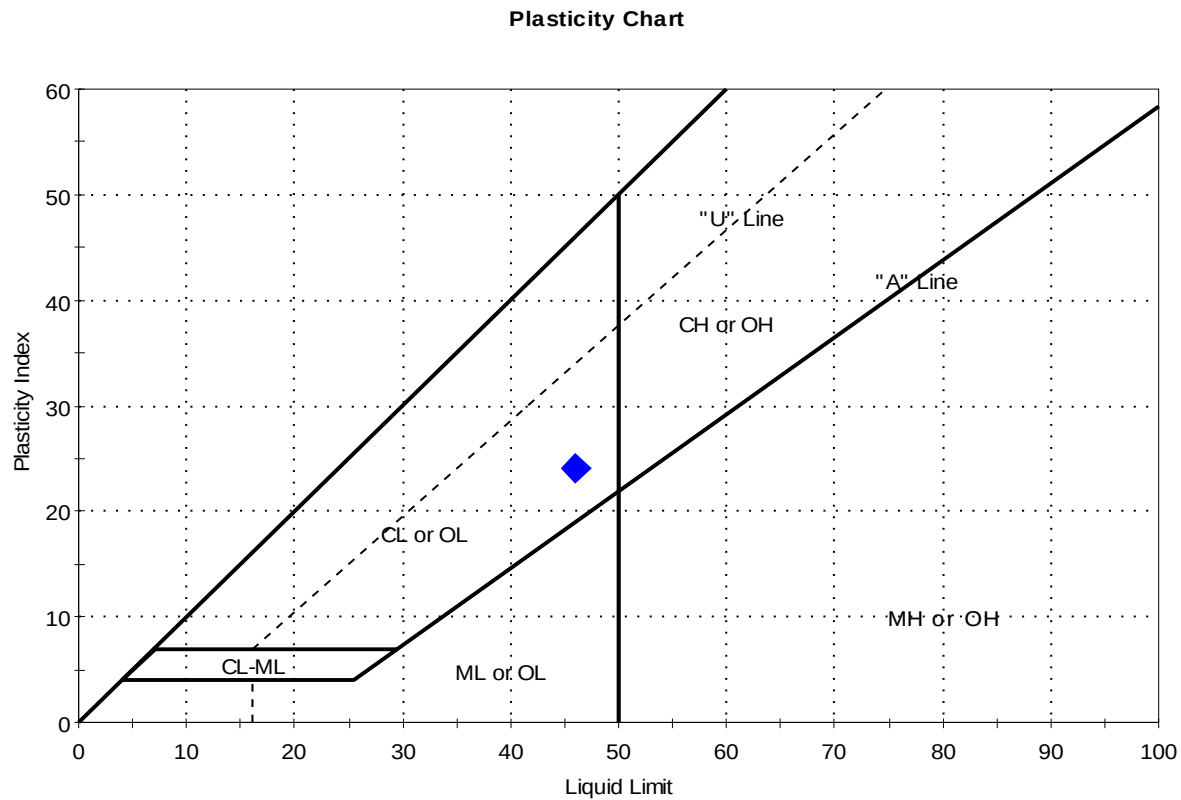
Dilatancy: SLOW

Toughness: LOW



|                     |                              |              |            |
|---------------------|------------------------------|--------------|------------|
| Client:             | Haley & Aldrich, Inc.        | Project No:  | GTX-306390 |
| Project:            | Rt 2 over Beach Bridge Brook |              |            |
| Location:           | Greenbush, ME                |              |            |
| Boring ID:          | BB-GBB-102                   | Sample Type: | bag        |
| Sample ID:          | 7D                           | Test Date:   | 05/09/17   |
| Depth :             | 20-22                        | Test Id:     | 410689     |
| Test Comment:       | ---                          | Tested By:   | cam        |
| Visual Description: | Moist, olive clay            | Checked By:  | jsc        |
| Sample Comment:     | ---                          |              |            |

## Atterberg Limits - ASTM D4318



| Symbol | Sample ID | Boring   | Depth | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification |
|--------|-----------|----------|-------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | 7D        | B-BBG-10 | 20-22 | 35                          | 46           | 22            | 24               | 0.5             |                     |

Sample Prepared using the WET method

Dry Strength: VERY HIGH

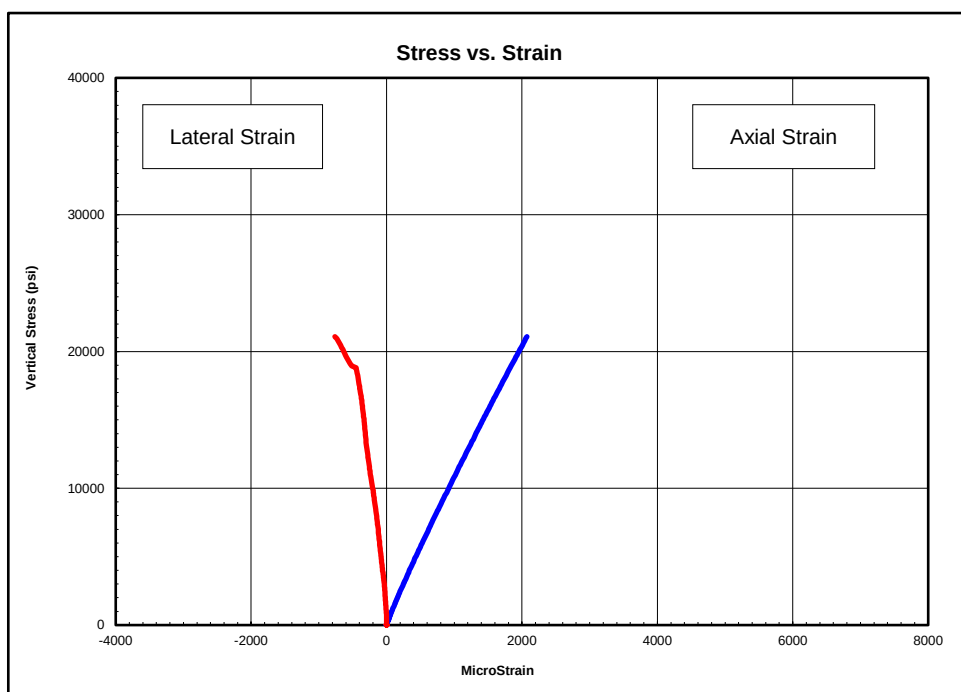
Dilatancy: SLOW

Toughness: LOW



|                     |                                            |
|---------------------|--------------------------------------------|
| Client:             | Haley & Aldrich, Inc.                      |
| Project Name:       | Rt 2 over Beach Bridge Brook               |
| Project Location:   | Greenbush, ME                              |
| GTX #:              | 306390                                     |
| Test Date:          | 5/9/2017                                   |
| Tested By:          | daa/trm                                    |
| Checked By:         | jsc                                        |
| Boring ID:          | BB-GBB-101                                 |
| Sample ID:          | R2                                         |
| Depth, ft:          | 40.61-40.99                                |
| Sample Type:        | rock core                                  |
| Sample Description: | See photographs<br>Intact material failure |

## Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 21,091 psi

| Stress Range, psi | Young's Modulus, psi | Poisson's Ratio |
|-------------------|----------------------|-----------------|
| 2100-7700         | 10,700,000           | 0.24            |
| 7700-13400        | 9,990,000            | 0.29            |
| 13400-19000       | 9,550,000            | 0.29            |

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.  
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.  
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.  
Calculations assume samples are isotropic, which is not necessarily the case.

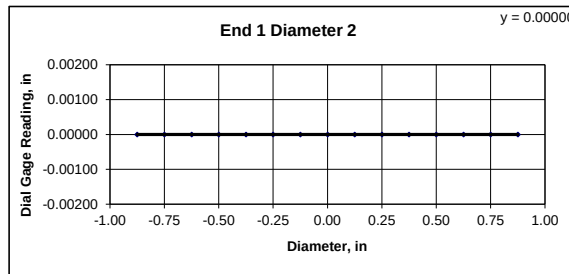
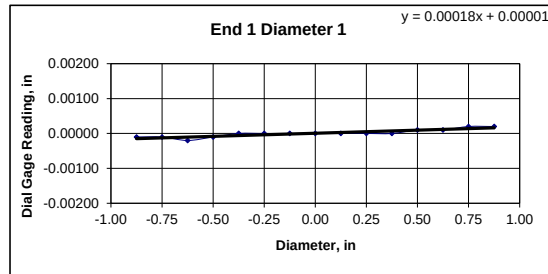


|                     |                              |             |          |
|---------------------|------------------------------|-------------|----------|
| Client:             | Haley & Aldrich, Inc.        | Test Date:  | 5/9/2017 |
| Project Name:       | Rt 2 over Beach Bridge Brook | Tested By:  | daa/trm  |
| Project Location:   | Greenbush, ME                | Checked By: | jsc      |
| GTX #:              | 306390                       |             |          |
| Boring ID:          | BB-GBB-101                   |             |          |
| Sample ID:          | R2                           |             |          |
| Depth:              | 40.61-40.99 ft               |             |          |
| Visual Description: | See photographs              |             |          |

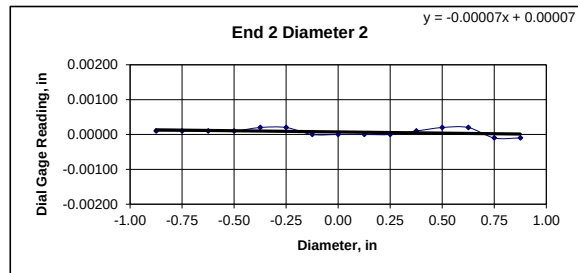
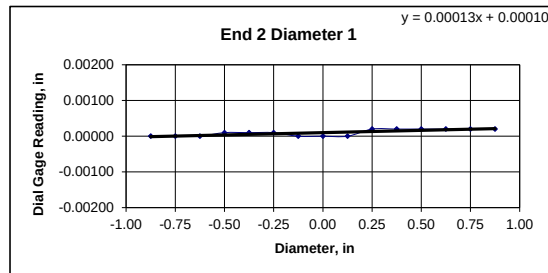
## UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

| BULK DENSITY                       |       |                                             |         | DEVIATION FROM STRAIGHTNESS (Procedure S1)                                                               |  |
|------------------------------------|-------|---------------------------------------------|---------|----------------------------------------------------------------------------------------------------------|--|
|                                    | 1     | 2                                           | Average | Maximum gap between side of core and reference surface plate:<br>Is the maximum gap $\leq$ 0.02 in.? YES |  |
| Specimen Length, in:               | 4.22  | 4.22                                        | 4.22    | Maximum difference must be $< 0.020$ in.                                                                 |  |
| Specimen Diameter, in:             | 1.99  | 1.99                                        | 1.99    | Straightness Tolerance Met? YES                                                                          |  |
| Specimen Mass, g:                  | 584.9 |                                             |         |                                                                                                          |  |
| Bulk Density, lb/ft <sup>3</sup> : | 169   |                                             |         |                                                                                                          |  |
| Length to Diameter Ratio:          | 2.1   | Minimum Diameter Tolerance Met? YES         |         |                                                                                                          |  |
|                                    |       | Length to Diameter Ratio Tolerance Met? YES |         |                                                                                                          |  |

| END FLATNESS AND PARALLELISM (Procedure FP1)                                                                                                         |          |          |          |          |         |         |         |         |         |         |         |         |         |          |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|
| END 1                                                                                                                                                | -0.875   | -0.750   | -0.625   | -0.500   | -0.375  | -0.250  | -0.125  | 0.000   | 0.125   | 0.250   | 0.375   | 0.500   | 0.625   | 0.750    | 0.875    |
| Diameter 1, in                                                                                                                                       | -0.00010 | -0.00010 | -0.00020 | -0.00010 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00010 | 0.00010 | 0.00020  | 0.00020  |
| Diameter 2, in (rotated 90°)                                                                                                                         | 0.00000  | 0.00000  | 0.00000  | 0.00000  | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000  | 0.00000  |
| Difference between max and min readings, in:<br>0° = 0.00040      90° = 0.00000                                                                      |          |          |          |          |         |         |         |         |         |         |         |         |         |          |          |
| END 2                                                                                                                                                | -0.875   | -0.750   | -0.625   | -0.500   | -0.375  | -0.250  | -0.125  | 0.000   | 0.125   | 0.250   | 0.375   | 0.500   | 0.625   | 0.750    | 0.875    |
| Diameter 1, in                                                                                                                                       | 0.00000  | 0.00000  | 0.00000  | 0.00010  | 0.00010 | 0.00010 | 0.00000 | 0.00000 | 0.00000 | 0.00020 | 0.00020 | 0.00020 | 0.00020 | 0.00020  | 0.00020  |
| Diameter 2, in (rotated 90°)                                                                                                                         | 0.00010  | 0.00010  | 0.00010  | 0.00010  | 0.00020 | 0.00020 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00010 | 0.00020 | 0.00020 | -0.00010 | -0.00010 |
| Difference between max and min readings, in:<br>0° = 0.0002      90° = 0.0003<br>Maximum difference must be < 0.0020 in.      Difference = ± 0.00020 |          |          |          |          |         |         |         |         |         |         |         |         |         |          |          |
| Flatness Tolerance Met? YES                                                                                                                          |          |          |          |          |         |         |         |         |         |         |         |         |         |          |          |



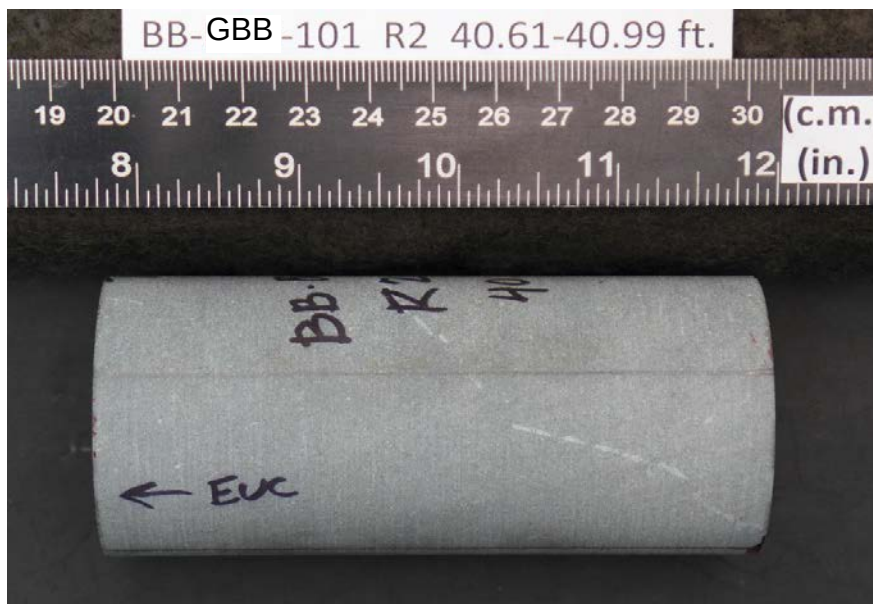
|                                               |         |
|-----------------------------------------------|---------|
| DIAMETER 1                                    |         |
| End 1:                                        |         |
| Slope of Best Fit Line                        | 0.00018 |
| Angle of Best Fit Line:                       | 0.01031 |
| End 2:                                        |         |
| Slope of Best Fit Line                        | 0.00013 |
| Angle of Best Fit Line:                       | 0.00745 |
| Maximum Angular Difference:                   | 0.00286 |
| Parallelism Tolerance Met? Spherically Seated | YES     |



|                                               |          |
|-----------------------------------------------|----------|
| DIAMETER 2                                    |          |
| End 1:                                        |          |
| Slope of Best Fit Line                        | 0.00000  |
| Angle of Best Fit Line:                       | 0.00000  |
| End 2:                                        |          |
| Slope of Best Fit Line                        | -0.00007 |
| Angle of Best Fit Line:                       | -0.00401 |
| Maximum Angular Difference:                   | 0.00401  |
| Parallelism Tolerance Met? Spherically Seated | YES      |

| PERPENDICULARITY (Procedure P1) |                                       |                |         |        |                                 | Maximum angle of departure must be $\leq 0.25^\circ$ |  |
|---------------------------------|---------------------------------------|----------------|---------|--------|---------------------------------|------------------------------------------------------|--|
| END 1                           | Difference, Maximum and Minimum (in.) | Diameter (in.) | Slope   | Angle° | Perpendicularity Tolerance Met? |                                                      |  |
| Diameter 1, in                  | 0.00040                               | 1.990          | 0.00020 | 0.012  | YES                             |                                                      |  |
| Diameter 2, in (rotated 90°)    | 0.00000                               | 1.990          | 0.00000 | 0.000  | YES                             | Perpendicularity Tolerance Met? YES                  |  |
| END 2                           |                                       |                |         |        |                                 |                                                      |  |
| Diameter 1, in                  | 0.00020                               | 1.990          | 0.00010 | 0.006  | YES                             |                                                      |  |
| Diameter 2, in (rotated 90°)    | 0.00030                               | 1.990          | 0.00015 | 0.009  | YES                             |                                                      |  |

|                   |                              |
|-------------------|------------------------------|
| Client:           | Haley & Aldrich, Inc.        |
| Project Name:     | Rt 2 over Beach Bridge Brook |
| Project Location: | Greenbush, ME                |
| GTX #:            | 306390                       |
| Test Date:        | 5/9/2017                     |
| Tested By:        | daa/trm                      |
| Checked By:       | jsc                          |
| Boring ID:        | BB-GBB-101                   |
| Sample ID:        | R2                           |
| Depth, ft:        | 40.61-40.99                  |



After cutting and grinding

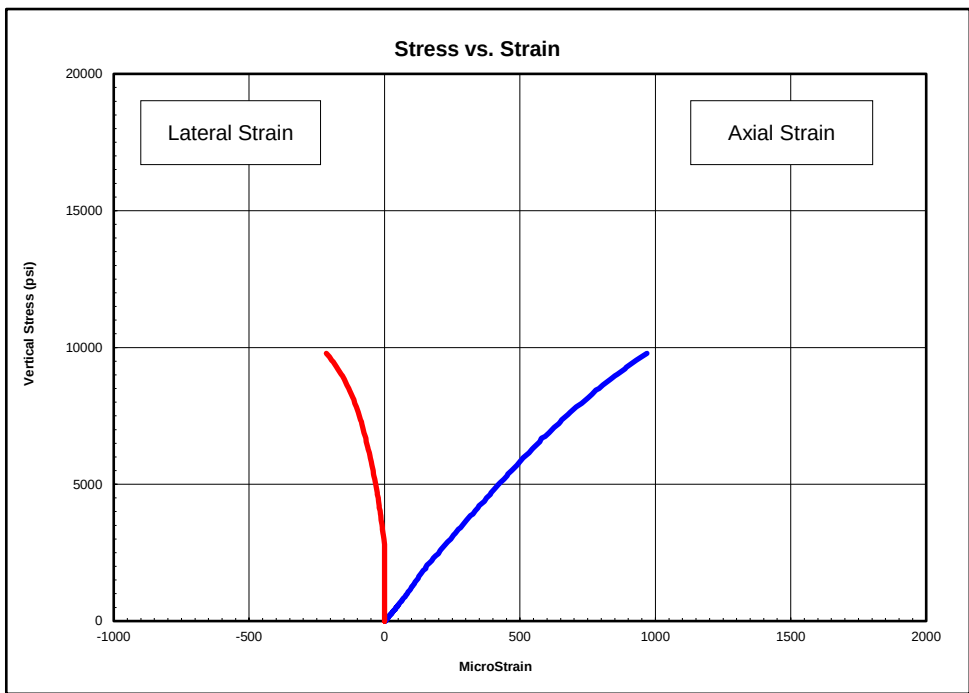


After break



|                     |                                                              |
|---------------------|--------------------------------------------------------------|
| Client:             | Haley & Aldrich, Inc.                                        |
| Project Name:       | Rt 2 over Beach Bridge Brook                                 |
| Project Location:   | Greenbush, ME                                                |
| GTX #:              | 306390                                                       |
| Test Date:          | 5/9/2017                                                     |
| Tested By:          | daa/trm                                                      |
| Checked By:         | jsc                                                          |
| Boring ID:          | BB-GBB-102                                                   |
| Sample ID:          | R2                                                           |
| Depth, ft:          | 40.51-40.88                                                  |
| Sample Type:        | rock core                                                    |
| Sample Description: | See photographs<br>Intact material and discontinuity failure |

## Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 9,789 psi

| Stress Range, psi | Young's Modulus, psi | Poisson's Ratio |
|-------------------|----------------------|-----------------|
| 1000-3600         | 12,200,000           | 0.06            |
| 3600-6200         | 10,800,000           | 0.19            |
| 6200-8800         | 8,890,000            | 0.30            |

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.  
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.  
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.  
Calculations assume samples are isotropic, which is not necessarily the case.

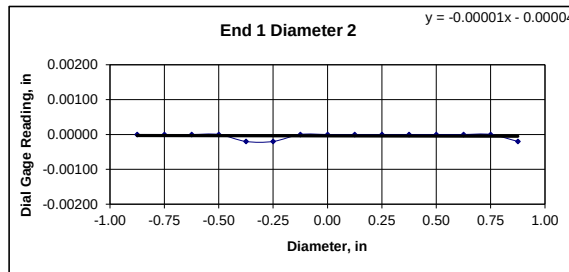
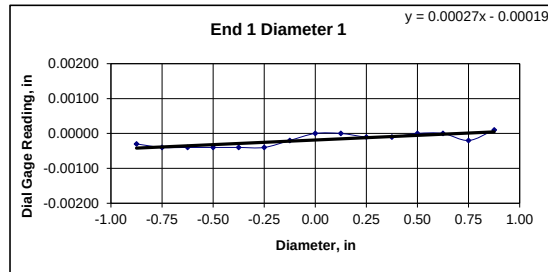


|                     |                              |             |          |
|---------------------|------------------------------|-------------|----------|
| Client:             | Haley & Aldrich, Inc.        | Test Date:  | 5/9/2017 |
| Project Name:       | Rt 2 over Beach Bridge Brook | Tested By:  | daa/trm  |
| Project Location:   | Greenbush, ME                | Checked By: | jsc      |
| GTX #:              | 306390                       |             |          |
| Boring ID:          | BB-GBB-102                   |             |          |
| Sample ID:          | R2                           |             |          |
| Depth:              | 40.51-40.88 ft               |             |          |
| Visual Description: | See photographs              |             |          |

## UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

| BULK DENSITY                       |        |                                             |         | DEVIATION FROM STRAIGHTNESS (Procedure S1)                                                               |  |
|------------------------------------|--------|---------------------------------------------|---------|----------------------------------------------------------------------------------------------------------|--|
|                                    | 1      | 2                                           | Average | Maximum gap between side of core and reference surface plate:<br>Is the maximum gap $\leq$ 0.02 in.? YES |  |
| Specimen Length, in:               | 4.22   | 4.22                                        | 4.22    | Maximum difference must be $<$ 0.020 in.                                                                 |  |
| Specimen Diameter, in:             | 1.99   | 1.99                                        | 1.99    | Straightness Tolerance Met? YES                                                                          |  |
| Specimen Mass, g:                  | 587.83 |                                             |         |                                                                                                          |  |
| Bulk Density, lb/ft <sup>3</sup> : | 170    |                                             |         |                                                                                                          |  |
| Length to Diameter Ratio:          | 2.1    | Minimum Diameter Tolerance Met? YES         |         |                                                                                                          |  |
|                                    |        | Length to Diameter Ratio Tolerance Met? YES |         |                                                                                                          |  |

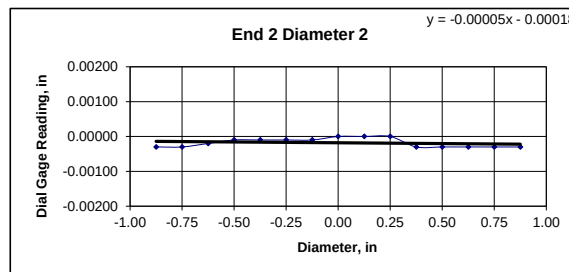
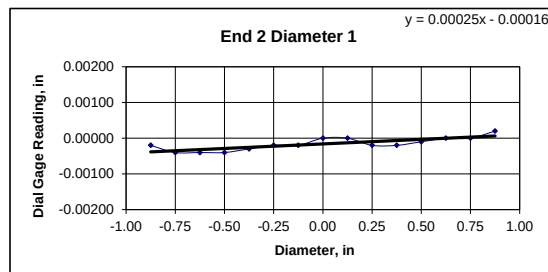
| END FLATNESS AND PARALLELISM (Procedure FP1)                                                                                                         |          |          |          |          |          |          |          |         |         |          |          |          |          |          |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|---------|---------|----------|----------|----------|----------|----------|----------|
| END 1                                                                                                                                                | -0.875   | -0.750   | -0.625   | -0.500   | -0.375   | -0.250   | -0.125   | 0.000   | 0.125   | 0.250    | 0.375    | 0.500    | 0.625    | 0.750    | 0.875    |
| Diameter 1, in                                                                                                                                       | -0.00030 | -0.00040 | -0.00040 | -0.00040 | -0.00040 | -0.00040 | -0.00020 | 0.00000 | 0.00000 | -0.00010 | -0.00010 | 0.00000  | 0.00000  | -0.00020 | 0.00010  |
| Diameter 2, in (rotated 90°)                                                                                                                         | 0.00000  | 0.00000  | 0.00000  | 0.00000  | -0.00020 | -0.00020 | 0.00000  | 0.00000 | 0.00000 | 0.00000  | 0.00000  | 0.00000  | 0.00000  | 0.00000  | -0.00020 |
| Difference between max and min readings, in:<br>0° = 0.00050      90° = 0.00020                                                                      |          |          |          |          |          |          |          |         |         |          |          |          |          |          |          |
| END 2                                                                                                                                                | -0.875   | -0.750   | -0.625   | -0.500   | -0.375   | -0.250   | -0.125   | 0.000   | 0.125   | 0.250    | 0.375    | 0.500    | 0.625    | 0.750    | 0.875    |
| Diameter 1, in                                                                                                                                       | -0.00020 | -0.00040 | -0.00040 | -0.00040 | -0.00030 | -0.00020 | -0.00020 | 0.00000 | 0.00000 | -0.00020 | -0.00020 | -0.00010 | 0.00000  | 0.00000  | 0.00020  |
| Diameter 2, in (rotated 90°)                                                                                                                         | -0.00030 | -0.00030 | -0.00020 | -0.00010 | -0.00010 | -0.00010 | -0.00010 | 0.00000 | 0.00000 | 0.00000  | -0.00030 | -0.00030 | -0.00030 | -0.00030 | -0.00030 |
| Difference between max and min readings, in:<br>0° = 0.0006      90° = 0.0003<br>Maximum difference must be < 0.0020 in.      Difference = ± 0.00030 |          |          |          |          |          |          |          |         |         |          |          |          |          |          |          |
| Flatness Tolerance Met? YES                                                                                                                          |          |          |          |          |          |          |          |         |         |          |          |          |          |          |          |



### DIAMETER 1

|                             |                         |         |
|-----------------------------|-------------------------|---------|
| End 1:                      | Slope of Best Fit Line  | 0.00027 |
|                             | Angle of Best Fit Line: | 0.01547 |
| End 2:                      | Slope of Best Fit Line  | 0.00025 |
|                             | Angle of Best Fit Line: | 0.01432 |
| Maximum Angular Difference: |                         | 0.00115 |

Parallelism Tolerance Met? YES  
Spherically Seated



### DIAMETER 2

|                             |                         |          |
|-----------------------------|-------------------------|----------|
| End 1:                      | Slope of Best Fit Line  | -0.00001 |
|                             | Angle of Best Fit Line: | -0.00057 |
| End 2:                      | Slope of Best Fit Line  | -0.00005 |
|                             | Angle of Best Fit Line: | -0.00286 |
| Maximum Angular Difference: |                         | 0.00229  |

Parallelism Tolerance Met? YES  
Spherically Seated

| PERPENDICULARITY (Procedure P1) |                                       |                |         |        |                                 | Maximum angle of departure must be $\leq$ 0.25° |  |
|---------------------------------|---------------------------------------|----------------|---------|--------|---------------------------------|-------------------------------------------------|--|
| END 1                           | Difference, Maximum and Minimum (in.) | Diameter (in.) | Slope   | Angle° | Perpendicularity Tolerance Met? |                                                 |  |
| Diameter 1, in                  | 0.00050                               | 1.990          | 0.00025 | 0.014  | YES                             |                                                 |  |
| Diameter 2, in (rotated 90°)    | 0.00020                               | 1.990          | 0.00010 | 0.006  | YES                             | Perpendicularity Tolerance Met? YES             |  |
| END 2                           |                                       |                |         |        |                                 |                                                 |  |
| Diameter 1, in                  | 0.00060                               | 1.990          | 0.00030 | 0.017  | YES                             |                                                 |  |
| Diameter 2, in (rotated 90°)    | 0.00030                               | 1.990          | 0.00015 | 0.009  | YES                             |                                                 |  |



|                   |                              |
|-------------------|------------------------------|
| Client:           | Haley & Aldrich, Inc.        |
| Project Name:     | Rt 2 over Beach Bridge Brook |
| Project Location: | Greenbush, ME                |
| GTX #:            | 306390                       |
| Test Date:        | 5/9/2017                     |
| Tested By:        | daa/trm                      |
| Checked By:       | jsc                          |
| Boring ID:        | BB-GBB-102                   |
| Sample ID:        | R2                           |
| Depth, ft:        | 40.51-40.88                  |



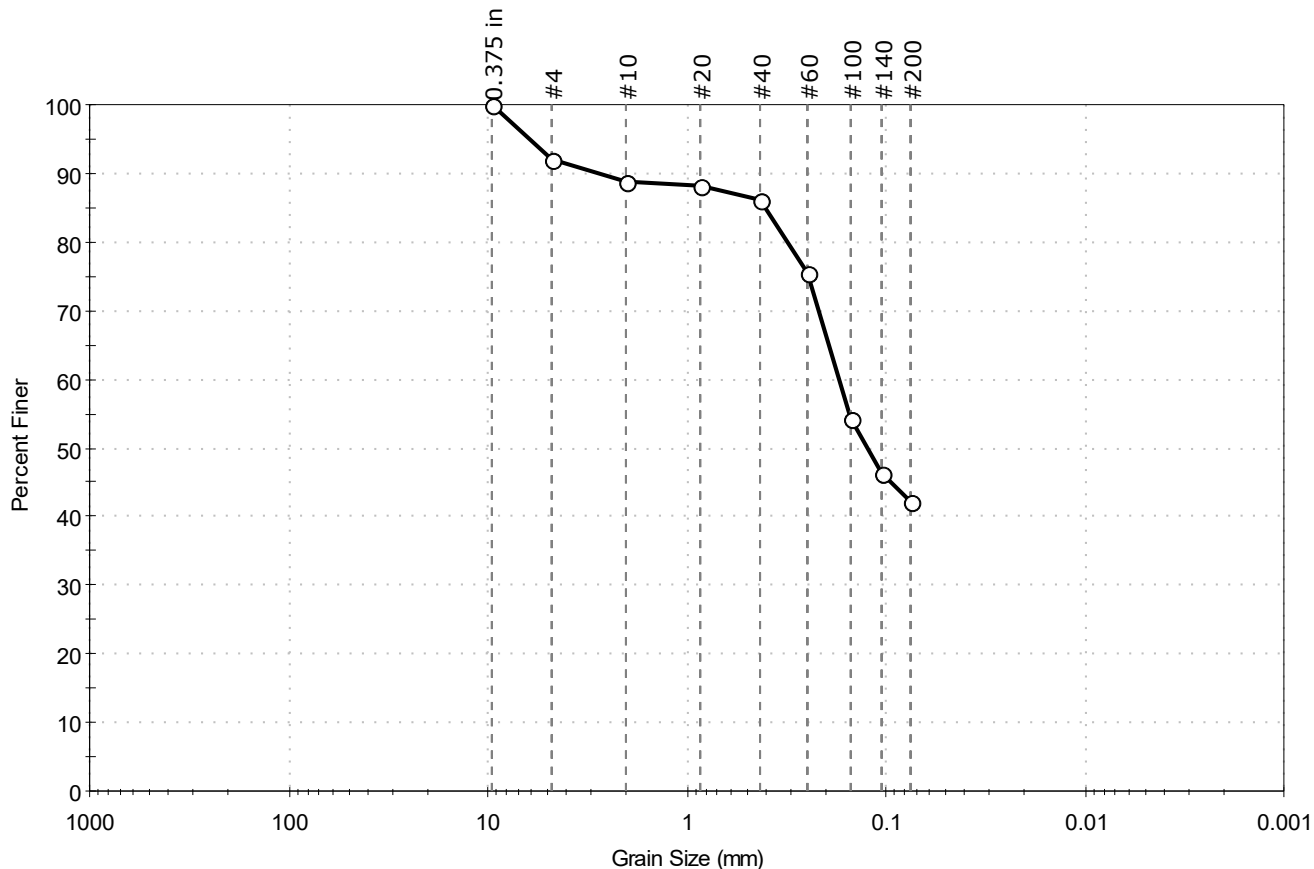
After cutting and grinding



After break

|                     |                                    |              |            |
|---------------------|------------------------------------|--------------|------------|
| Client:             | Haley & Aldrich, Inc.              |              |            |
| Project:            | US Rte 2 Brdg ov Boombridge Brk    |              |            |
| Location:           | Greenbush, ME                      | Project No:  | GTX-313979 |
| Boring ID:          | BB-GBB-201                         | Sample Type: | jar        |
| Sample ID:          | 4D                                 | Test Date:   | 07/23/21   |
| Depth :             | 8-10                               | Test Id:     | 625330     |
| Test Comment:       | ---                                |              |            |
| Visual Description: | Moist, yellowish brown clayey sand |              |            |
| Sample Comment:     | ---                                |              |            |

## Particle Size Analysis - ASTM D6913



| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
|----------|----------|--------|--------------------|
| —        | 8.0      | 49.9   | 42.1               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| 0.375 in   | 9.50           | 100           |               |          |
| #4         | 4.75           | 92            |               |          |
| #10        | 2.00           | 89            |               |          |
| #20        | 0.85           | 88            |               |          |
| #40        | 0.42           | 86            |               |          |
| #60        | 0.25           | 75            |               |          |
| #100       | 0.15           | 54            |               |          |
| #140       | 0.11           | 46            |               |          |
| #200       | 0.075          | 42            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

### Coefficients

$D_{85} = 0.4006 \text{ mm}$        $D_{30} = \text{N/A}$   
 $D_{60} = 0.1726 \text{ mm}$        $D_{15} = \text{N/A}$   
 $D_{50} = 0.1251 \text{ mm}$        $D_{10} = \text{N/A}$   
 $C_u = \text{N/A}$        $C_c = \text{N/A}$

### Classification

ASTM      N/A

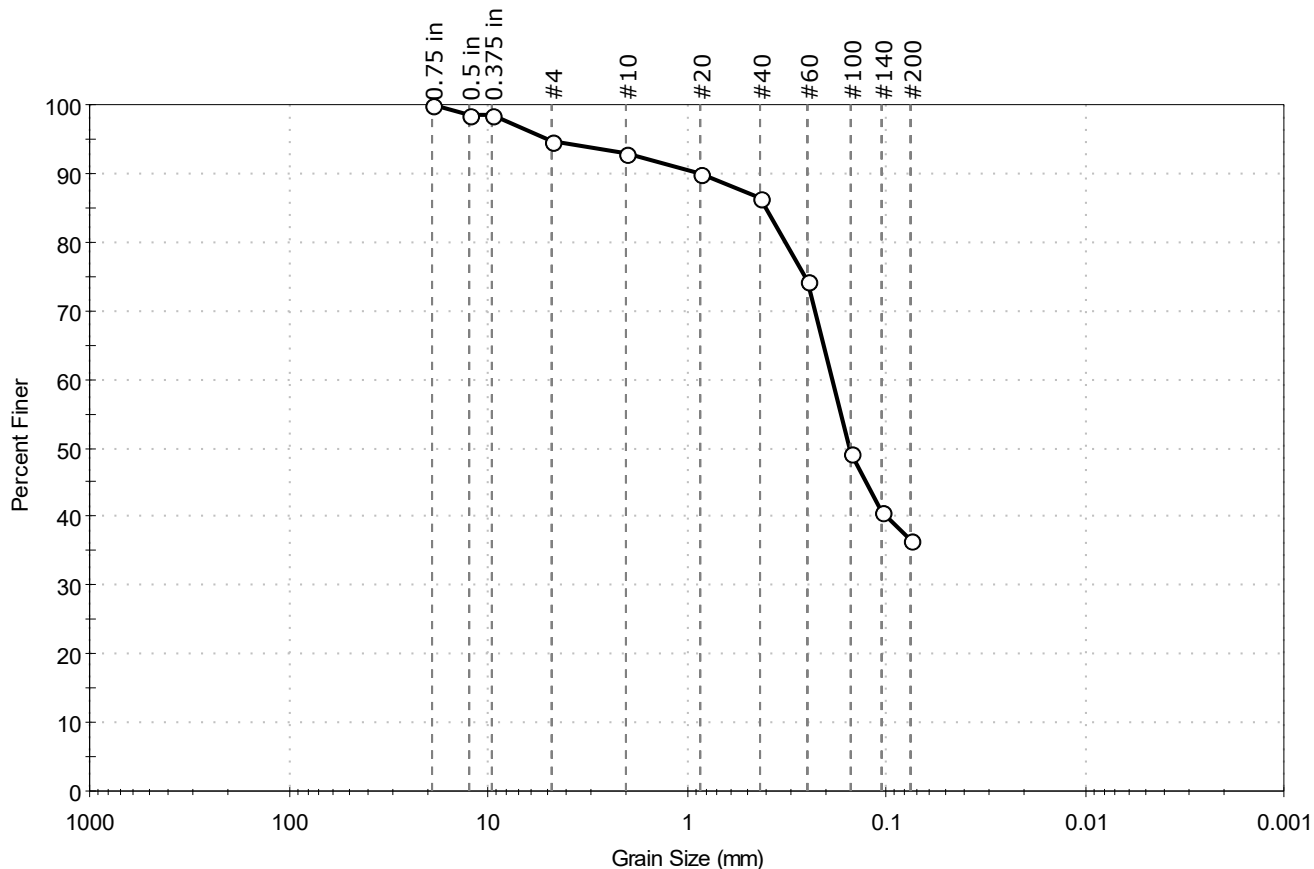
AASHTO      Silty Soils (A-4 (0))

### Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR  
 Sand/Gravel Hardness : HARD

|                     |                                 |              |            |
|---------------------|---------------------------------|--------------|------------|
| Client:             | Haley & Aldrich, Inc.           |              |            |
| Project:            | US Rte 2 Brdg ov Boombridge Brk |              |            |
| Location:           | Greenbush, ME                   | Project No:  | GTX-313979 |
| Boring ID:          | BB-GBB-201                      | Sample Type: | jar        |
| Sample ID:          | 5DA                             | Test Date:   | 07/23/21   |
| Depth :             | 10-12                           | Test Id:     | 625331     |
| Test Comment:       | ---                             |              |            |
| Visual Description: | Moist, olive gray clayey sand   |              |            |
| Sample Comment:     | ---                             |              |            |

## Particle Size Analysis - ASTM D6913



| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
|----------|----------|--------|--------------------|
| —        | 5.3      | 58.3   | 36.4               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| 0.75 in    | 19.00          | 100           |               |          |
| 0.5 in     | 12.50          | 98            |               |          |
| 0.375 in   | 9.50           | 98            |               |          |
| #4         | 4.75           | 95            |               |          |
| #10        | 2.00           | 93            |               |          |
| #20        | 0.85           | 90            |               |          |
| #40        | 0.425          | 86            |               |          |
| #60        | 0.25           | 74            |               |          |
| #100       | 0.15           | 49            |               |          |
| #140       | 0.11           | 41            |               |          |
| #200       | 0.075          | 36            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

### Coefficients

$D_{85} = 0.3982 \text{ mm}$        $D_{30} = \text{N/A}$   
 $D_{60} = 0.1861 \text{ mm}$        $D_{15} = \text{N/A}$   
 $D_{50} = 0.1518 \text{ mm}$        $D_{10} = \text{N/A}$   
 $C_u = \text{N/A}$        $C_c = \text{N/A}$

### Classification

ASTM      N/A

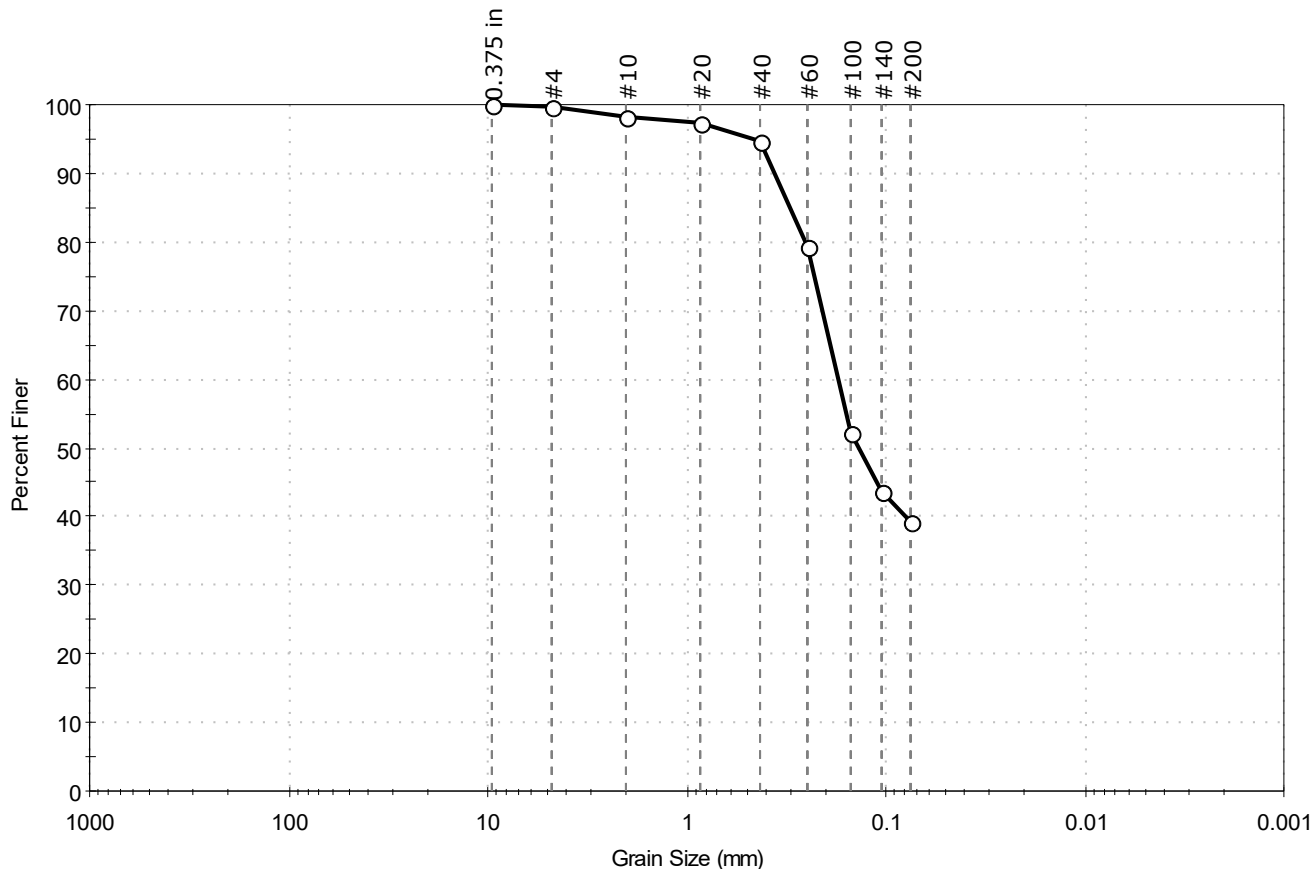
AASHTO      Silty Soils (A-4 (0))

### Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR  
 Sand/Gravel Hardness : HARD

|                                                       |                        |
|-------------------------------------------------------|------------------------|
| Client: Haley & Aldrich, Inc.                         | Project No: GTX-313979 |
| Project: US Rte 2 Brdg ov Boombridge Brk              |                        |
| Location: Greenbush, ME                               |                        |
| Boring ID: BB-GBB-202                                 | Sample Type: jar       |
| Sample ID: 4D                                         | Test Date: 07/23/21    |
| Depth: 8-10                                           | Test Id: 625332        |
| Test Comment: ---                                     | Tested By: ckg         |
| Visual Description: Moist, yellowish brown silty sand | Checked By: bfs        |
| Sample Comment: ---                                   |                        |

## Particle Size Analysis - ASTM D6913



| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
|----------|----------|--------|--------------------|
| —        | 0.3      | 60.6   | 39.1               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| 0.375 in   | 9.50           | 100           |               |          |
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 98            |               |          |
| #20        | 0.85           | 97            |               |          |
| #40        | 0.42           | 95            |               |          |
| #60        | 0.25           | 79            |               |          |
| #100       | 0.15           | 52            |               |          |
| #140       | 0.11           | 44            |               |          |
| #200       | 0.075          | 39            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

### Coefficients

$D_{85} = 0.3033 \text{ mm}$        $D_{30} = \text{N/A}$   
 $D_{60} = 0.1733 \text{ mm}$        $D_{15} = \text{N/A}$   
 $D_{50} = 0.1366 \text{ mm}$        $D_{10} = \text{N/A}$   
 $C_u = \text{N/A}$        $C_c = \text{N/A}$

### Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

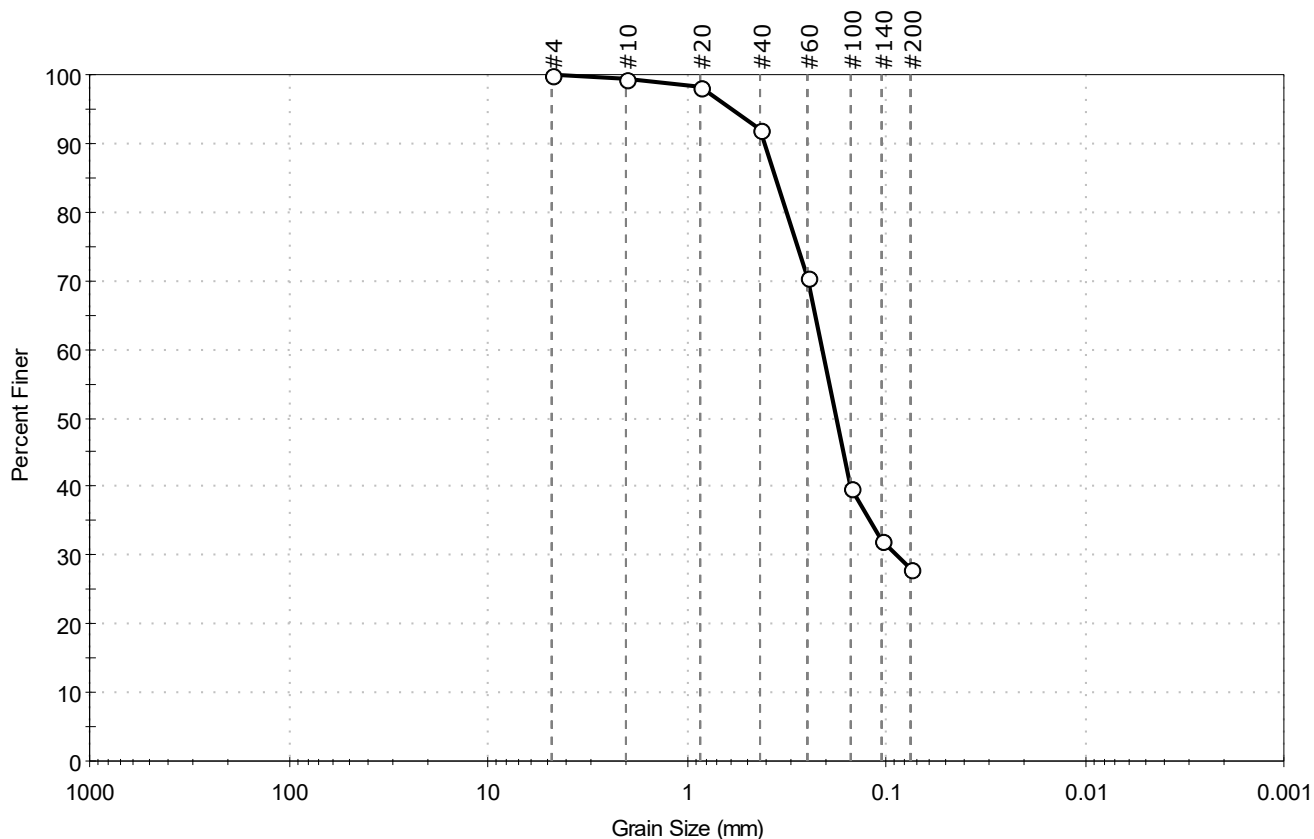
### Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

|                                                       |                        |                 |
|-------------------------------------------------------|------------------------|-----------------|
| Client: Haley & Aldrich, Inc.                         | Project No: GTX-313979 |                 |
| Project: US Rte 2 Brdg ov Boombridge Brk              |                        |                 |
| Location: Greenbush, ME                               |                        |                 |
| Boring ID: BB-GBB-202                                 | Sample Type: jar       | Tested By: ckg  |
| Sample ID: 5D                                         | Test Date: 07/23/21    | Checked By: bfs |
| Depth: 10-12                                          | Test Id: 625333        |                 |
| Test Comment: ---                                     |                        |                 |
| Visual Description: Moist, yellowish brown silty sand |                        |                 |
| Sample Comment: ---                                   |                        |                 |

## Particle Size Analysis - ASTM D6913



| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
|----------|----------|--------|--------------------|
| —        | 0.0      | 72.0   | 28.0               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 99            |               |          |
| #20        | 0.85           | 98            |               |          |
| #40        | 0.42           | 92            |               |          |
| #60        | 0.25           | 71            |               |          |
| #100       | 0.15           | 40            |               |          |
| #140       | 0.11           | 32            |               |          |
| #200       | 0.075          | 28            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

### Coefficients

$D_{85} = 0.3564$  mm       $D_{30} = 0.0889$  mm  
 $D_{60} = 0.2097$  mm       $D_{15} = \text{N/A}$   
 $D_{50} = 0.1774$  mm       $D_{10} = \text{N/A}$   
 $C_u = \text{N/A}$        $C_c = \text{N/A}$

### Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

### Sample/Test Description

Sand/Gravel Particle Shape : ---  
 Sand/Gravel Hardness : ---



|            |                                 |              |            |
|------------|---------------------------------|--------------|------------|
| Client:    | Haley & Aldrich, Inc.           |              |            |
| Project:   | US Rte 2 Brdg ov Boombridge Brk |              |            |
| Location:  | Greenbush, ME                   | Project No:  | GTX-313979 |
| Boring ID: | ---                             | Sample Type: | ---        |
| Sample ID: | ---                             | Test Date:   | 08/04/21   |
| Depth :    | ---                             | Test Id:     | 625335     |
|            |                                 | Tested By:   | md         |
|            |                                 | Checked By:  | jsc        |

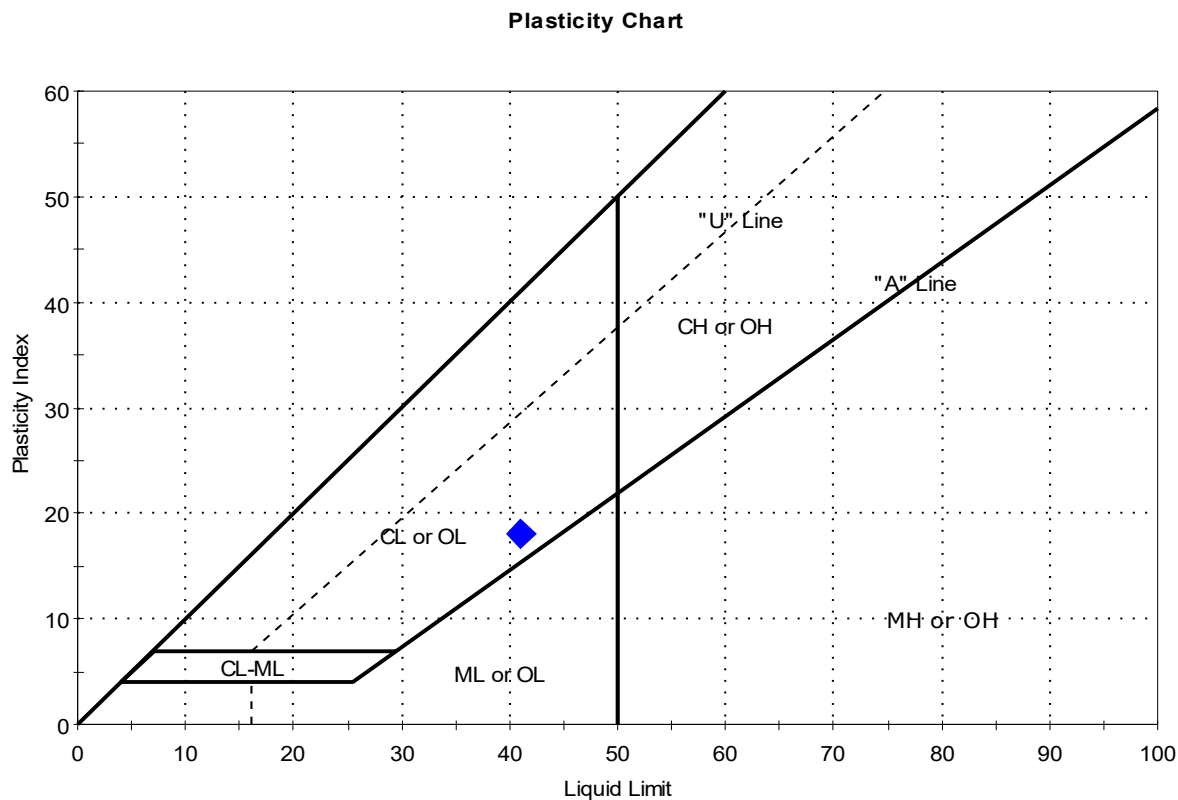
## Moisture Content of Soil and Rock - ASTM D2216

| Boring ID  | Sample ID | Depth | Description           | Moisture Content, % |
|------------|-----------|-------|-----------------------|---------------------|
| BB-GBB-201 | 1U        | 22-24 | Moist, dark gray clay | 33.3                |
| BB-GBB-202 | 2U        | 27-29 | Moist, gray clay      | 24.4                |

Notes: Temperature of Drying : 110° Celsius

|                     |                                 |              |            |
|---------------------|---------------------------------|--------------|------------|
| Client:             | Haley & Aldrich, Inc.           |              |            |
| Project:            | US Rte 2 Brdg ov Boombridge Brk |              |            |
| Location:           | Greenbush, ME                   | Project No:  | GTX-313979 |
| Boring ID:          | BB-GBB-201                      | Sample Type: | tube       |
| Sample ID:          | 1U                              | Test Date:   | 07/29/21   |
| Depth :             | 22-24                           | Test Id:     | 625328     |
| 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-GBB-20 | 22-24 | 33                          | 41           | 23            | 18               | 0.6             |                     |

Sample Prepared using the WET method

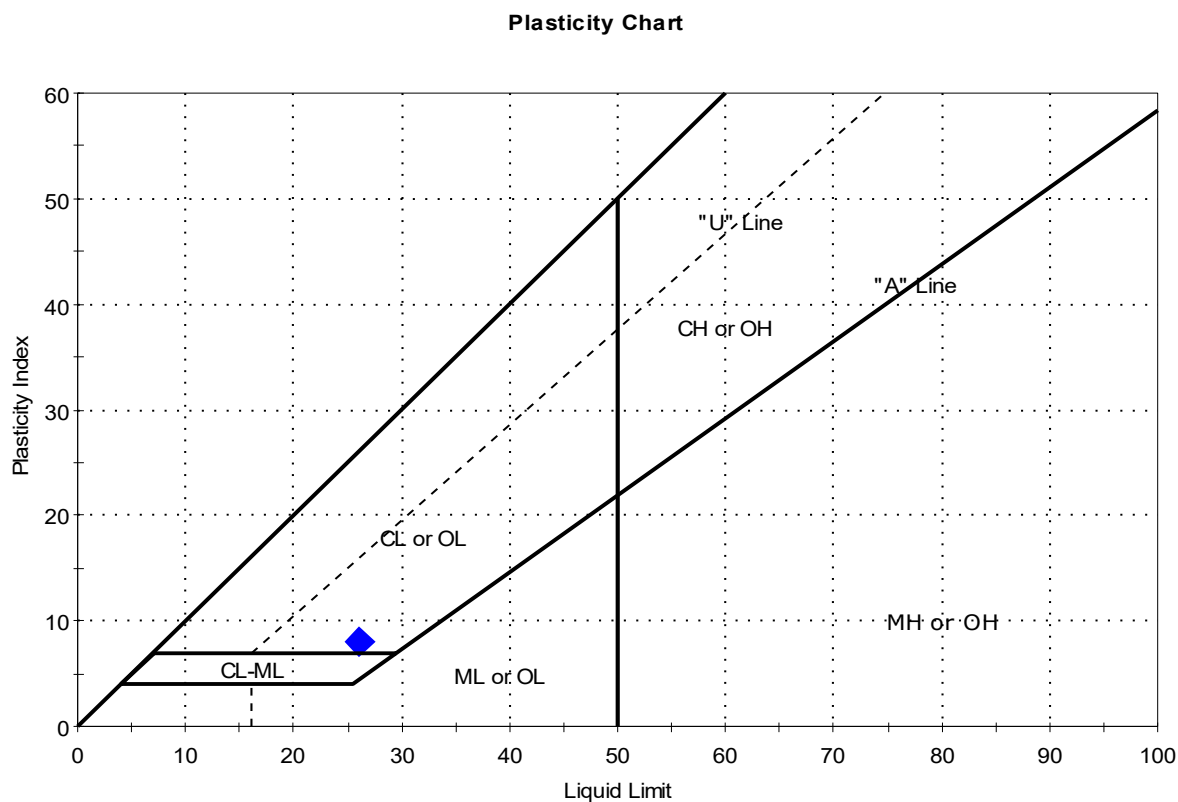
Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

|                     |                                 |              |            |
|---------------------|---------------------------------|--------------|------------|
| Client:             | Haley & Aldrich, Inc.           |              |            |
| Project:            | US Rte 2 Brdg ov Boombridge Brk |              |            |
| Location:           | Greenbush, ME                   | Project No:  | GTX-313979 |
| Boring ID:          | BB-GBB-202                      | Sample Type: | tube       |
| Sample ID:          | 2U                              | Test Date:   | 07/29/21   |
| Depth :             | 27-29                           | Test Id:     | 625329     |
| 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 |
|--------|-----------|----------|-------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | 2U        | B-GBB-20 | 27-29 | 24                          | 26           | 18            | 8                | 0.8             |                     |

Sample Prepared using the WET method

Dry Strength: HIGH

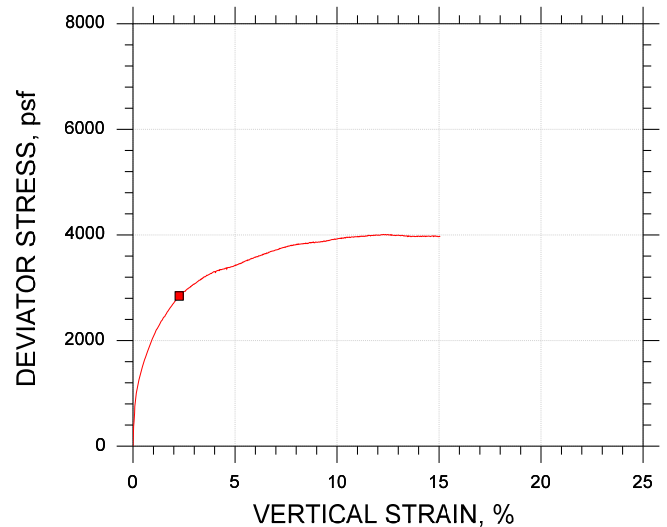
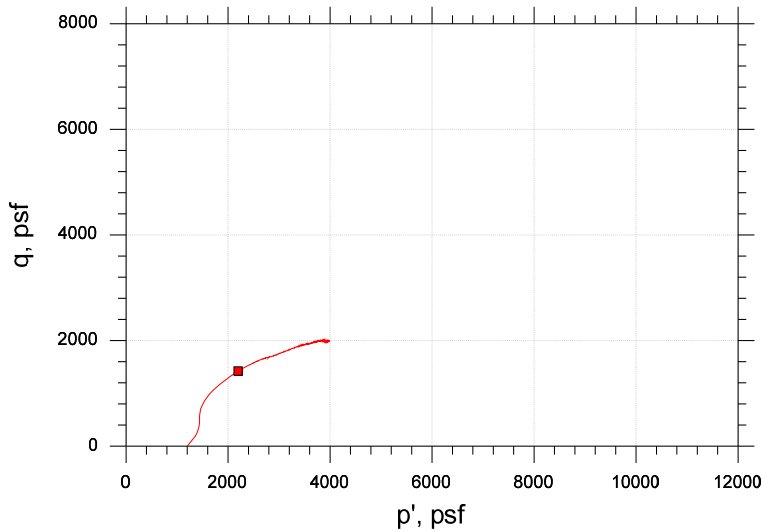
Dilatancy: SLOW

Toughness: LOW



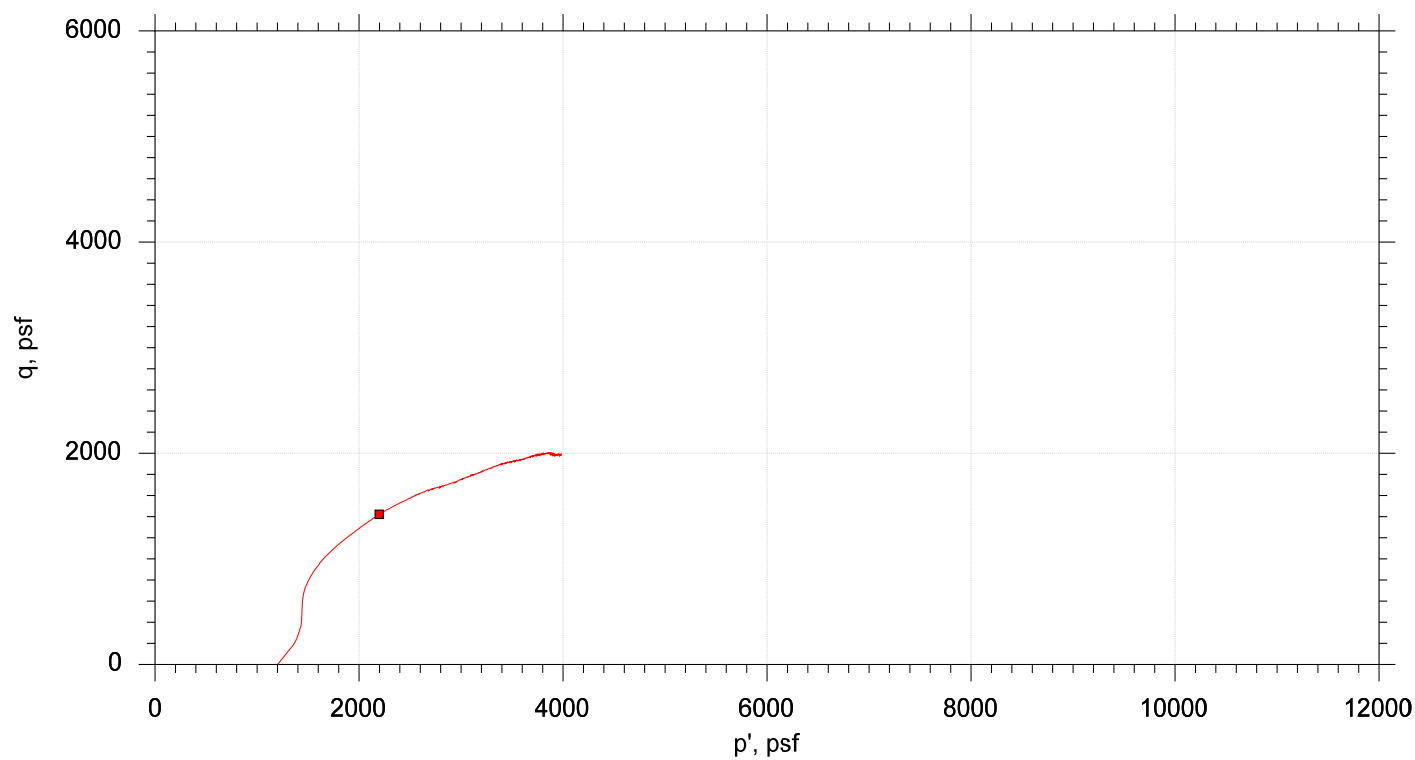
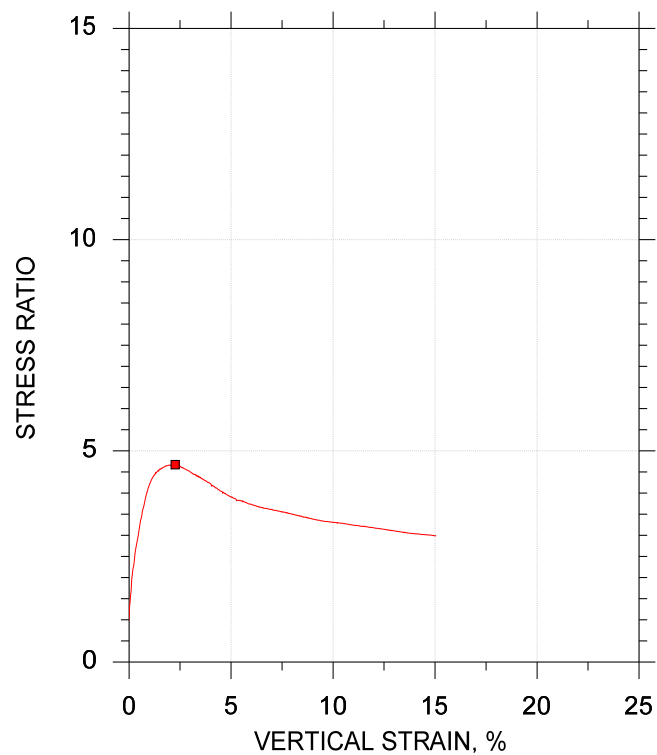
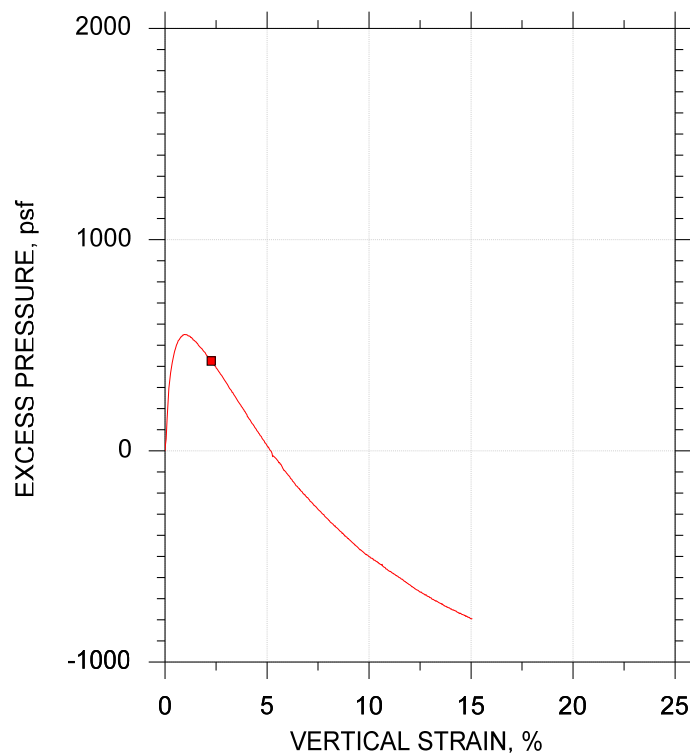
|                                               |                                  |
|-----------------------------------------------|----------------------------------|
| Client: Haley & Aldrich, Inc.                 |                                  |
| Project Name: US Rte 2 Brdf ov Boombridge Brk |                                  |
| Project Location: Greenbush, ME               |                                  |
| Project Number: GTX-313979                    |                                  |
| Tested By: trm                                | Checked By: njh                  |
| Boring ID: BB-GBB-201                         |                                  |
| Preparation: intact                           |                                  |
| Description: Moist, dark gray clay            |                                  |
| Classification: ---                           |                                  |
| Group Symbol: ---                             |                                  |
| Liquid Limit: 41                              | Plastic Limit: 23                |
| Plasticity Index: 18                          | Estimated Specific Gravity: 2.71 |

### CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                  |            |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------|--|--|
| Symbol                                                                                                                                                                                                                                                                                                                                                                                                                      | ■                                                |            |  |  |
| Sample ID                                                                                                                                                                                                                                                                                                                                                                                                                   | 1U                                               |            |  |  |
| Depth, ft                                                                                                                                                                                                                                                                                                                                                                                                                   | 22-24                                            |            |  |  |
| Test Number                                                                                                                                                                                                                                                                                                                                                                                                                 | CU-1-1                                           |            |  |  |
| Initial                                                                                                                                                                                                                                                                                                                                                                                                                     | Height, in                                       | 4.580      |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Diameter, in                                     | 2.040      |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Moisture Content (from Cuttings), %              | 33.3       |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Dry Density, pcf                                 | 88.9       |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Saturation (Wet Method), %                       | 99.9       |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Void Ratio                                       | 0.903      |  |  |
| Before Shear                                                                                                                                                                                                                                                                                                                                                                                                                | Moisture Content, %                              | 31.8       |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Dry Density, pcf                                 | 90.8       |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Cross-sectional Area (Method A), in <sup>2</sup> | 3.226      |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Saturation, %                                    | 100.0      |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Void Ratio                                       | 0.862      |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Back Pressure, psf                               | 2.174e+004 |  |  |
| Vertical Effective Consolidation Stress, psf                                                                                                                                                                                                                                                                                                                                                                                |                                                  | 1197.      |  |  |
| Horizontal Effective Consolidation Stress, psf                                                                                                                                                                                                                                                                                                                                                                              |                                                  | 1200.      |  |  |
| Vertical Strain after Consolidation, %                                                                                                                                                                                                                                                                                                                                                                                      |                                                  | 0.3751     |  |  |
| Volumetric Strain after Consolidation, %                                                                                                                                                                                                                                                                                                                                                                                    |                                                  | 0.7374     |  |  |
| Time to 50% Consolidation, min                                                                                                                                                                                                                                                                                                                                                                                              |                                                  | 60.80      |  |  |
| Shear Strength, psf                                                                                                                                                                                                                                                                                                                                                                                                         |                                                  | 1422.      |  |  |
| Strain at Failure, %                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  | 2.26       |  |  |
| Strain Rate, %/min                                                                                                                                                                                                                                                                                                                                                                                                          |                                                  | 0.01600    |  |  |
| Deviator Stress at Failure, psf                                                                                                                                                                                                                                                                                                                                                                                             |                                                  | 2844.      |  |  |
| Effective Minor Principal Stress at Failure, psf                                                                                                                                                                                                                                                                                                                                                                            |                                                  | 774.2      |  |  |
| Effective Major Principal Stress at Failure, psf                                                                                                                                                                                                                                                                                                                                                                            |                                                  | 3618.      |  |  |
| B-Value                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                  | 0.98       |  |  |
| Notes:<br>- Before Shear Saturation set to 100% for phase calculation.<br>- Moisture Content determined by ASTM D2216.<br>- Atterberg Limits determined by ASTM D4318.<br>- Deviator Stress includes membrane correction.<br>- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions. |                                                  |            |  |  |
| Remarks:                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                  |            |  |  |

# CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



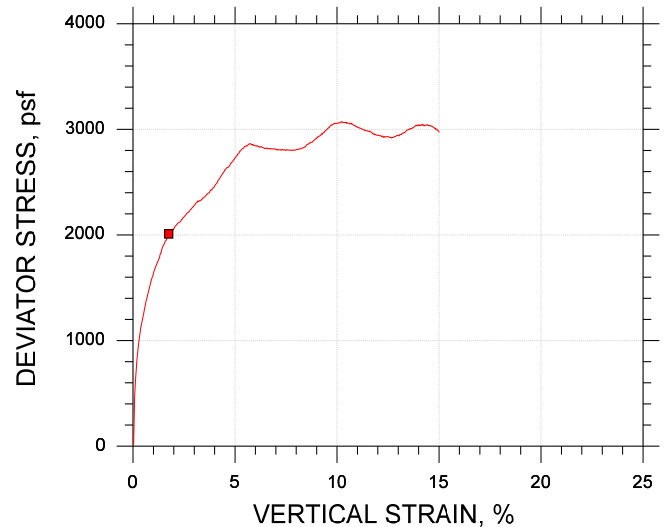
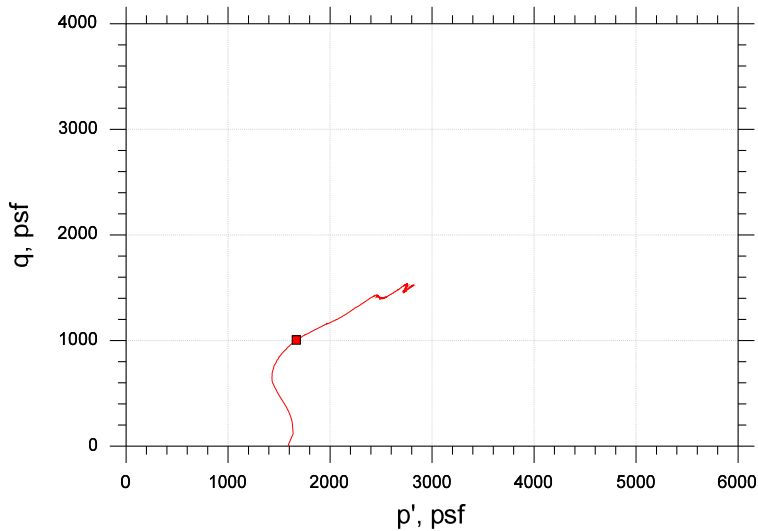
|                                    | Sample No. | Test No. | Depth | Tested By | Test Date | Checked By | Check Date | Test File          |
|------------------------------------|------------|----------|-------|-----------|-----------|------------|------------|--------------------|
| <span style="color: red;">■</span> | 1U         | CU-1-1   | 22-24 | trm       | 7/27/21   | njh        | 8/4/21     | 313979-CU-1-1n.dat |
|                                    |            |          |       |           |           |            |            |                    |
|                                    |            |          |       |           |           |            |            |                    |
|                                    |            |          |       |           |           |            |            |                    |

|                                                                                    |                                           |                         |                         |
|------------------------------------------------------------------------------------|-------------------------------------------|-------------------------|-------------------------|
|  |                                           |                         |                         |
|                                                                                    | Project: US Rte 2 Brdfl ov Boombridge Brk | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                    | Boring No.: BB-GBB-201                    | Sample Type: intact     |                         |
|                                                                                    | Description: Moist, dark gray clay        |                         |                         |
|                                                                                    | Remarks: System Q                         |                         |                         |



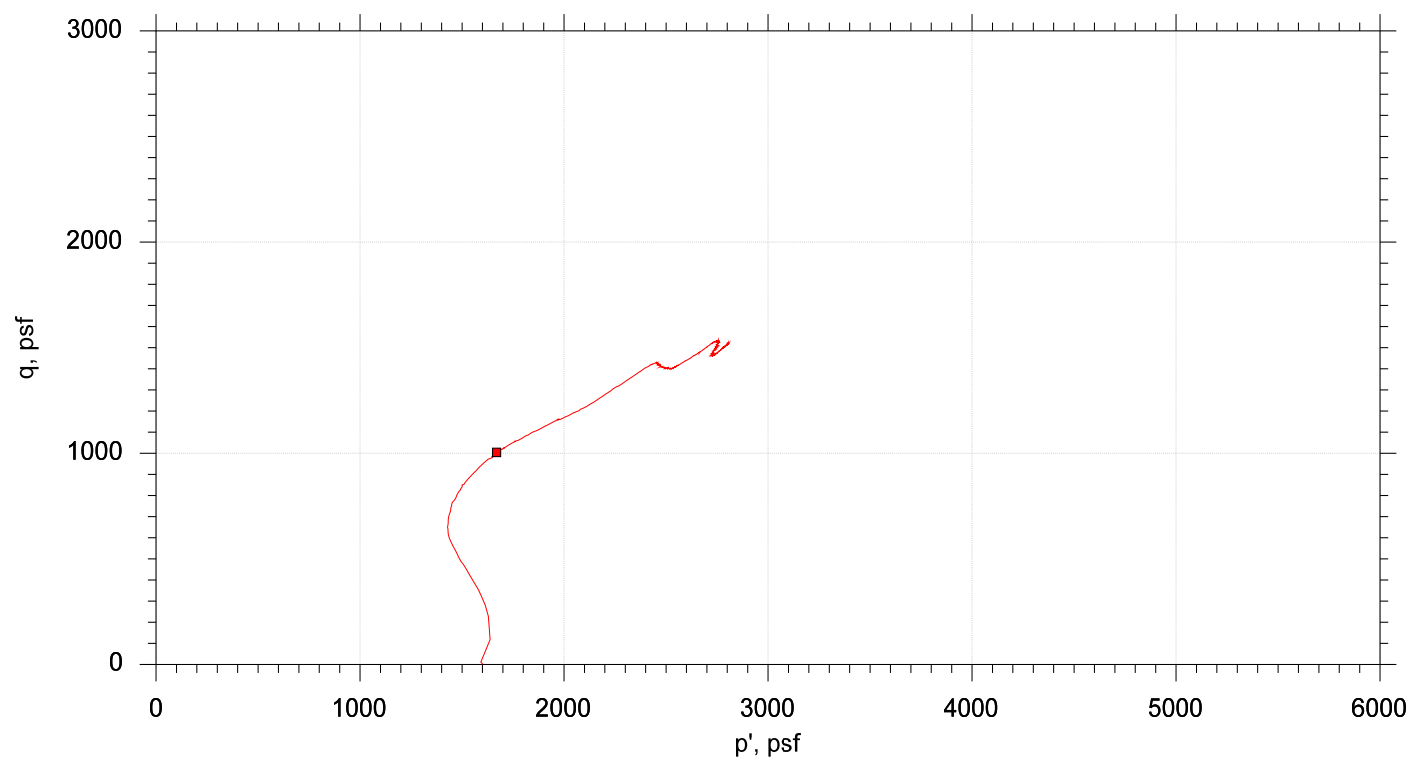
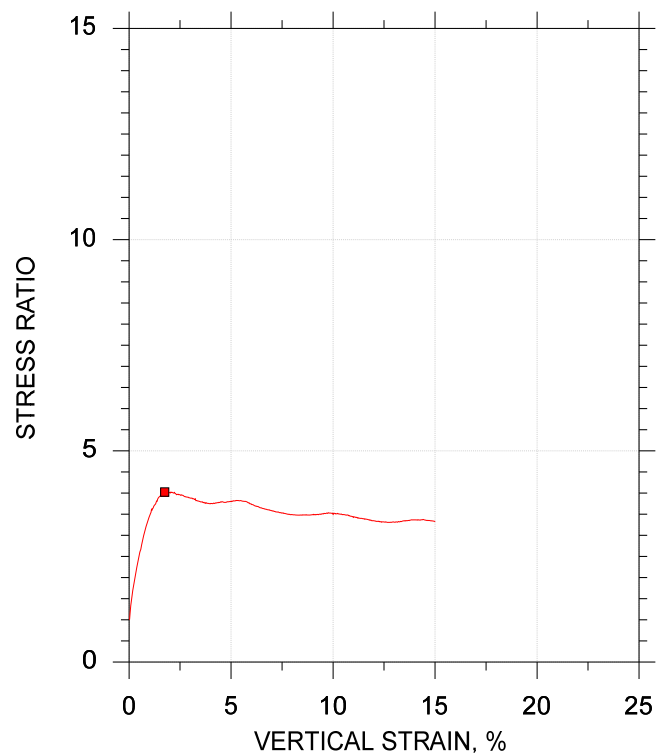
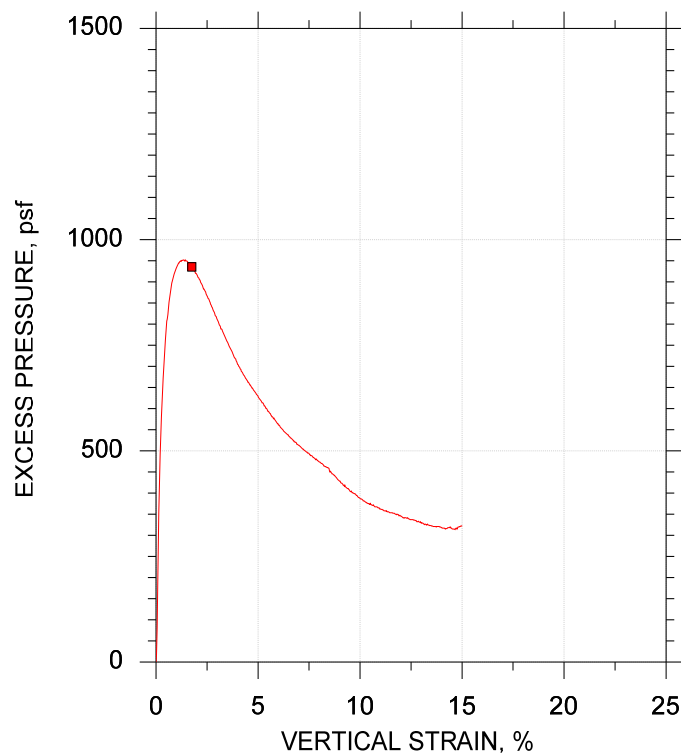
|                                               |                                 |
|-----------------------------------------------|---------------------------------|
| Client: Haley & Aldrich, Inc.                 |                                 |
| Project Name: US Rte 2 Brdf ov Boombridge Brk |                                 |
| Project Location: Green bush, ME              |                                 |
| Project Number: GTX-313979                    |                                 |
| Tested By: trm                                | Checked By: njh                 |
| Boring ID: BB-GBB-202                         |                                 |
| Preparation: intact                           |                                 |
| Description: Moist, gray clay                 |                                 |
| Classification: ---                           |                                 |
| Group Symbol: ---                             |                                 |
| Liquid Limit: 26                              | Plastic Limit: 18               |
| Plasticity Index: 8                           | Estimated Specific Gravity: 2.7 |

## CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                  |            |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------|--|--|
| Symbol                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  | ■          |  |  |
| Sample ID                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                  | 2U         |  |  |
| Depth, ft                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                  | 27-29      |  |  |
| Test Number                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                  | CU-2-1     |  |  |
| Initial                                                                                                                                                                                                                                                                                                                                                                                                                     | Height, in                                       | 4.600      |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Diameter, in                                     | 2.040      |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Moisture Content (from Cuttings), %              | 24.4       |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Dry Density, pcf                                 | 95.3       |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Saturation (Wet Method), %                       | 85.5       |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Void Ratio                                       | 0.769      |  |  |
| Before Shear                                                                                                                                                                                                                                                                                                                                                                                                                | Moisture Content, %                              | 27.3       |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Dry Density, pcf                                 | 97.1       |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Cross-sectional Area (Method A), in <sup>2</sup> | 3.226      |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Saturation, %                                    | 100.0      |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Void Ratio                                       | 0.737      |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Back Pressure, psf                               | 2.174e+004 |  |  |
| Vertical Effective Consolidation Stress, psf                                                                                                                                                                                                                                                                                                                                                                                |                                                  | 1600.      |  |  |
| Horizontal Effective Consolidation Stress, psf                                                                                                                                                                                                                                                                                                                                                                              |                                                  | 1601.      |  |  |
| Vertical Strain after Consolidation, %                                                                                                                                                                                                                                                                                                                                                                                      |                                                  | 0.3272     |  |  |
| Volumetric Strain after Consolidation, %                                                                                                                                                                                                                                                                                                                                                                                    |                                                  | 1.255      |  |  |
| Time to 50% Consolidation, min                                                                                                                                                                                                                                                                                                                                                                                              |                                                  | 41.00      |  |  |
| Shear Strength, psf                                                                                                                                                                                                                                                                                                                                                                                                         |                                                  | 1005.      |  |  |
| Strain at Failure, %                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  | 1.75       |  |  |
| Strain Rate, %/min                                                                                                                                                                                                                                                                                                                                                                                                          |                                                  | 0.01600    |  |  |
| Deviator Stress at Failure, psf                                                                                                                                                                                                                                                                                                                                                                                             |                                                  | 2009.      |  |  |
| Effective Minor Principal Stress at Failure, psf                                                                                                                                                                                                                                                                                                                                                                            |                                                  | 664.3      |  |  |
| Effective Major Principal Stress at Failure, psf                                                                                                                                                                                                                                                                                                                                                                            |                                                  | 2674.      |  |  |
| B-Value                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                  | 1.00       |  |  |
| Notes:<br>- Before Shear Saturation set to 100% for phase calculation.<br>- Moisture Content determined by ASTM D2216.<br>- Atterberg Limits determined by ASTM D4318.<br>- Deviator Stress includes membrane correction.<br>- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions. |                                                  |            |  |  |
| Remarks:                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                  |            |  |  |
| System Y                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                  |            |  |  |

# CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

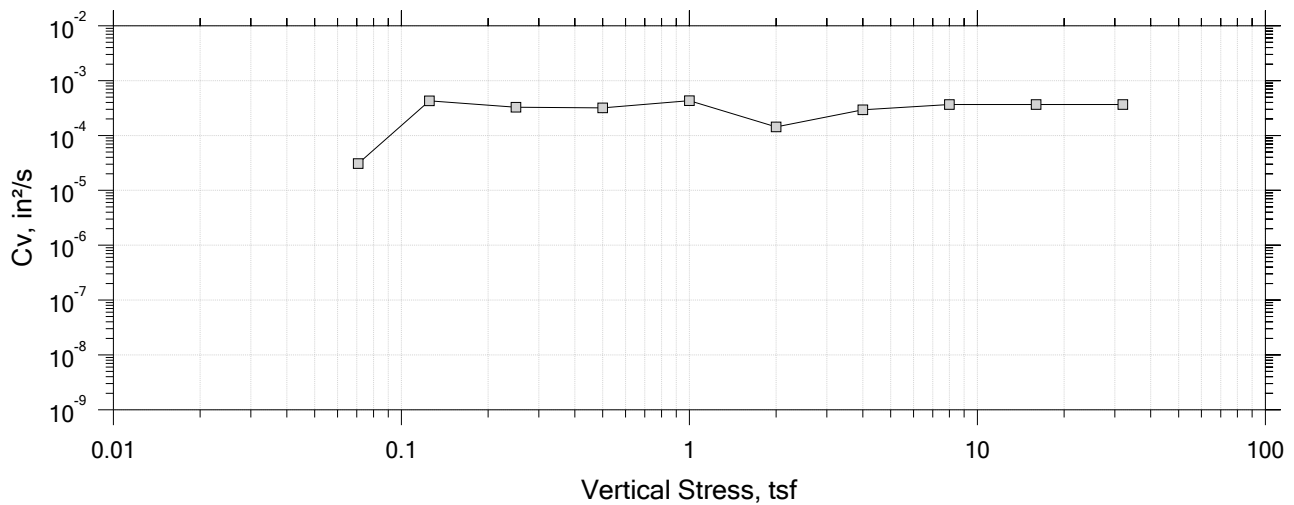
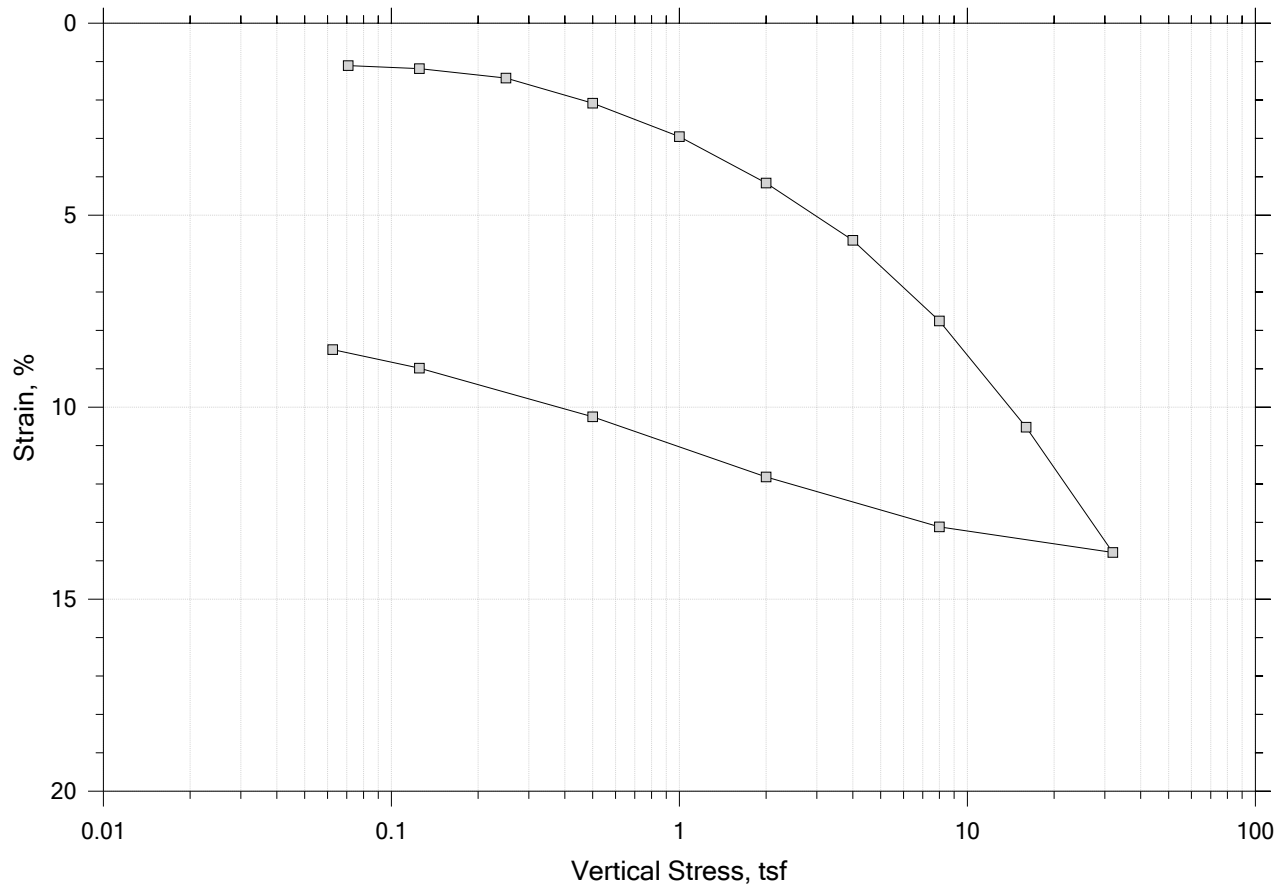


|   | Sample No. | Test No. | Depth | Tested By | Test Date | Checked By | Check Date | Test File          |
|---|------------|----------|-------|-----------|-----------|------------|------------|--------------------|
| ■ | 2U         | CU-2-1   | 27-29 | trm       | 7/27/21   | njh        | 8/4/21     | 313979-CU-2-1n.dat |
|   |            |          |       |           |           |            |            |                    |
|   |            |          |       |           |           |            |            |                    |
|   |            |          |       |           |           |            |            |                    |

|                                                                                    |                                         |                          |                         |
|------------------------------------------------------------------------------------|-----------------------------------------|--------------------------|-------------------------|
|  |                                         |                          |                         |
|                                                                                    | Project: US Rte 2 Brd ov Boombridge Brk | Location: Green bush, ME | Project No.: GTX-313979 |
|                                                                                    | Boring No.: BB-GBB-202                  | Sample Type: intact      |                         |
|                                                                                    | Description: Moist, gray clay           |                          |                         |
|                                                                                    | Remarks: System Y                       |                          |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

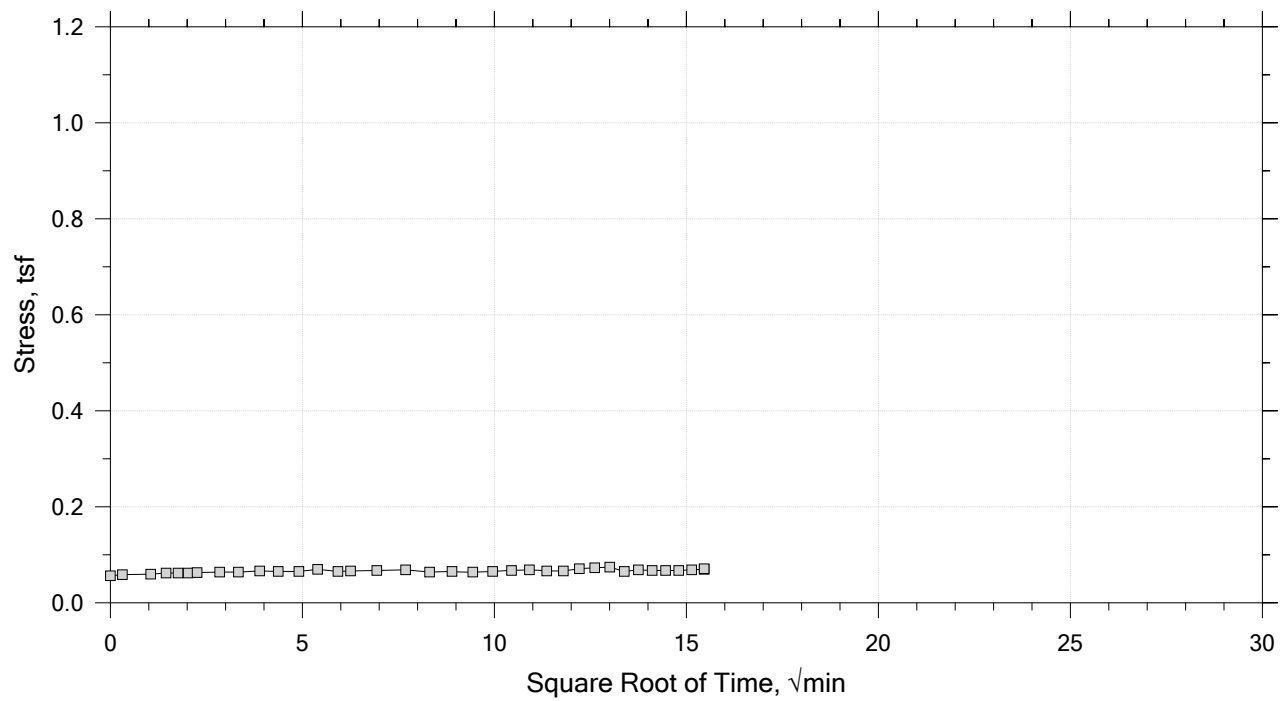
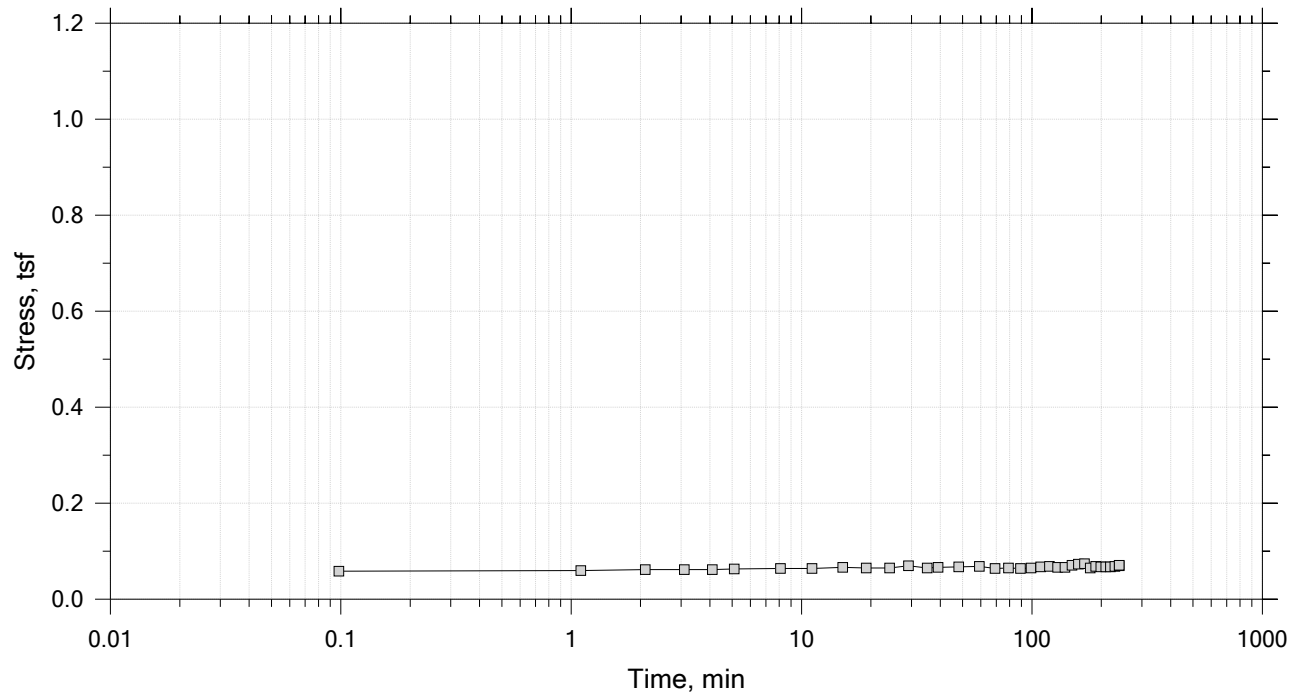
## Summary Report



|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     | Displacement at End of Increment                           |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 15  
Constant Volume Step  
Stress: 0.0707 tsf



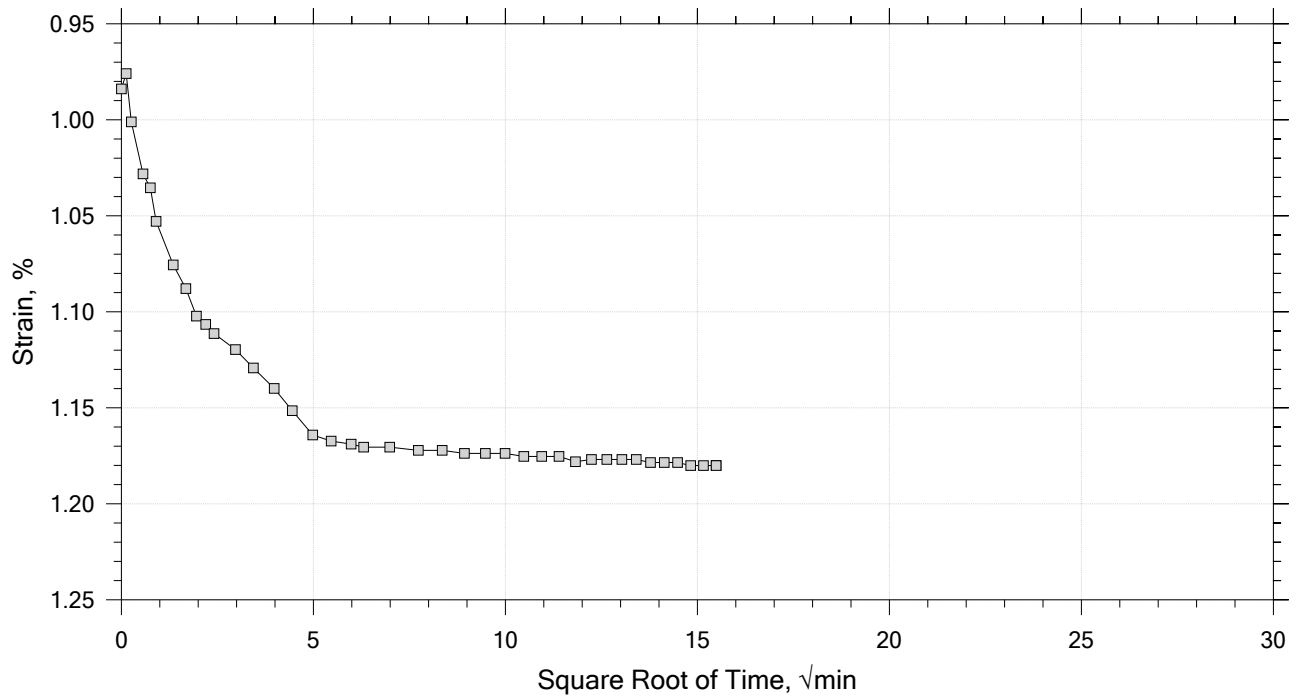
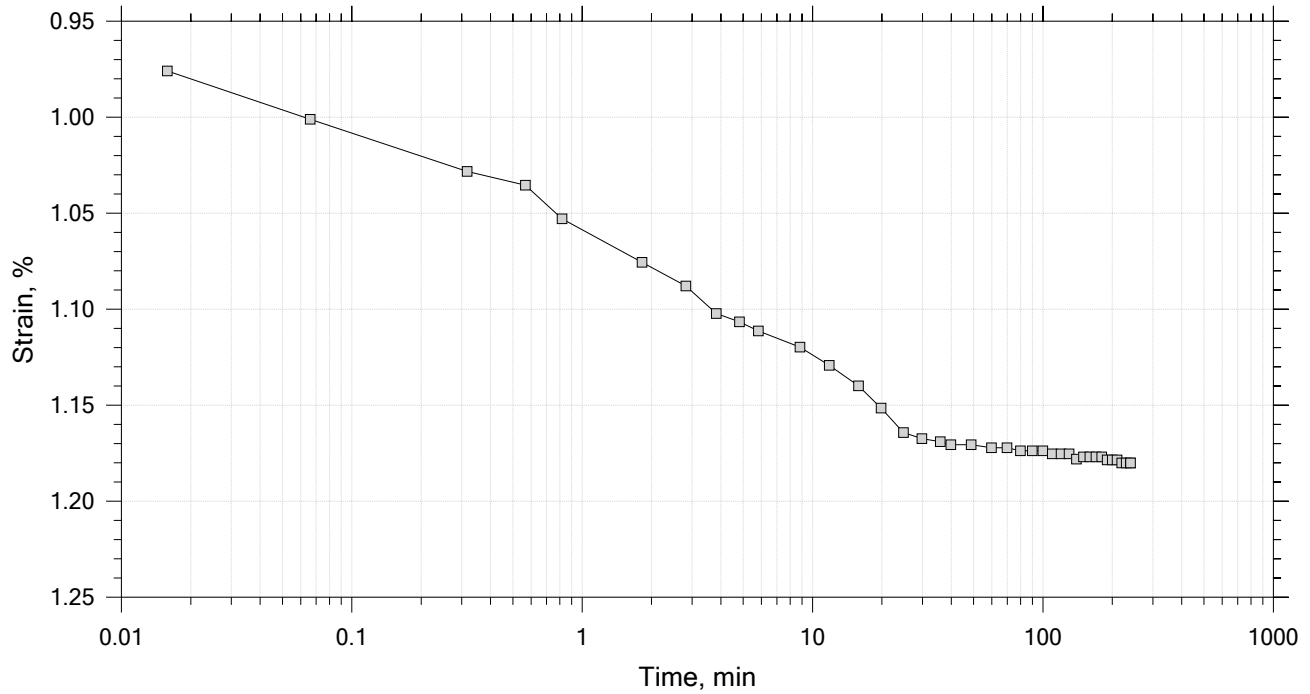
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 15

Constant Load Step

Stress: 0.125 tsf



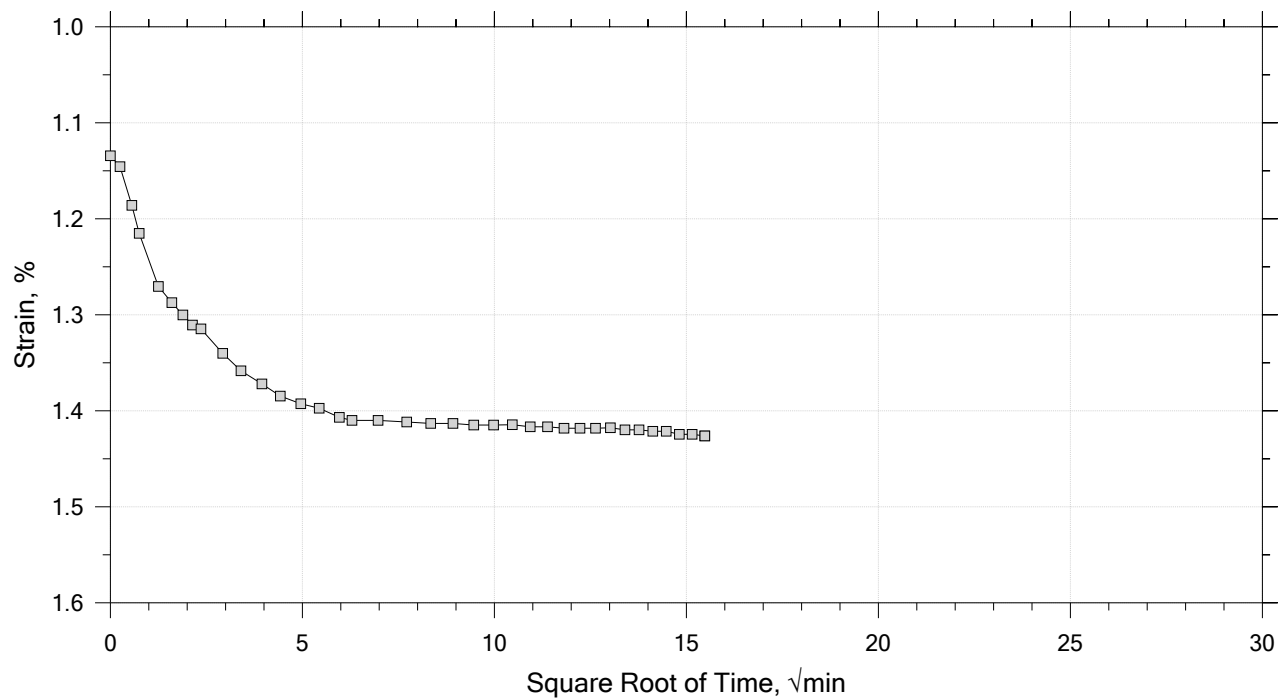
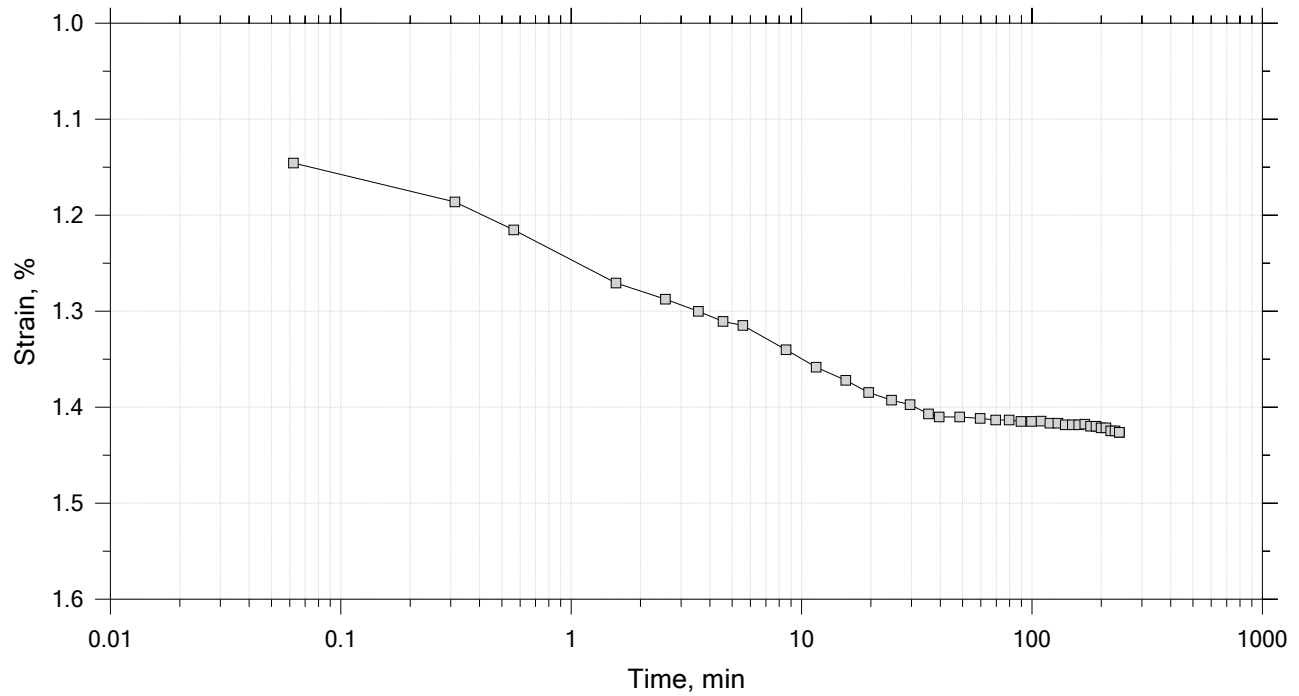
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 15

Constant Load Step

Stress: 0.25 tsf



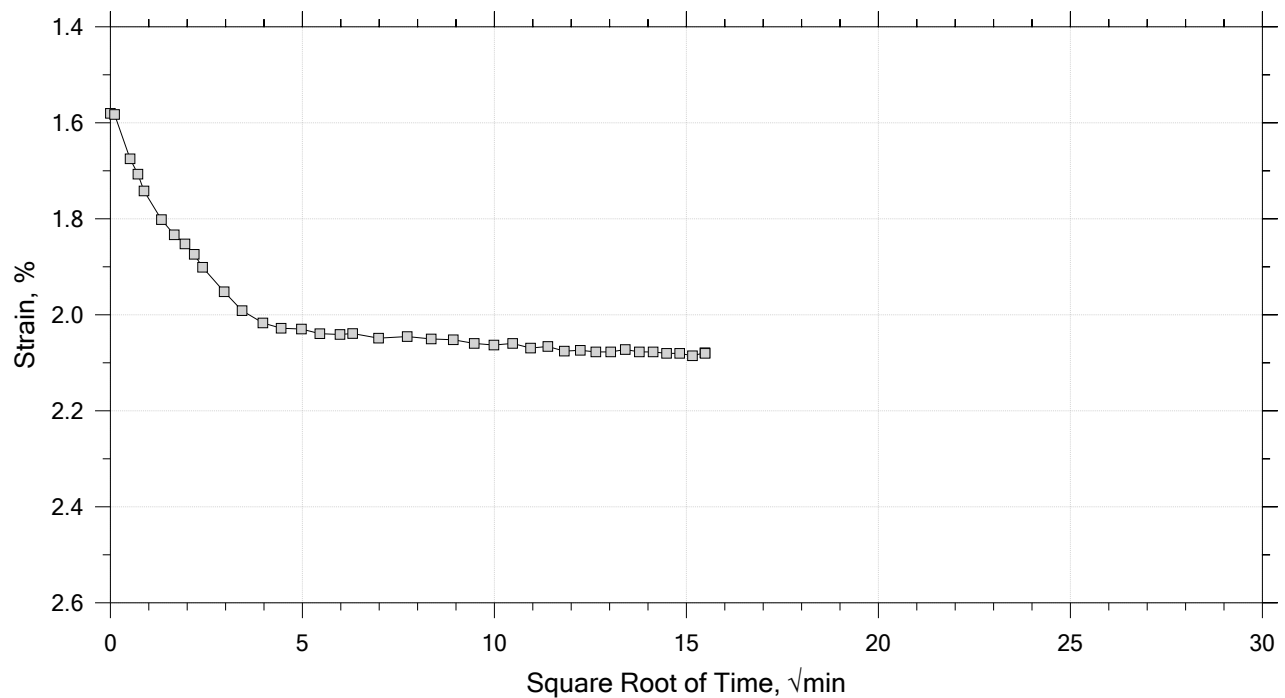
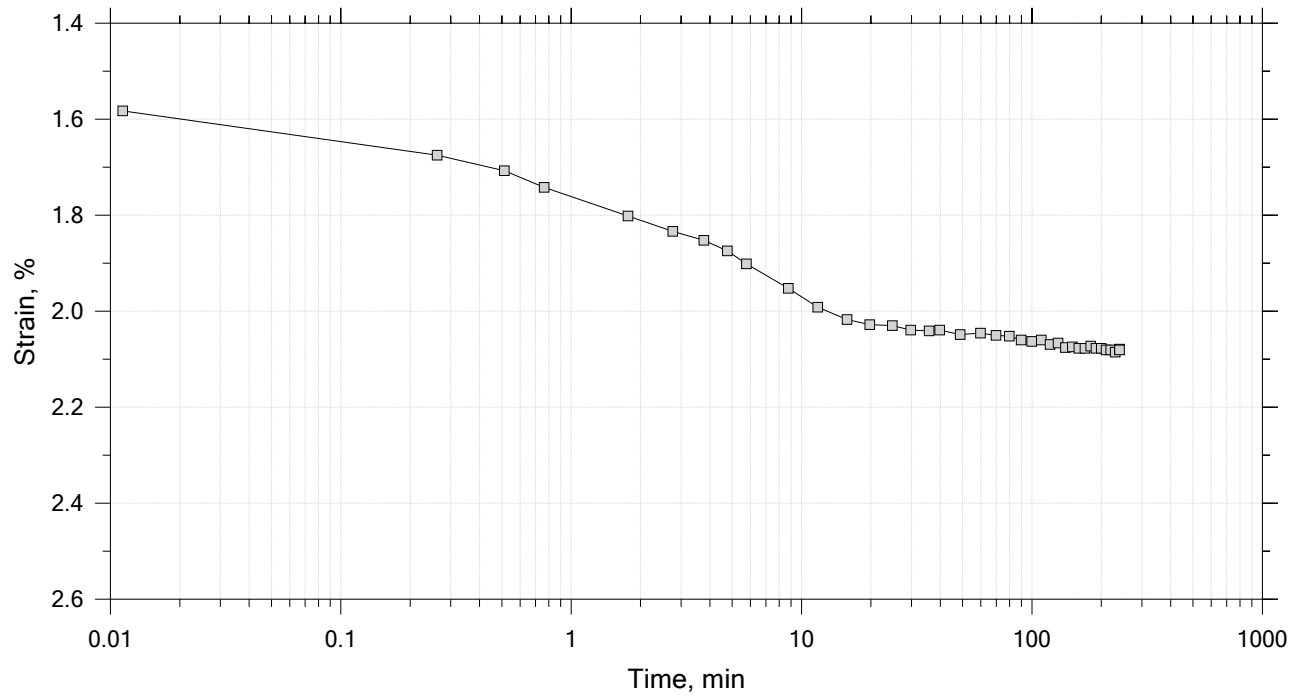
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 15

Constant Load Step

Stress: 0.5 tsf



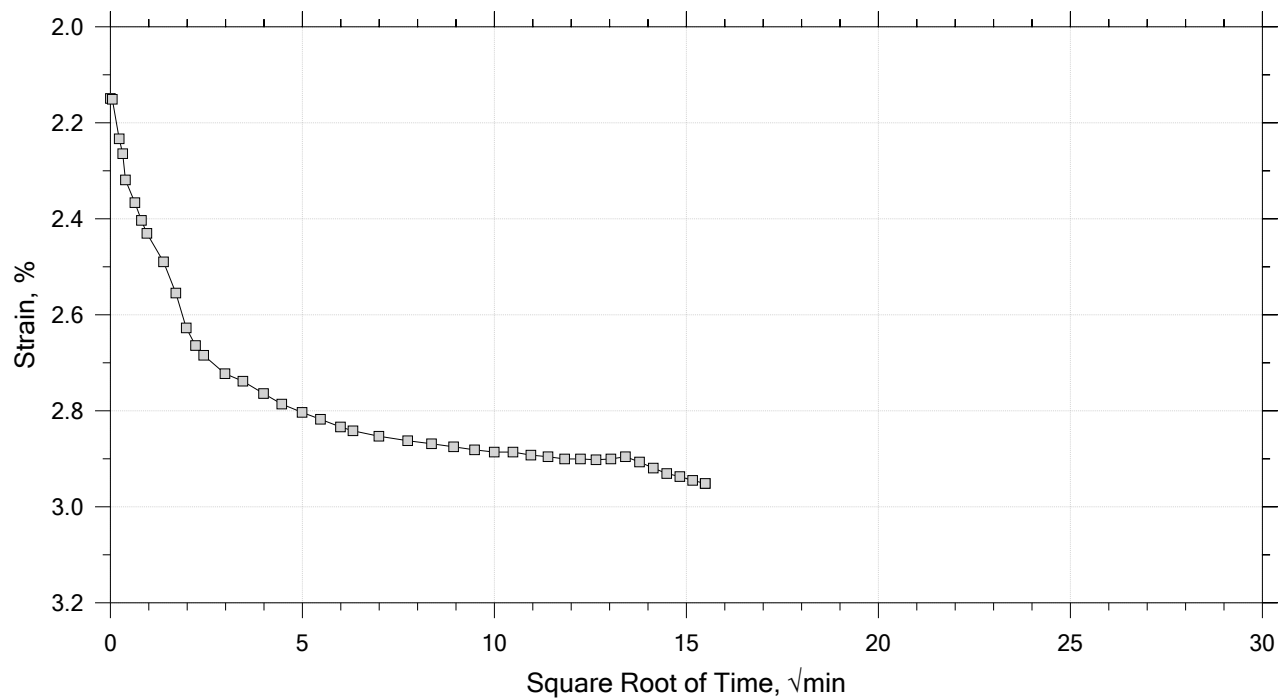
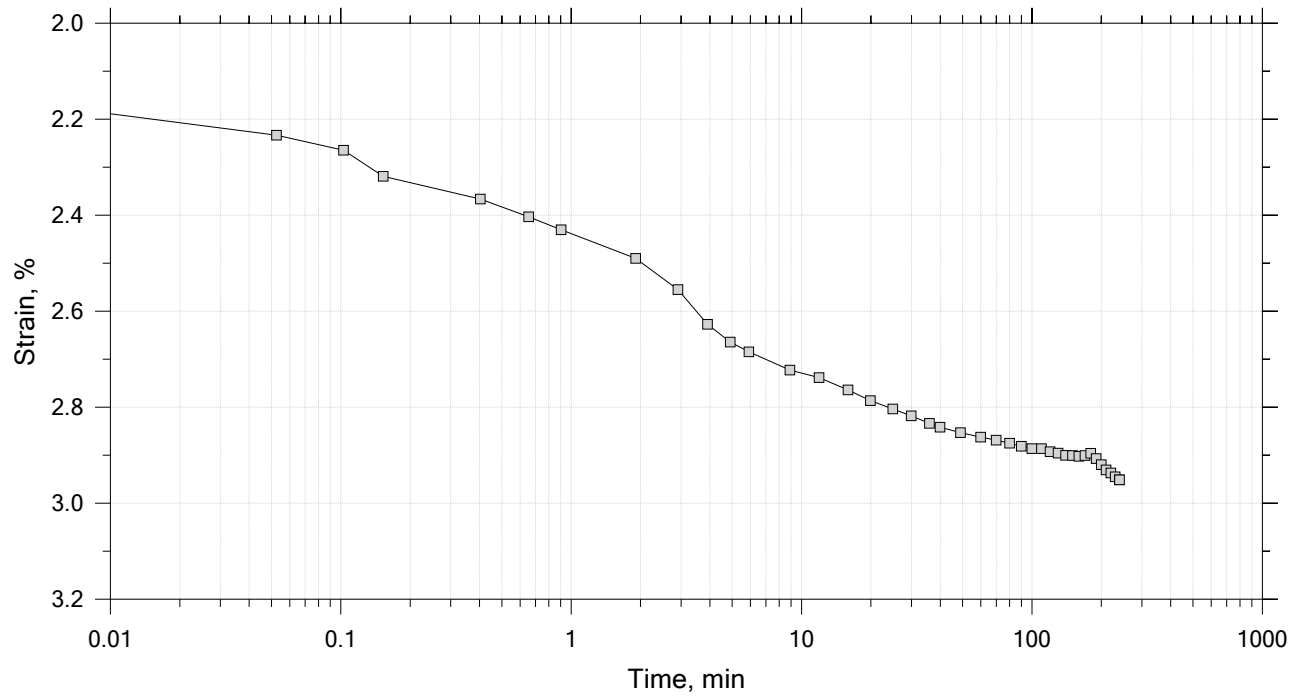
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 15

Constant Load Step

Stress: 1 tsf



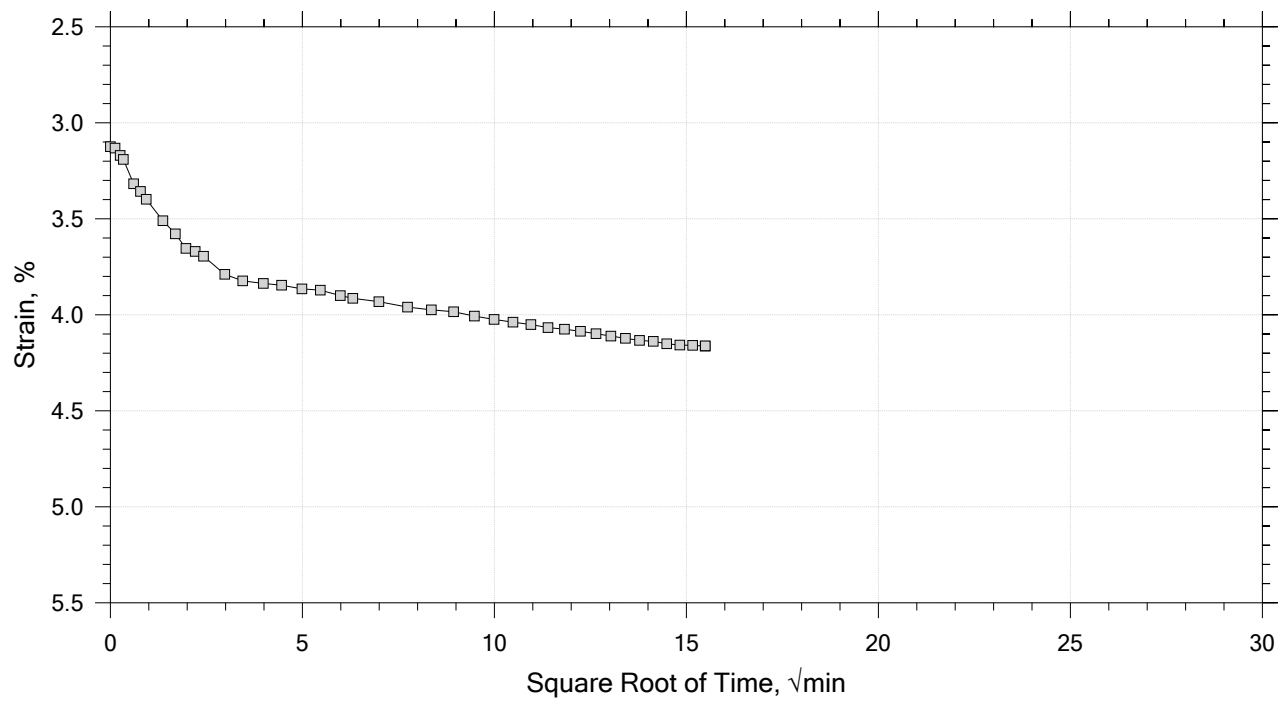
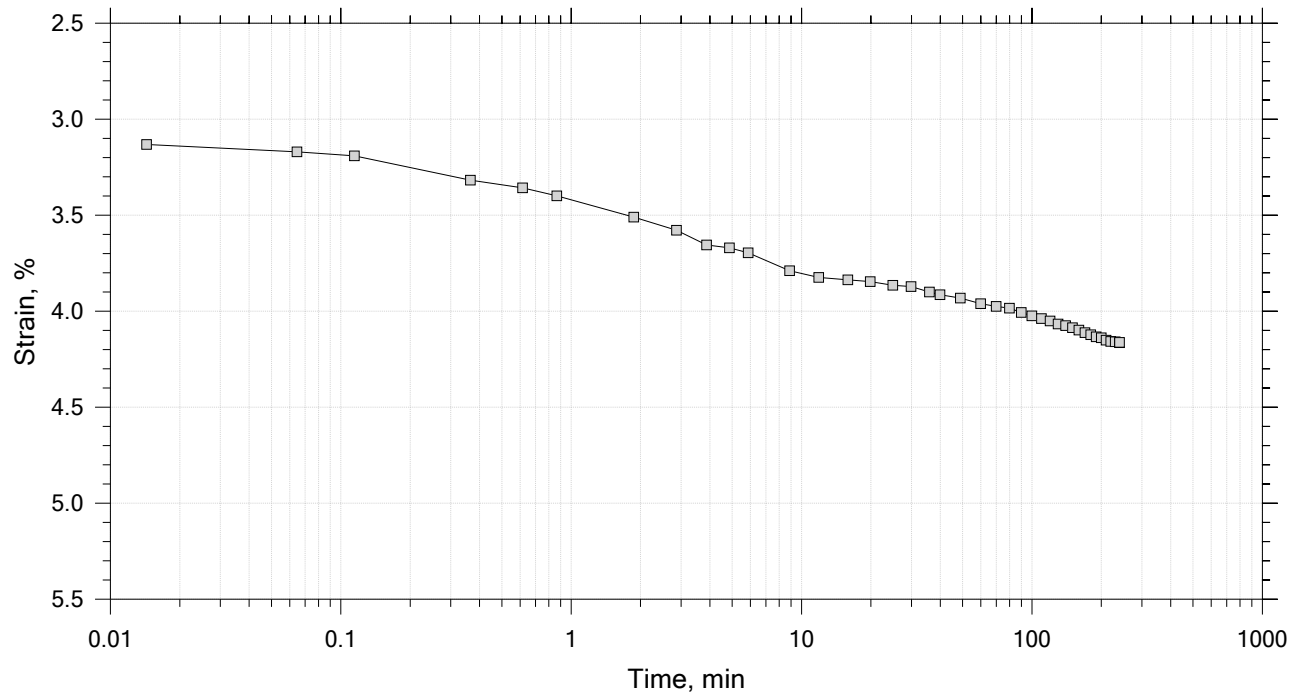
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 15

Constant Load Step

Stress: 2 tsf



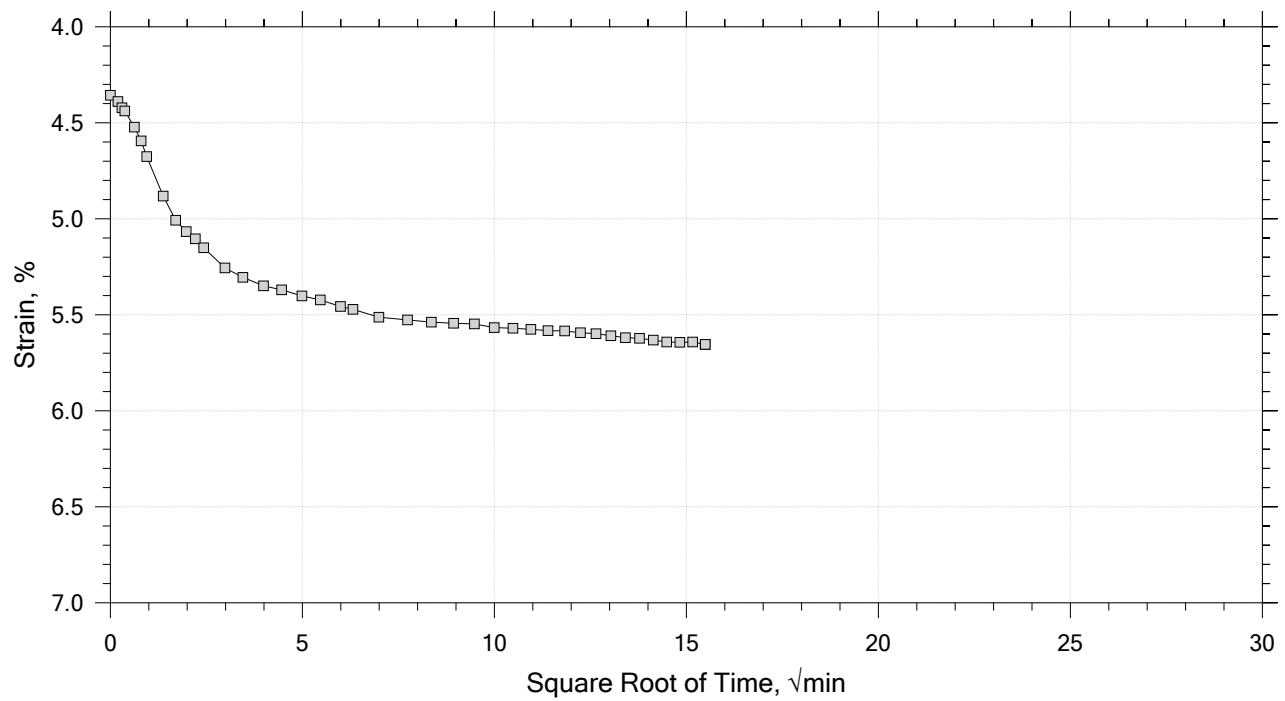
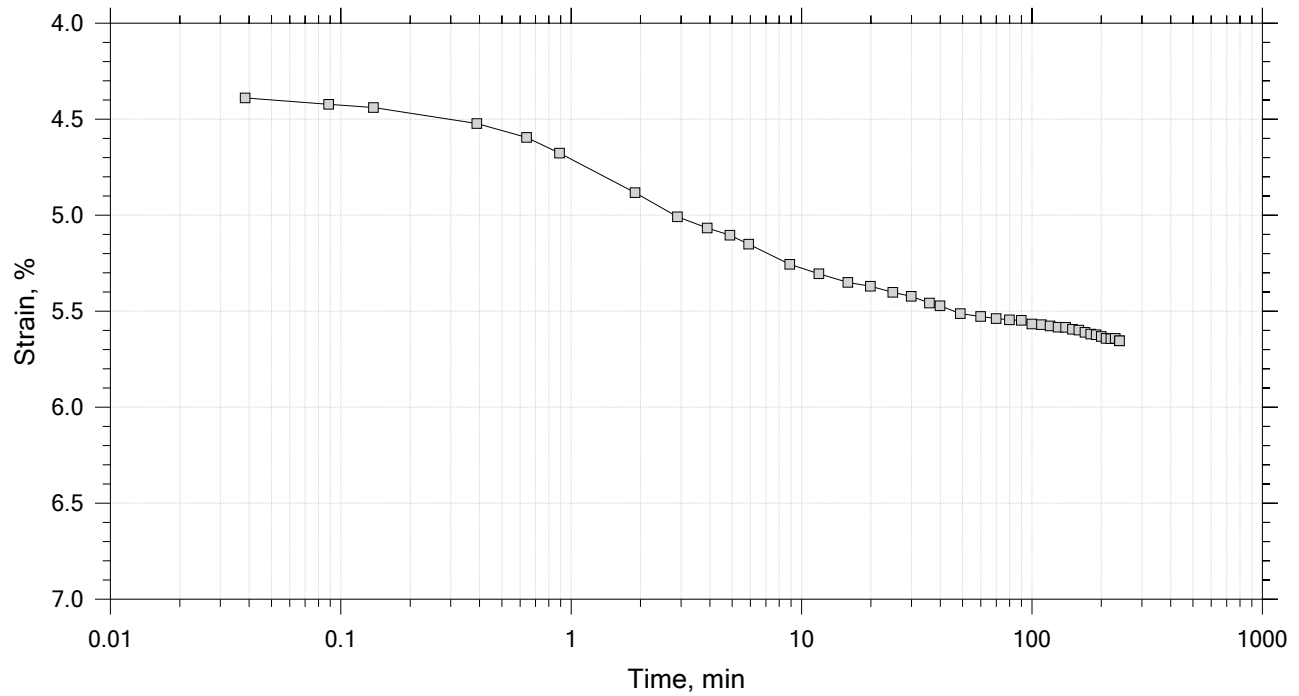
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 15

Constant Load Step

Stress: 4 tsf



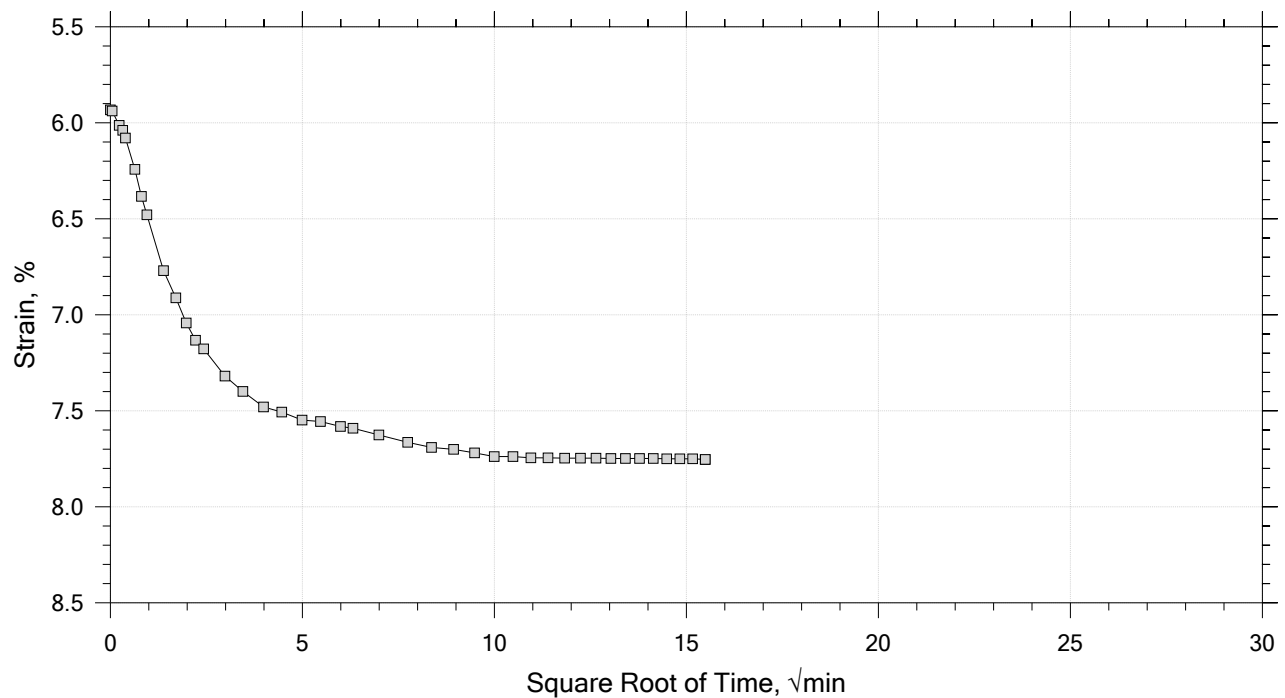
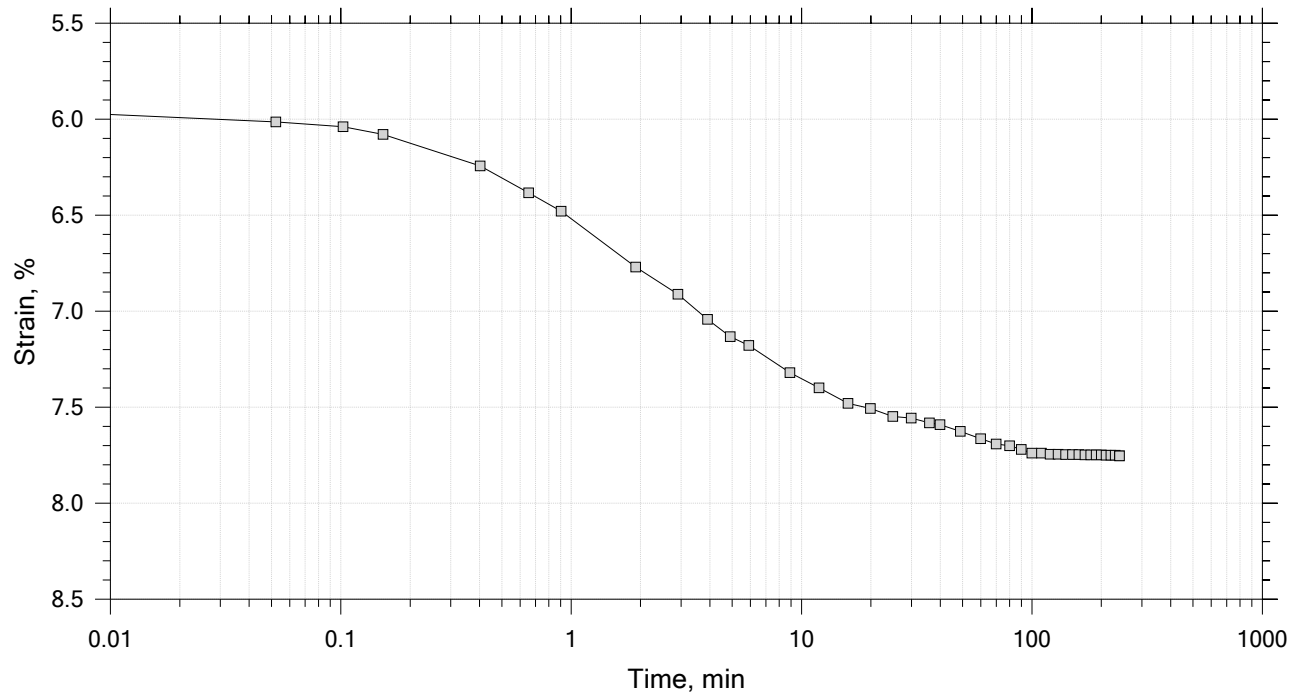
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 15

Constant Load Step

Stress: 8 tsf



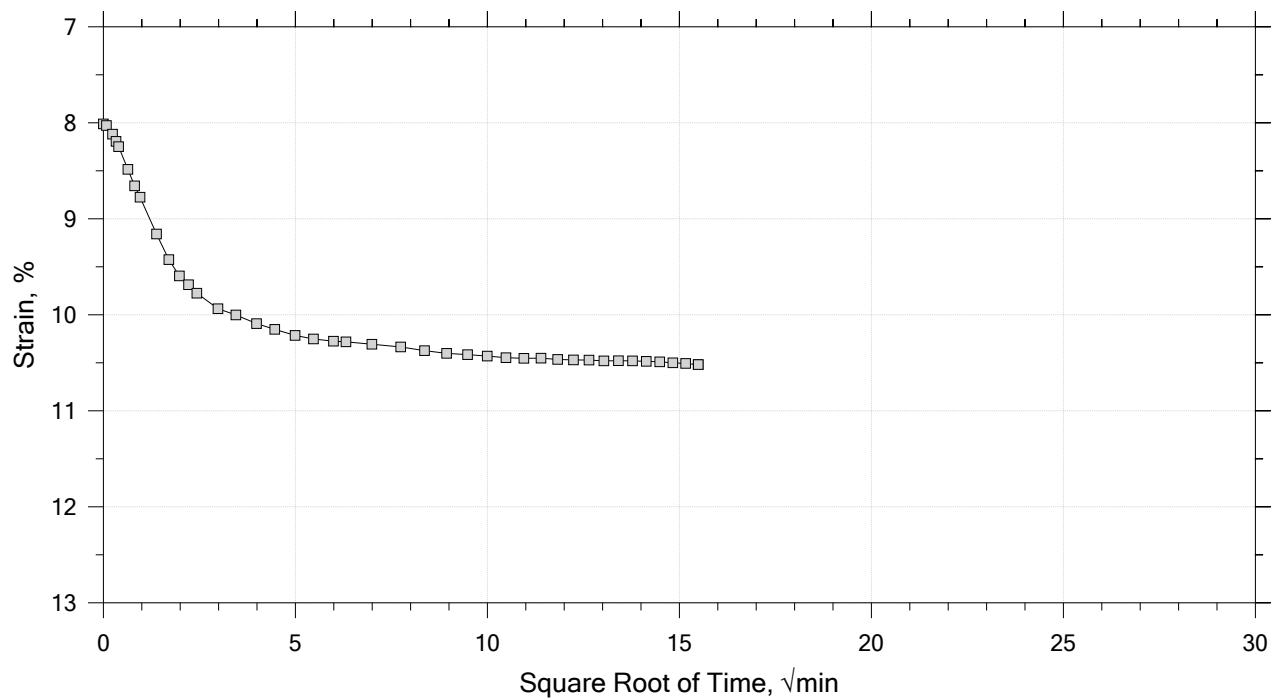
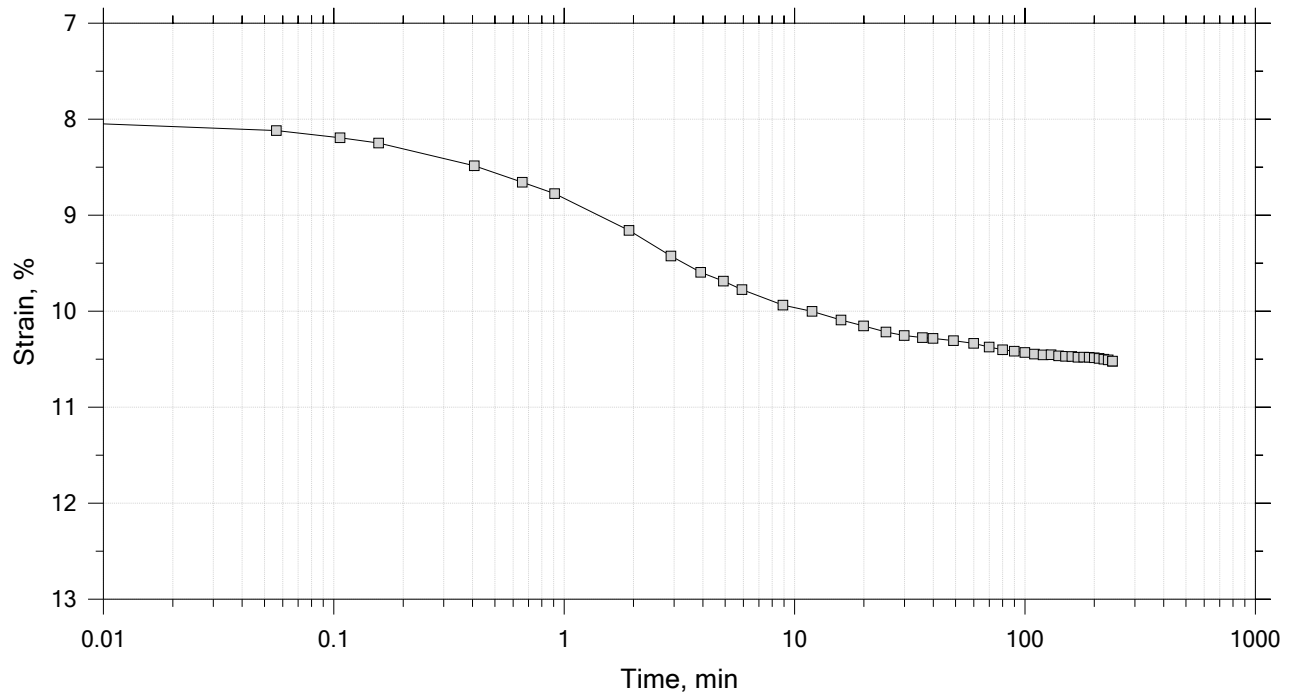
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 15

Constant Load Step

Stress: 16 tsf



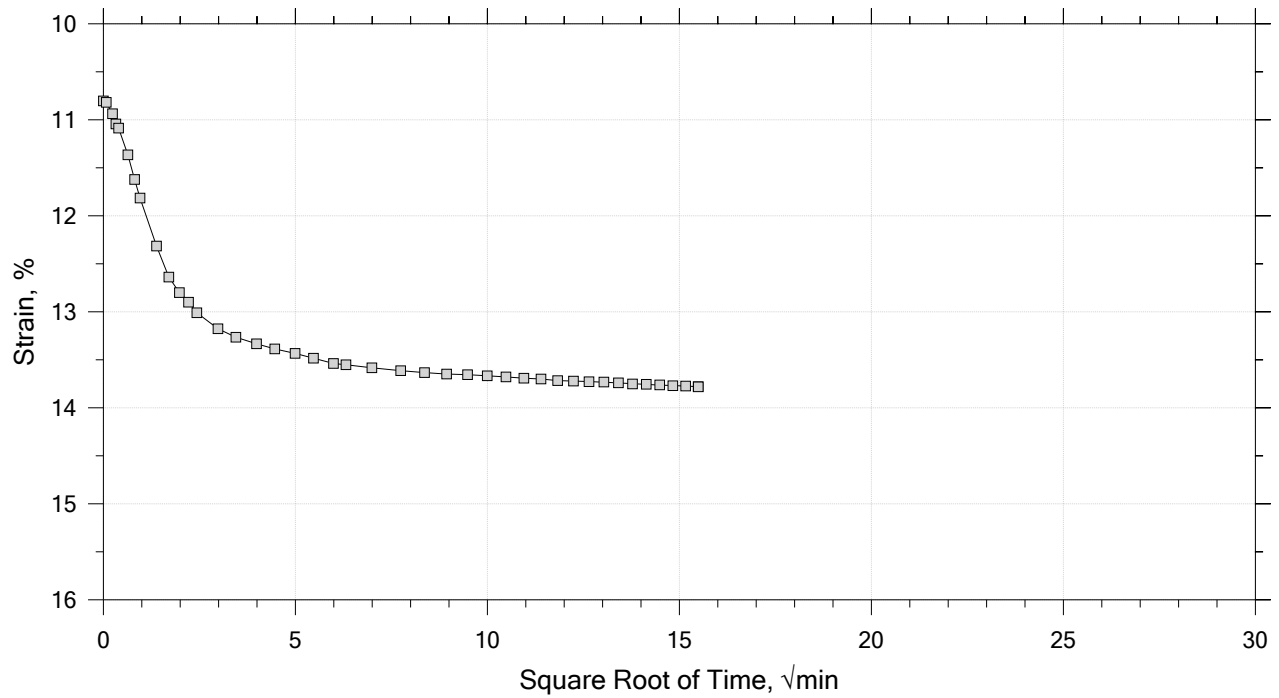
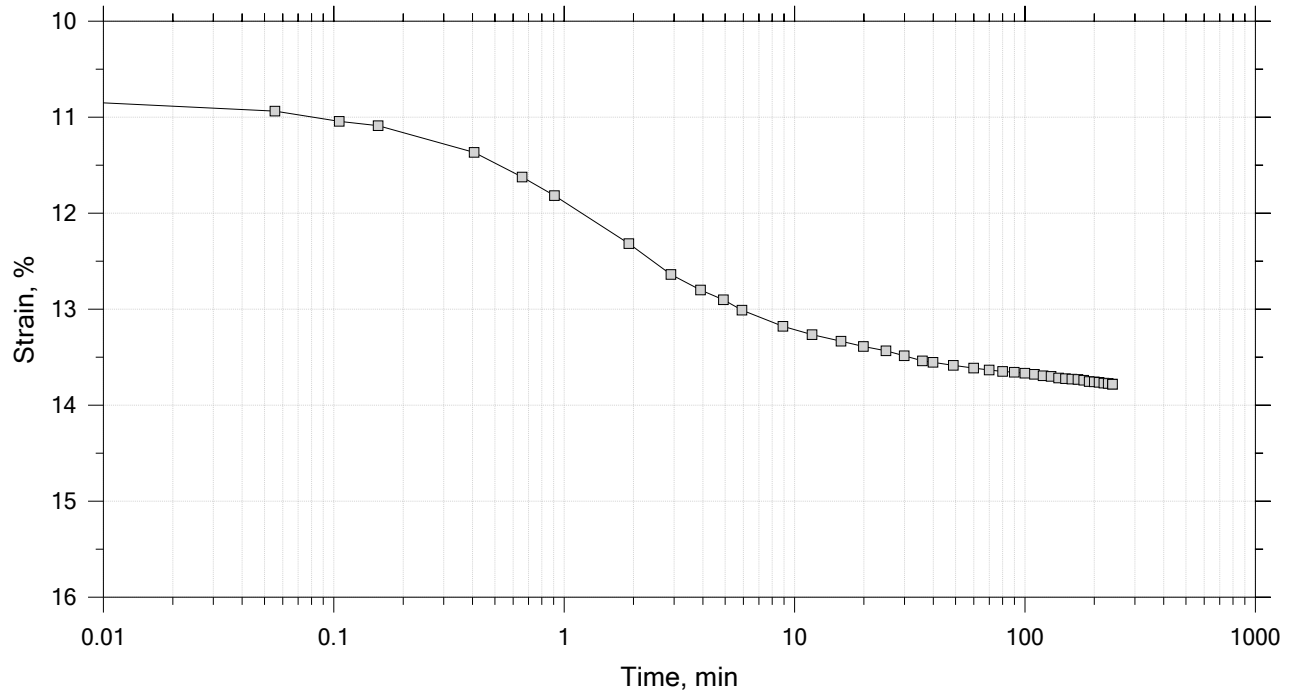
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 15

Constant Load Step

Stress: 32 tsf



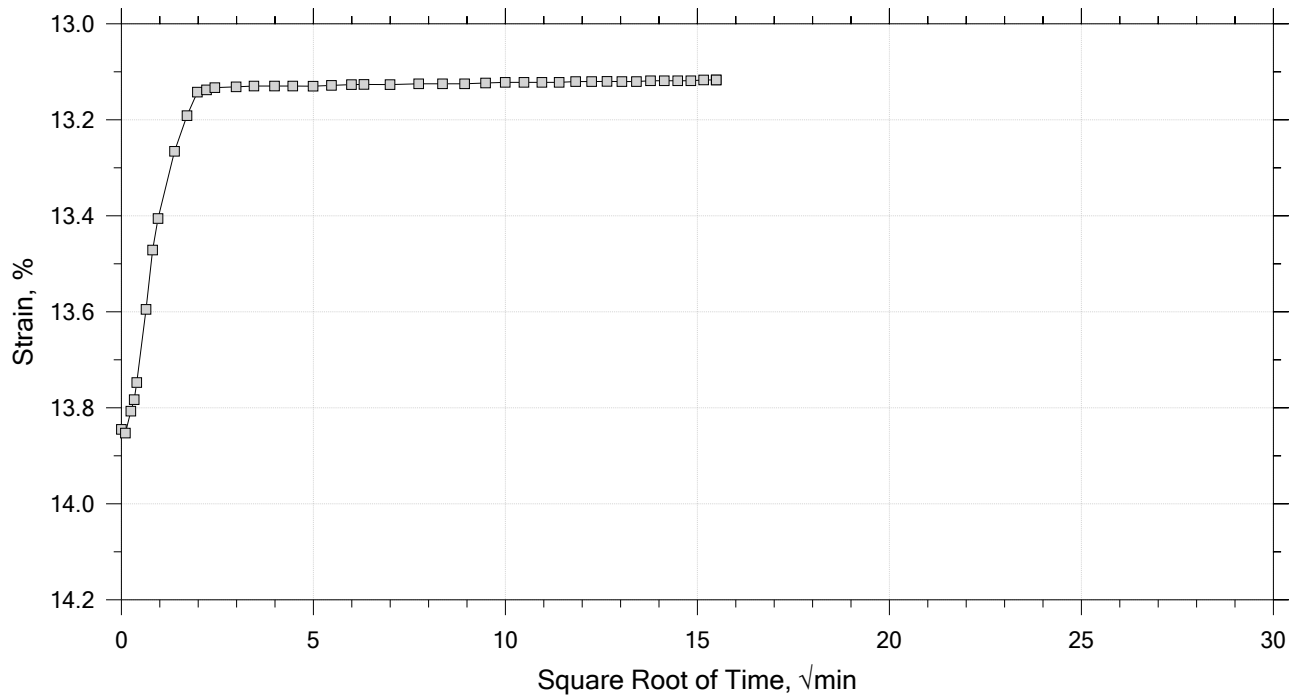
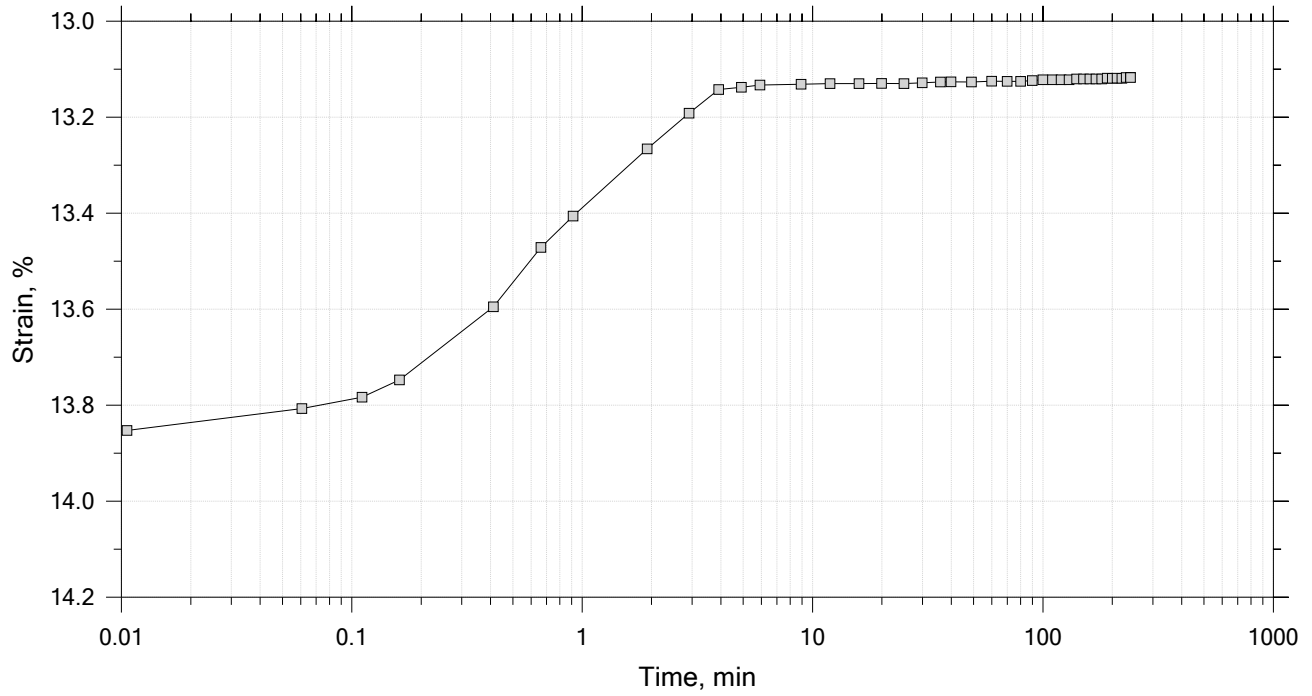
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 15

Constant Load Step

Stress: 8 tsf



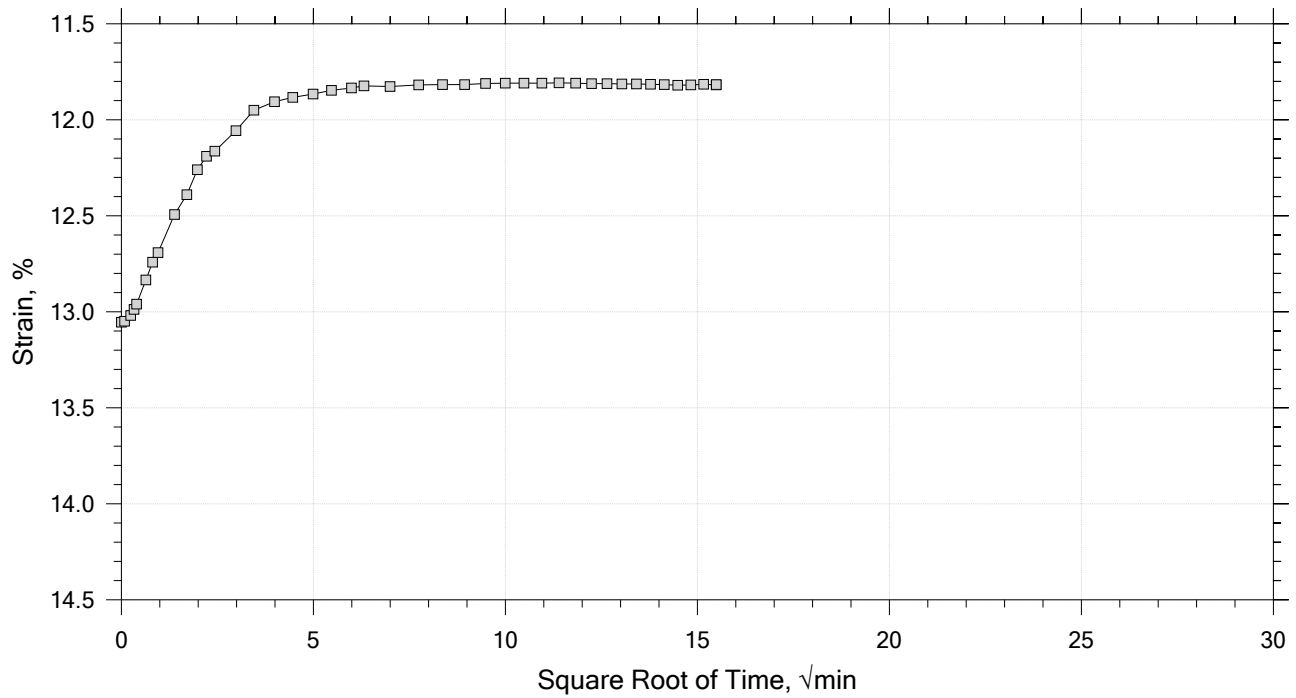
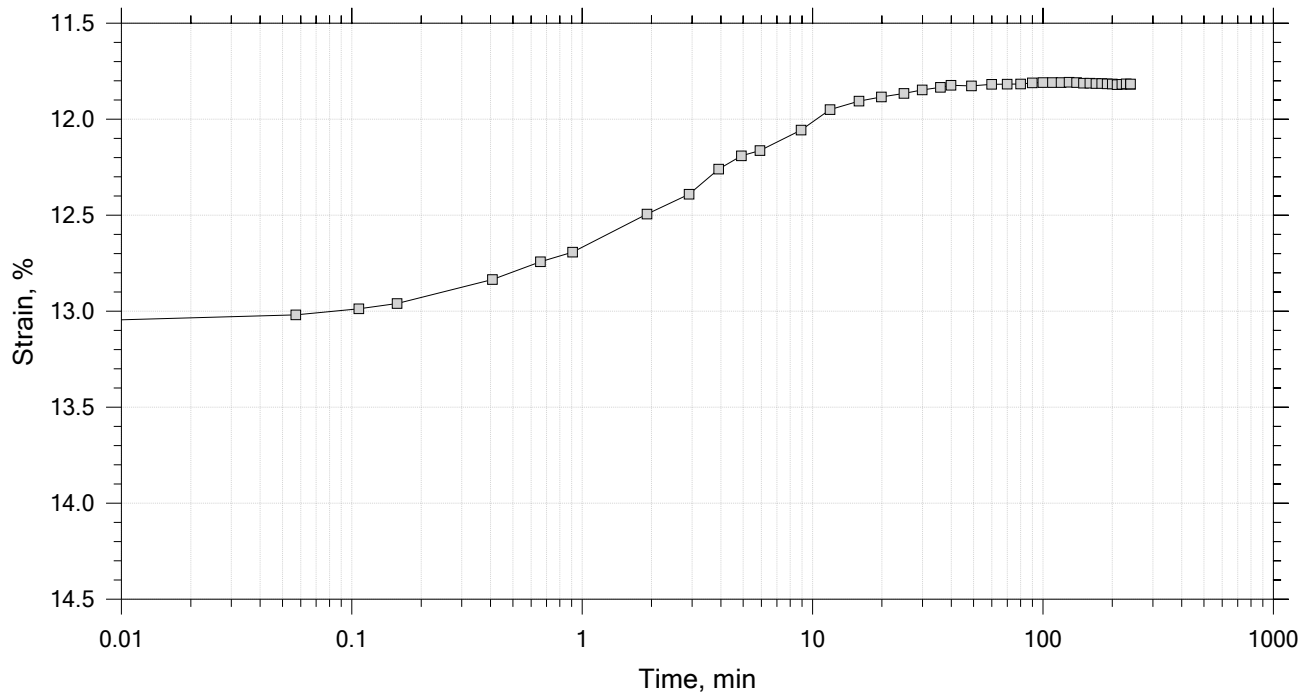
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 15

Constant Load Step

Stress: 2 tsf



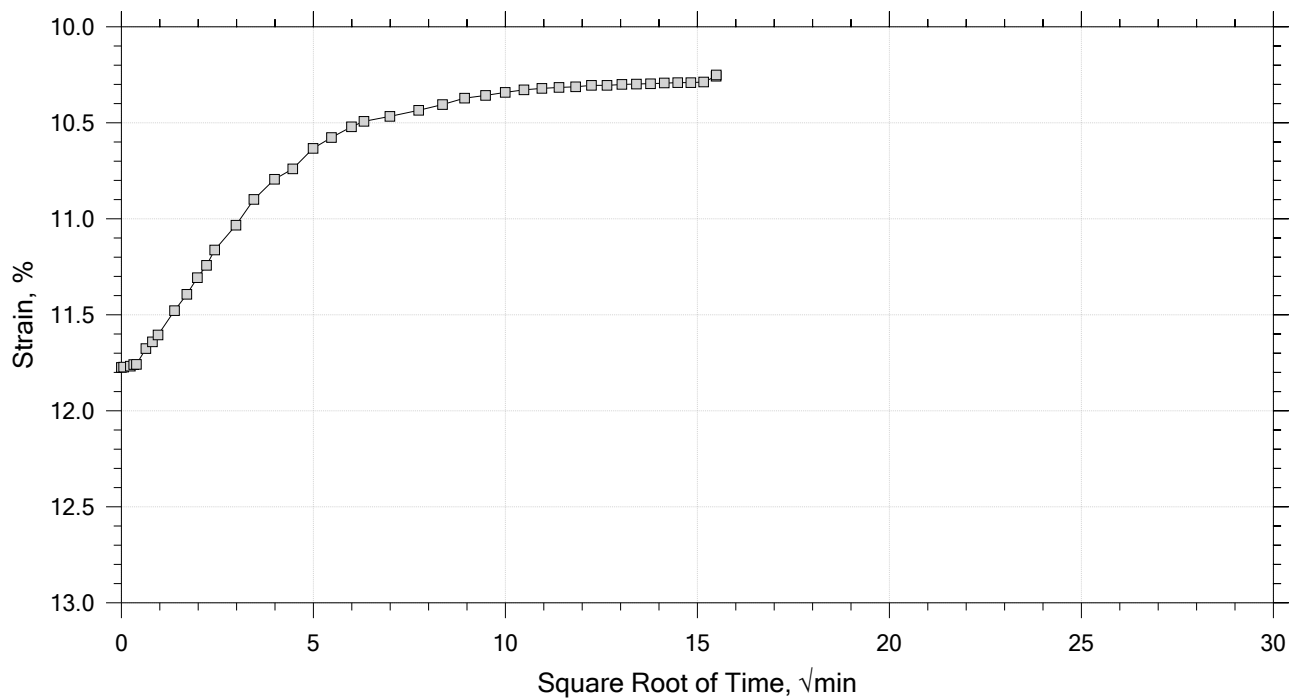
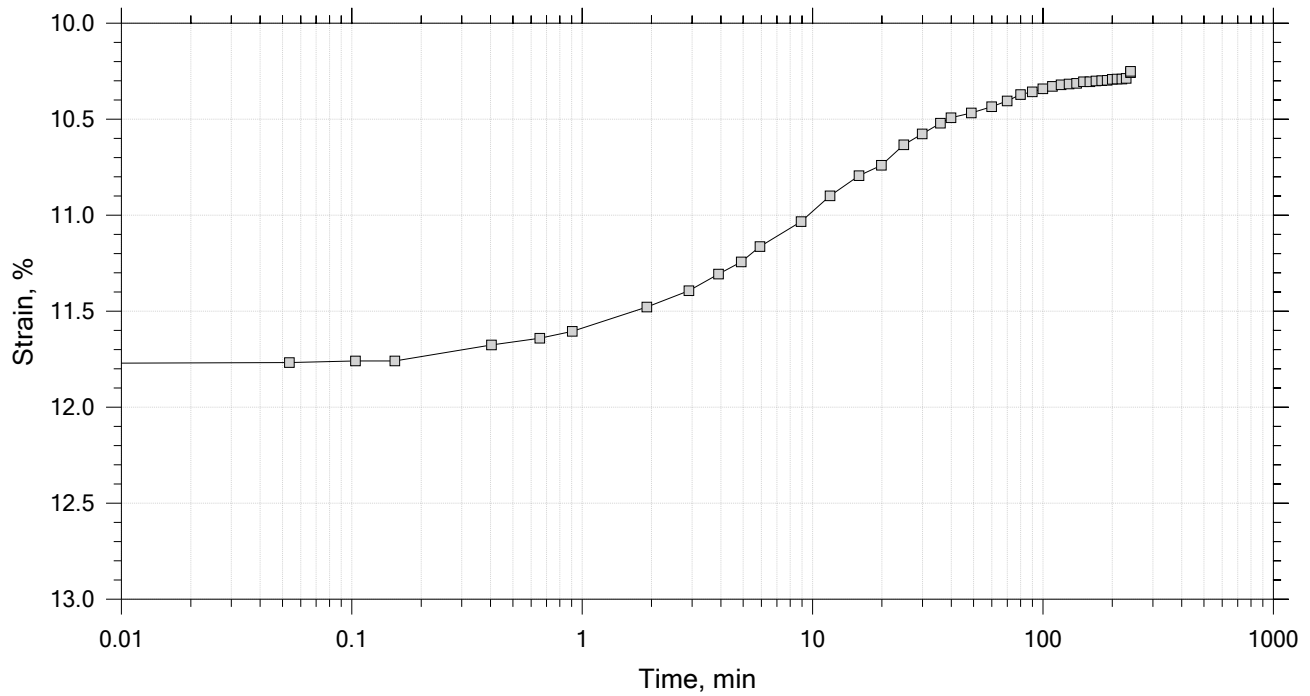
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 15

Constant Load Step

Stress: 0.5 tsf



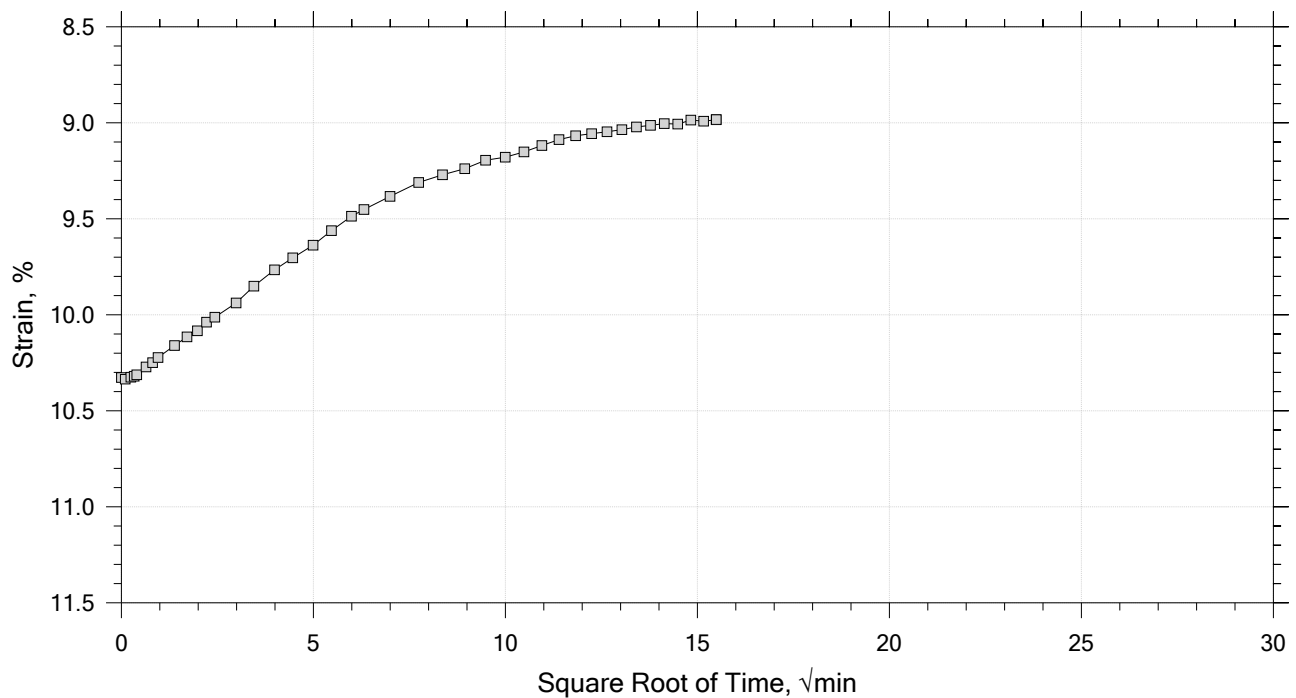
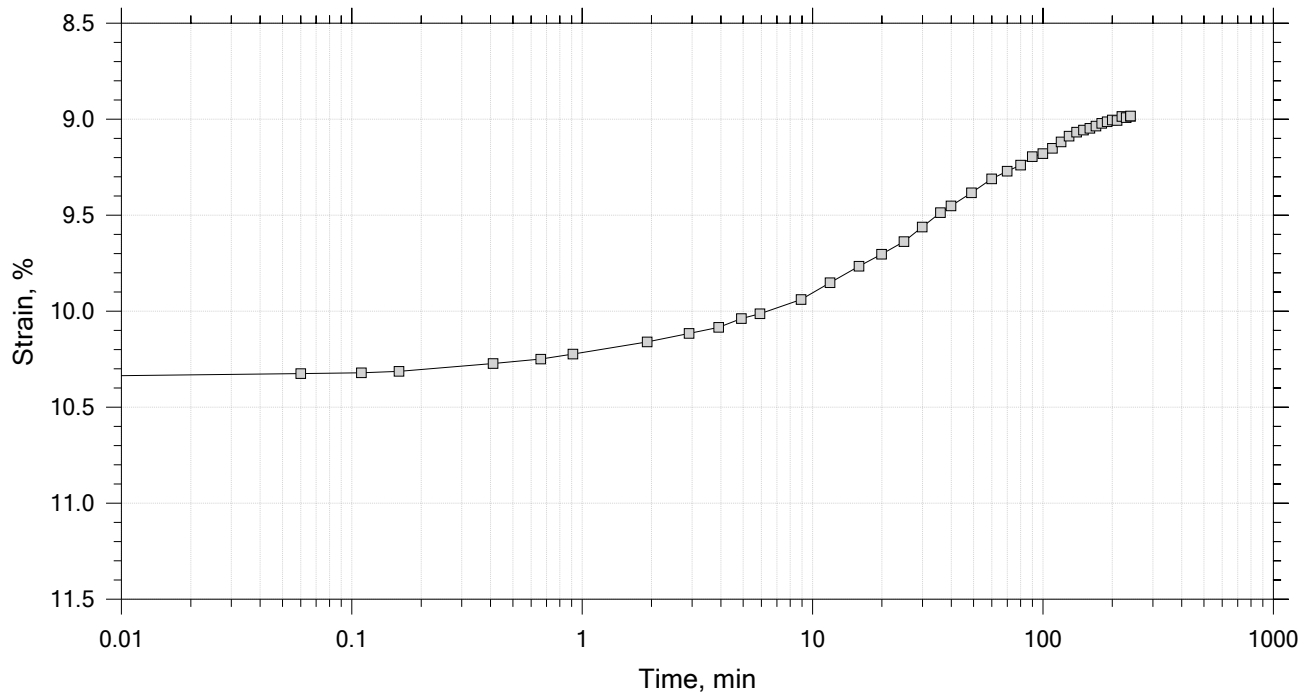
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 15

Constant Load Step

Stress: 0.125 tsf



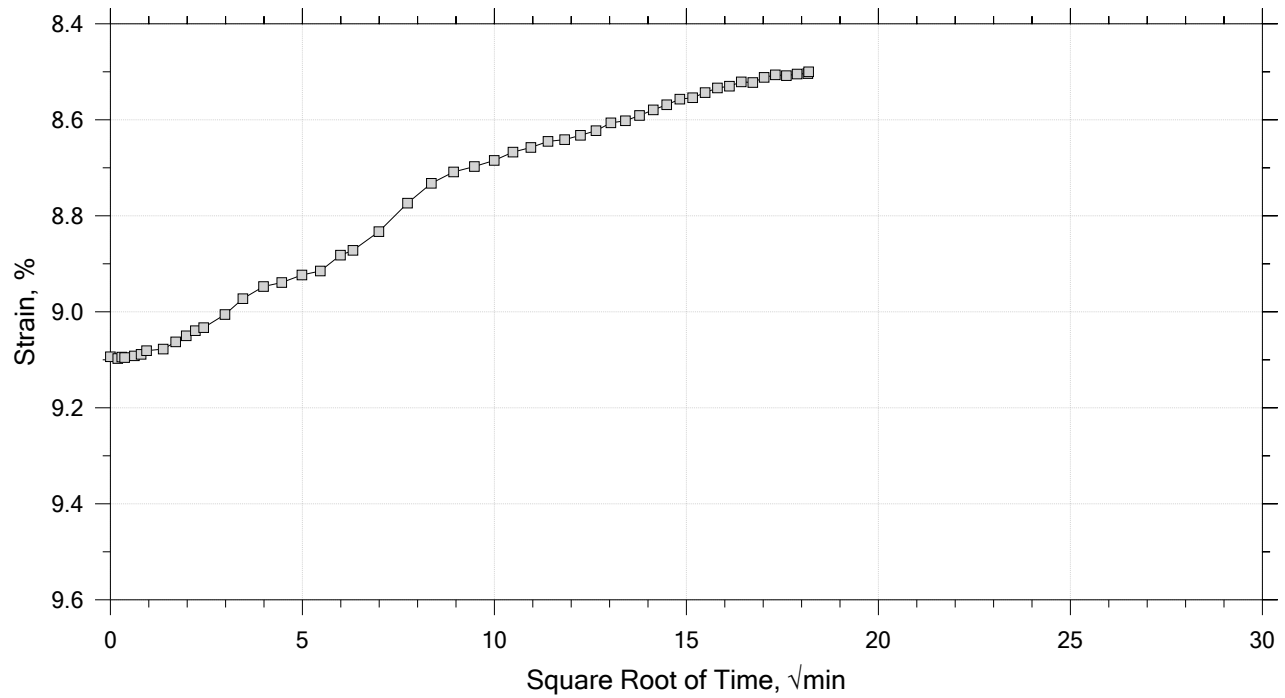
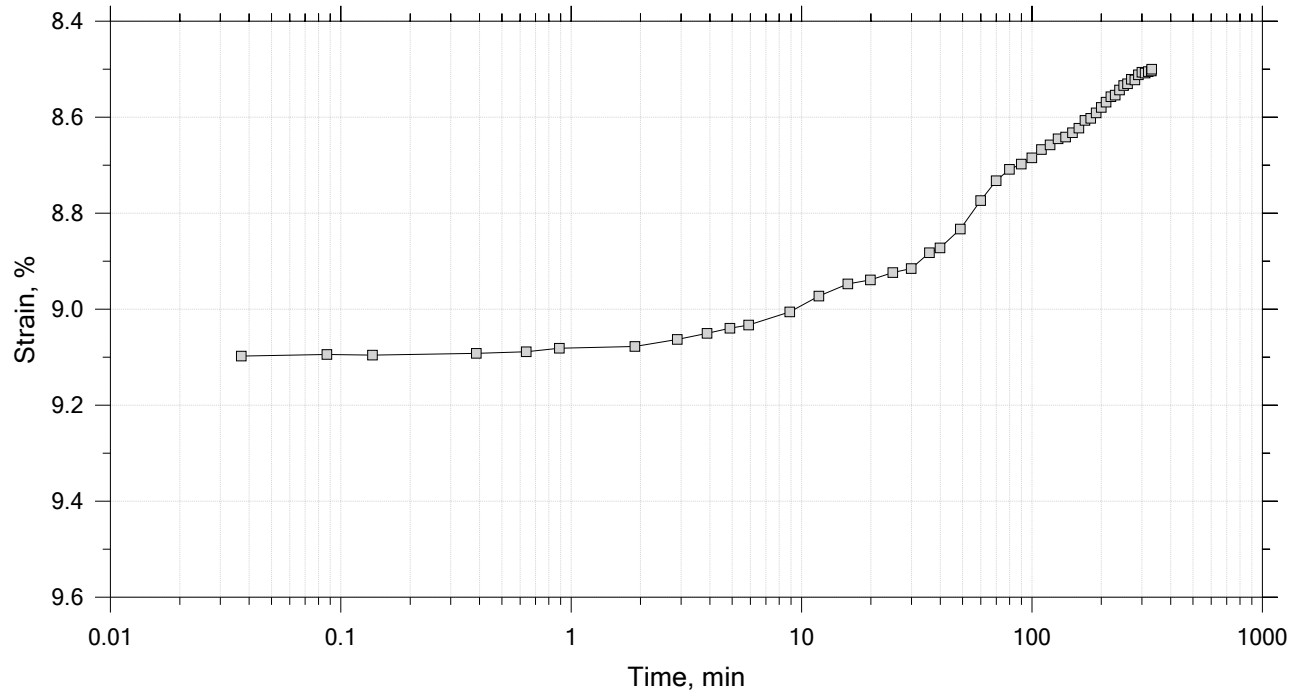
|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 15

Constant Load Step

Stress: 0.0625 tsf



|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

|                            |                                  |                      |
|----------------------------|----------------------------------|----------------------|
| Specimen Diameter: 2.50 in | Estimated Specific Gravity: 2.74 | Liquid Limit: 41     |
| Initial Height: 1.00 in    | Initial Void Ratio: 1.01         | Plastic Limit: 23    |
| Final Height: 0.90 in      | Final Void Ratio: 0.813          | Plasticity Index: 18 |

|                               | Before Test<br>Trimmings | Before Test<br>Specimen | After Test<br>Specimen | After Test<br>Trimmings |
|-------------------------------|--------------------------|-------------------------|------------------------|-------------------------|
| Container ID                  | E2959                    | RING                    |                        | E0386                   |
| Mass Container, gm            | 8.25                     | 108.06                  | 108.06                 | 8.44                    |
| Mass Container + Wet Soil, gm | 178.83                   | 256.92                  | 250                    | 152.1                   |
| Mass Container + Dry Soil, gm | 136.86                   | 217.53                  | 217.53                 | 119.24                  |
| Mass Dry Soil, gm             | 128.61                   | 109.47                  | 109.47                 | 110.8                   |
| Water Content, %              | 32.63                    | 35.98                   | 29.66                  | 29.66                   |
| Void Ratio                    | ---                      | 1.01                    | 0.81                   | ---                     |
| Degree of Saturation, %       | ---                      | 97.23                   | 100.00                 | ---                     |
| Dry Unit Weight, pcf          | ---                      | 84.96                   | 94.4                   | ---                     |

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: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIII-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     |                                                            |                         |                         |

## One-Dimensional Consolidation by ASTM D2435 - Method B

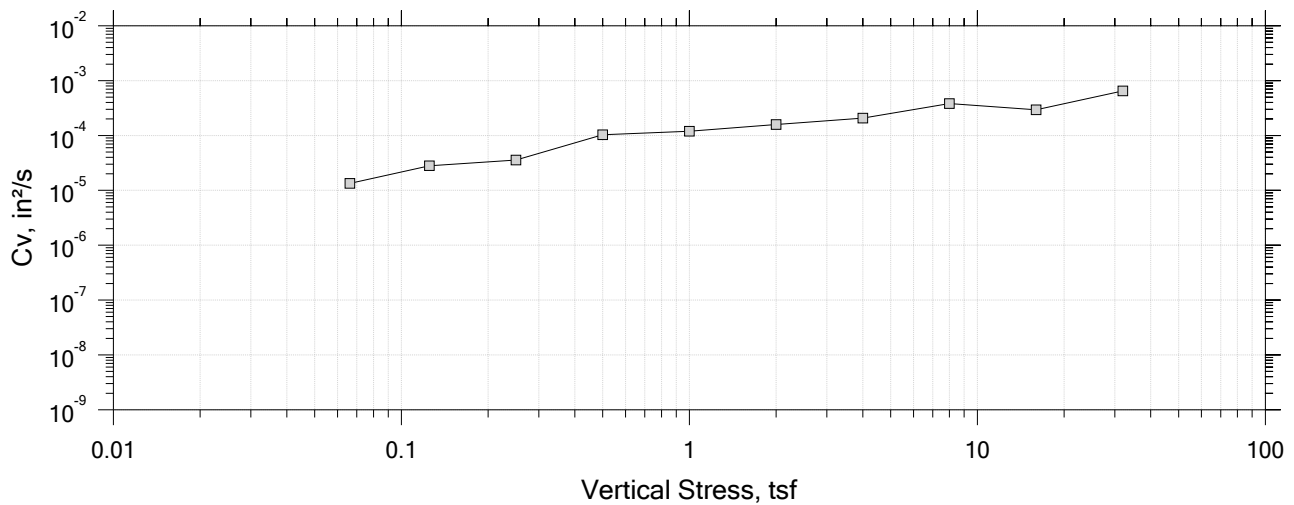
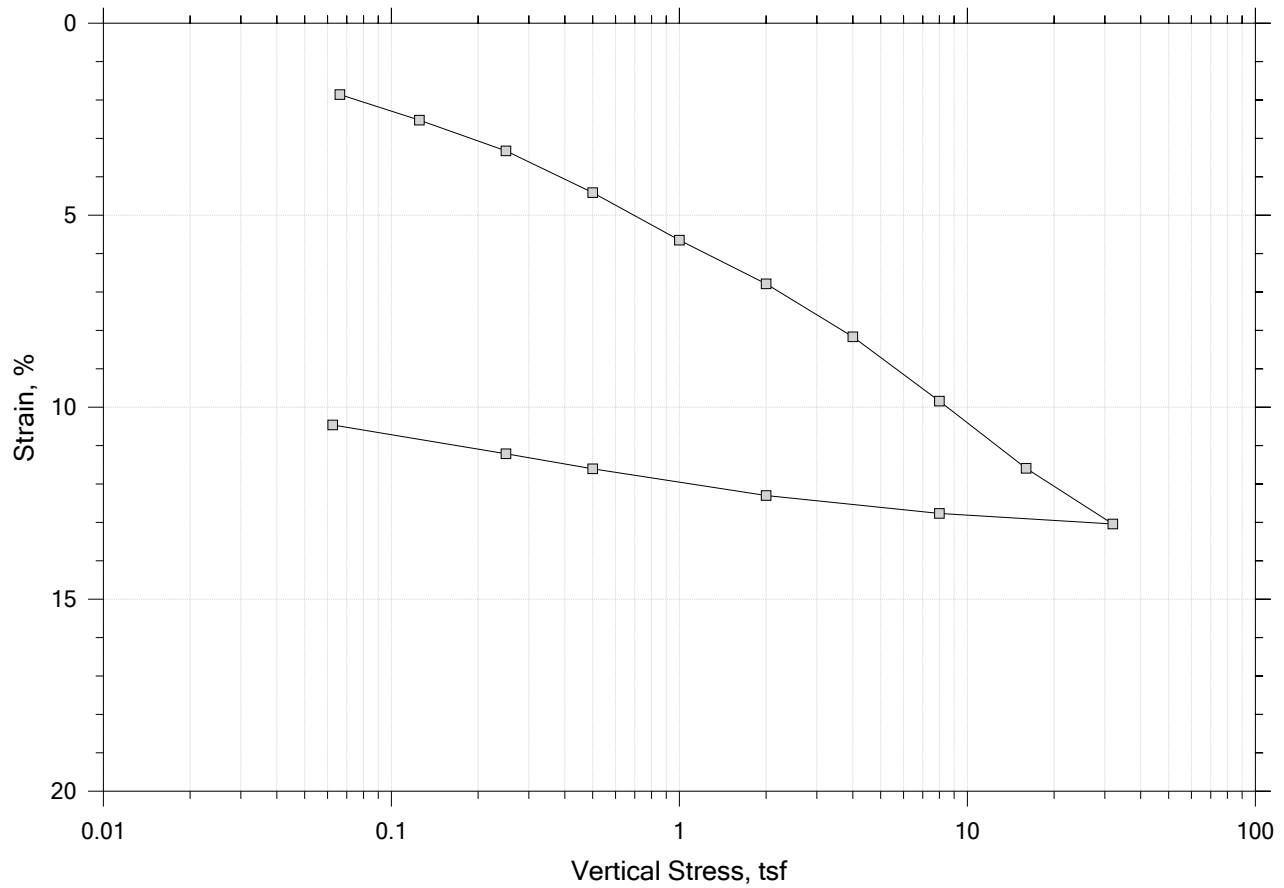
### Square Root of Time Coefficients

[illegible]

|                                                                                     |                                                            |                         |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                    | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-201                                     | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 1U                                             | Test Date: 7/23/21      | Depth: 22-24            |
|                                                                                     | Test No.: IP-1                                             | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, dark gray clay                         |                         |                         |
|                                                                                     | Remarks: System LTIIL-16-0834, Swell Pressure = 0.0707 tsf |                         |                         |
|                                                                                     | Displacement at End of Increment                           |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

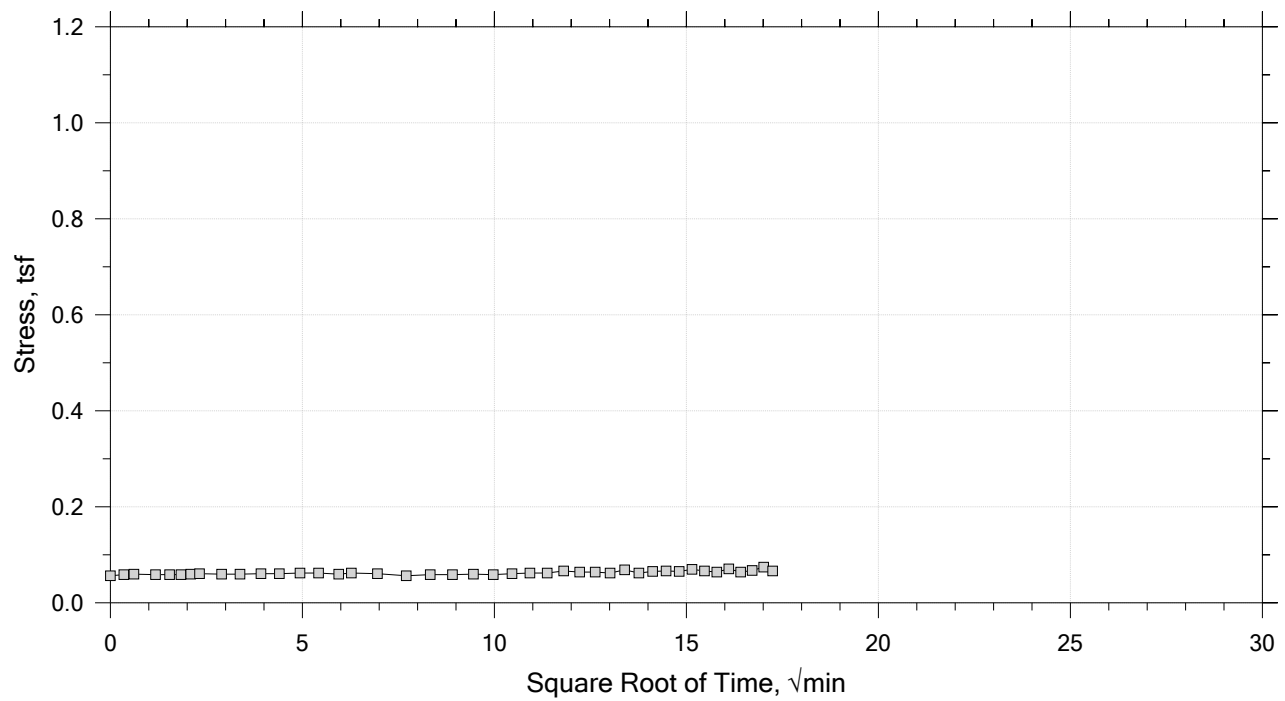
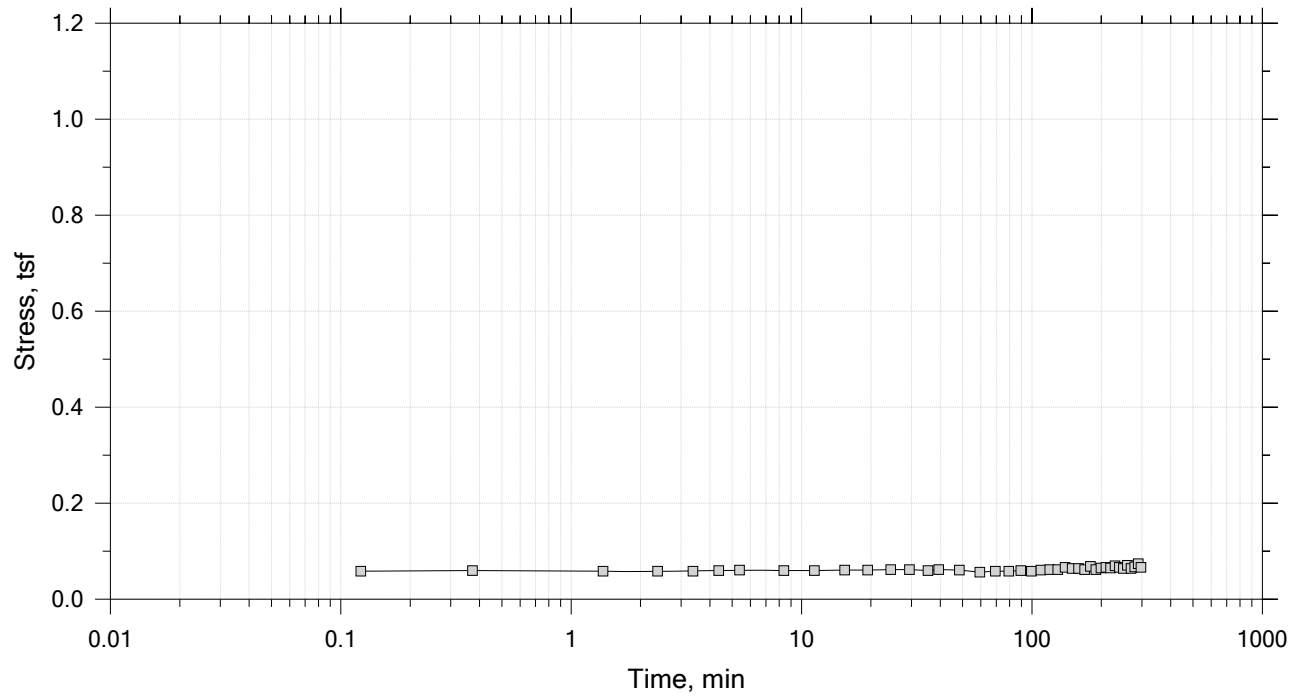
## Summary Report



|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     | Displacement at End of Increment                        |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 1 of 15  
Constant Volume Step  
Stress: 0.0663 tsf



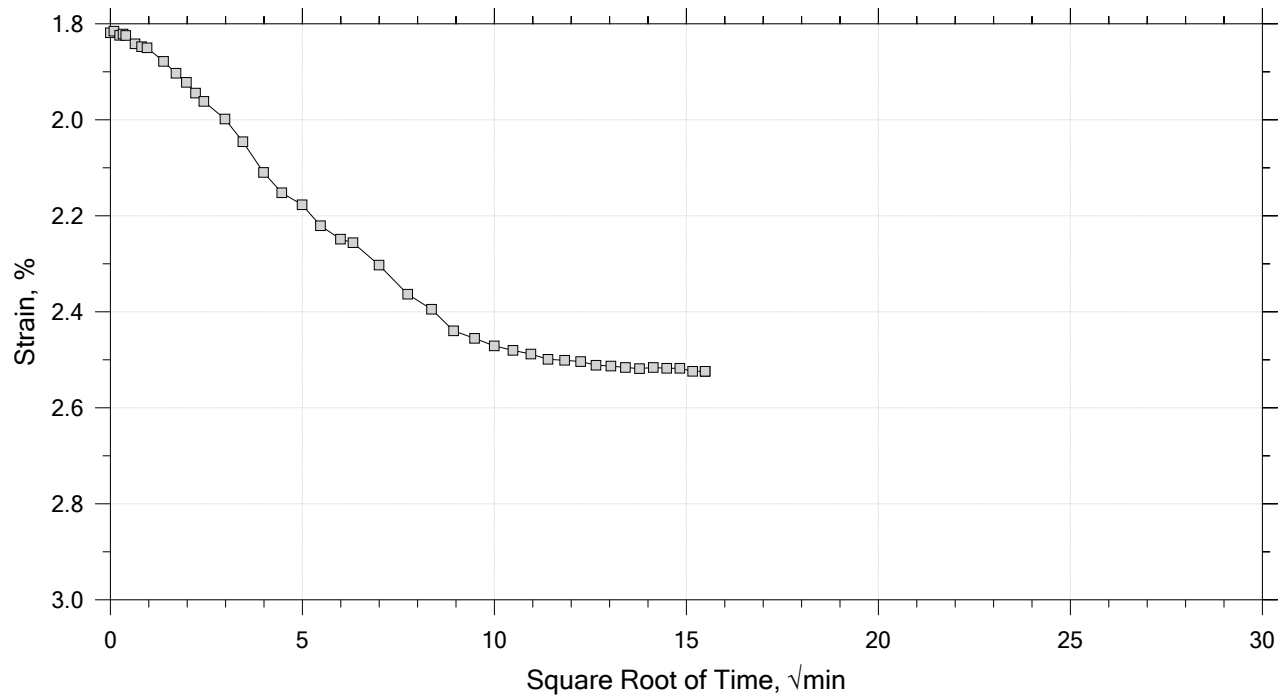
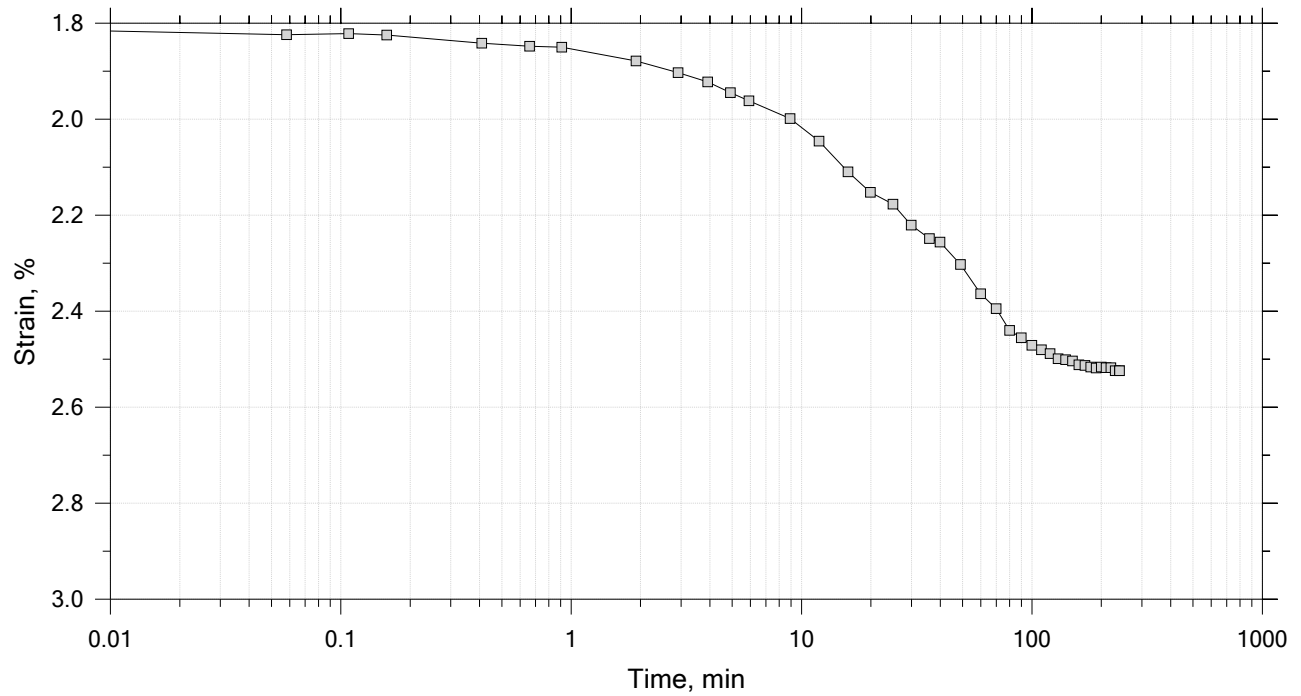
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 15

Constant Load Step

Stress: 0.125 tsf



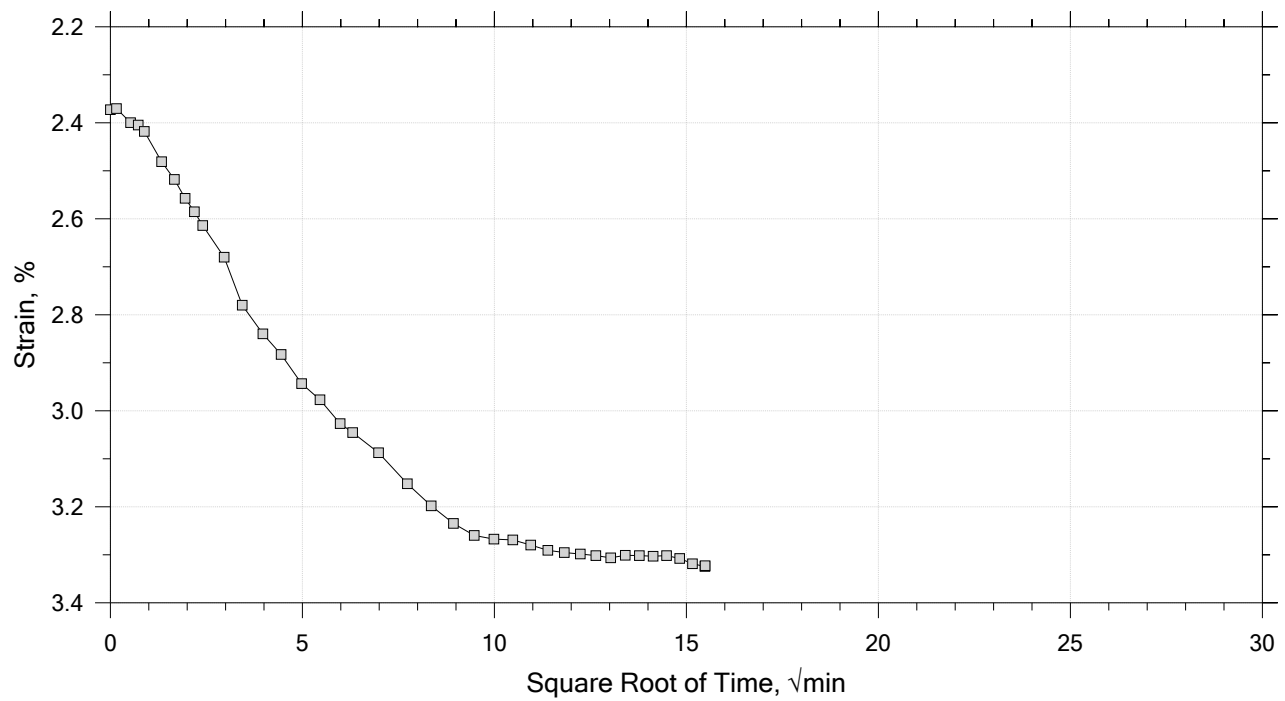
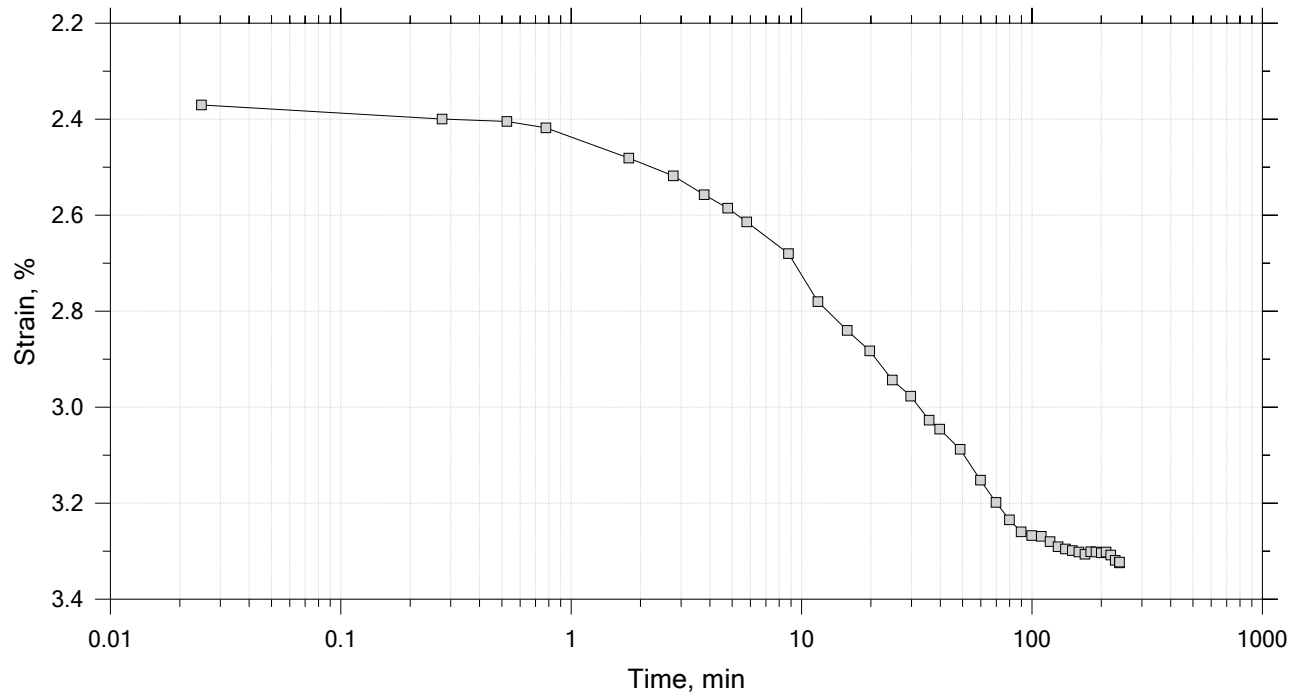
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 15

Constant Load Step

Stress: 0.25 tsf



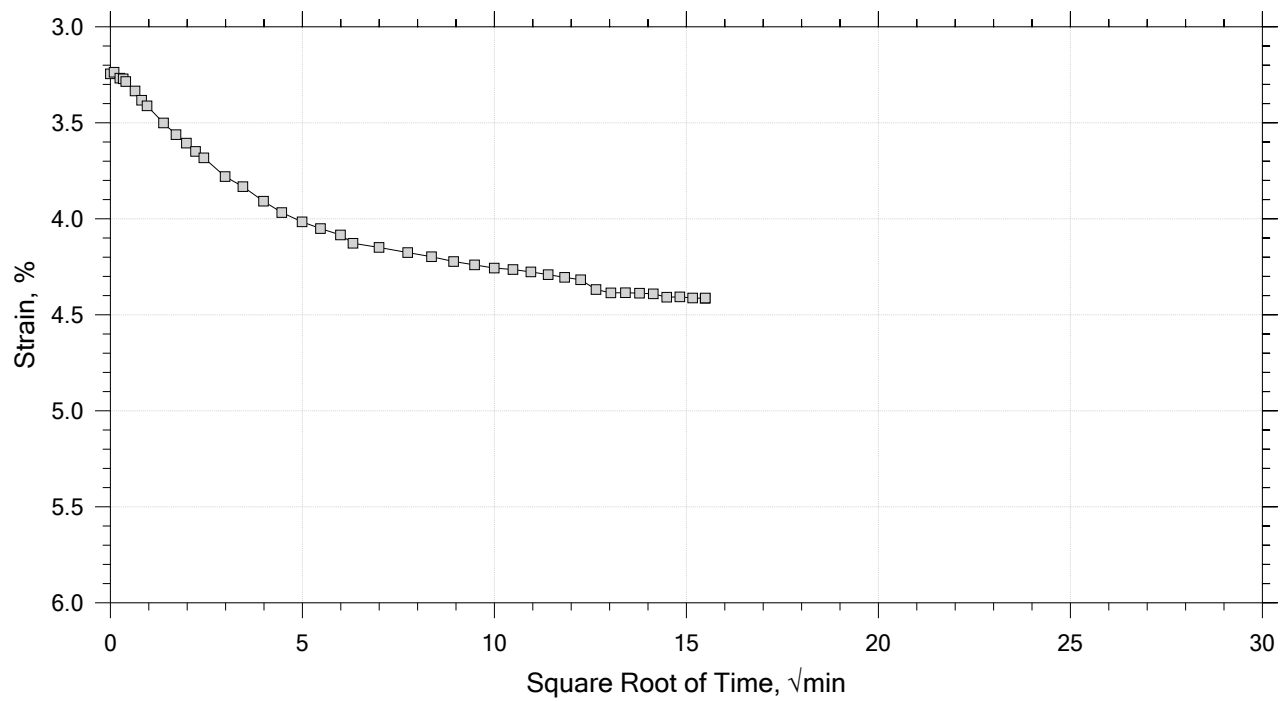
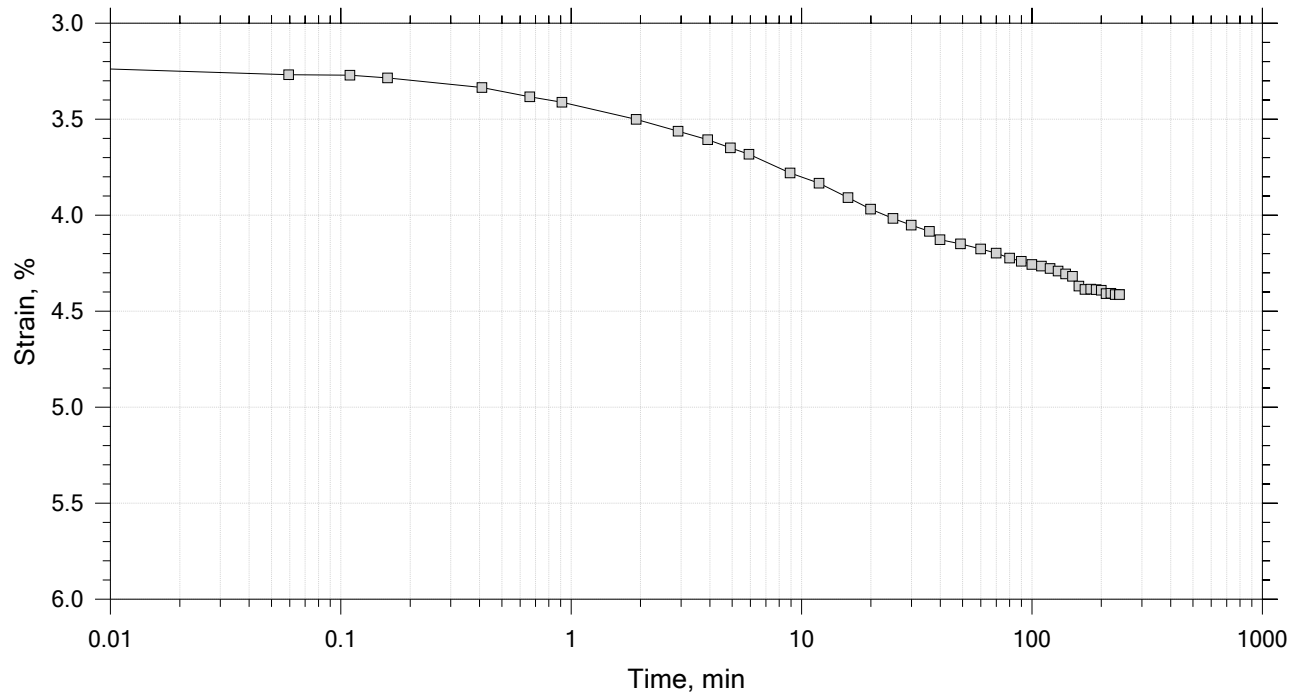
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 15

Constant Load Step

Stress: 0.5 tsf



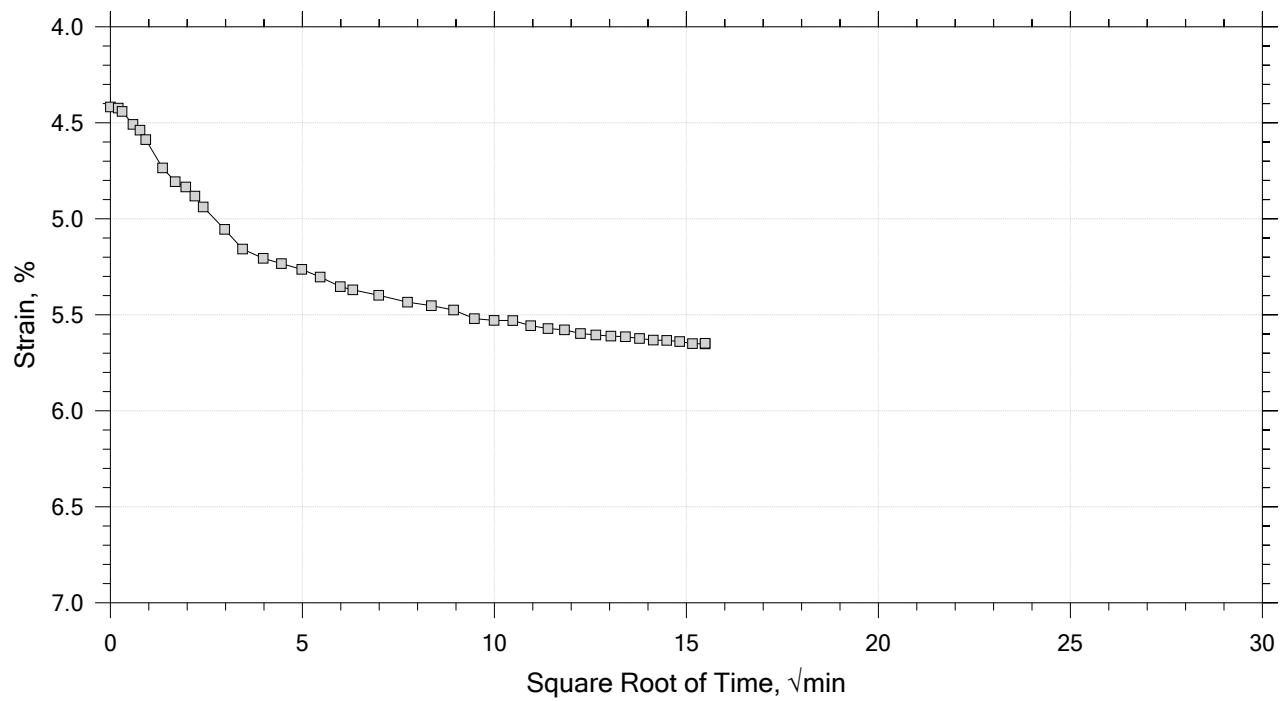
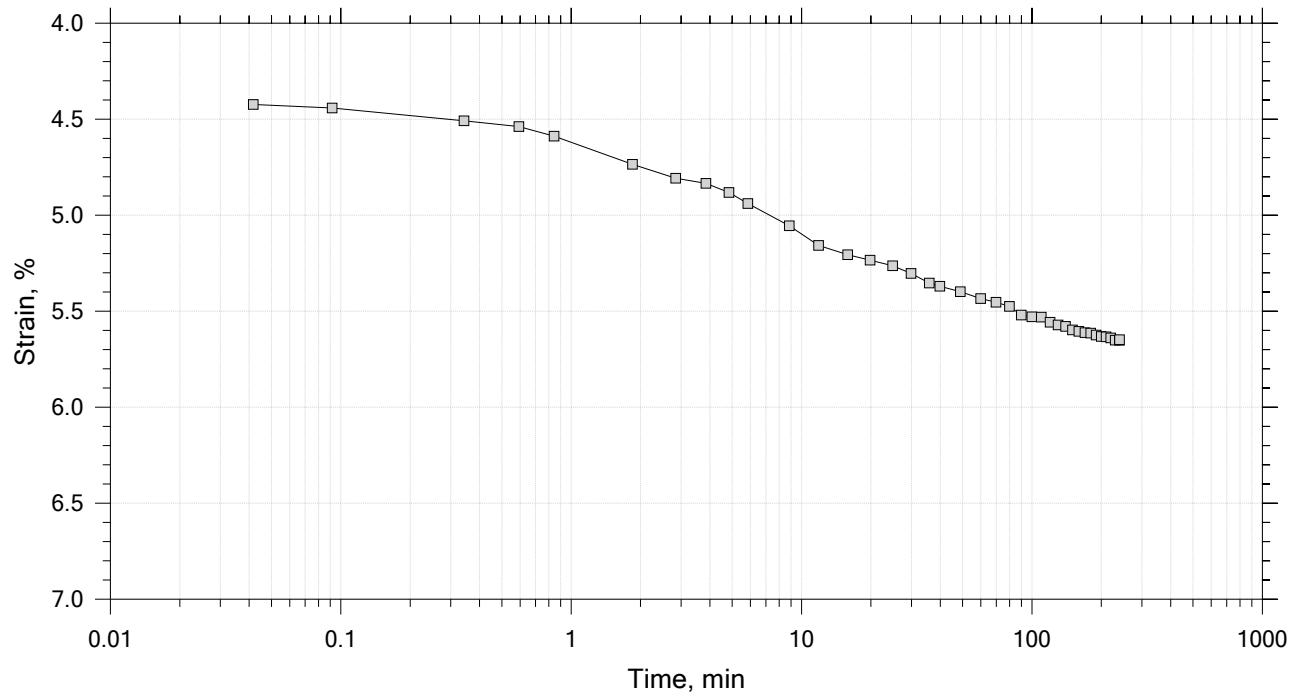
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 15

Constant Load Step

Stress: 1 tsf



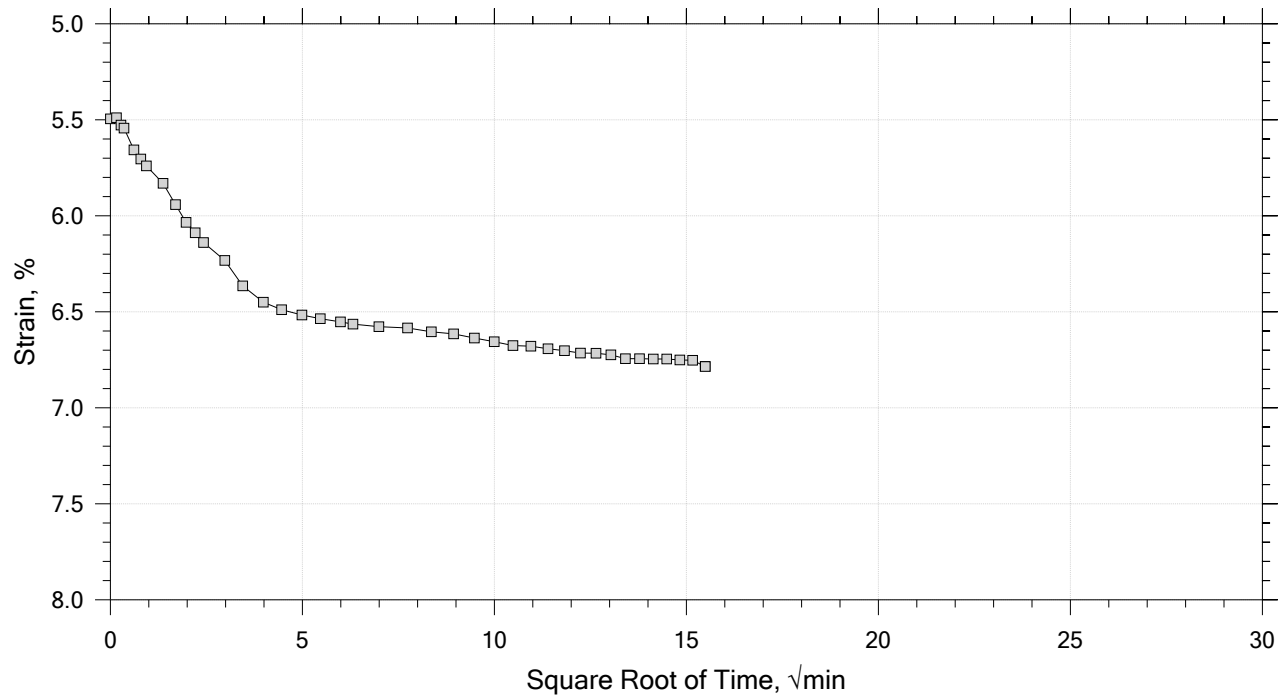
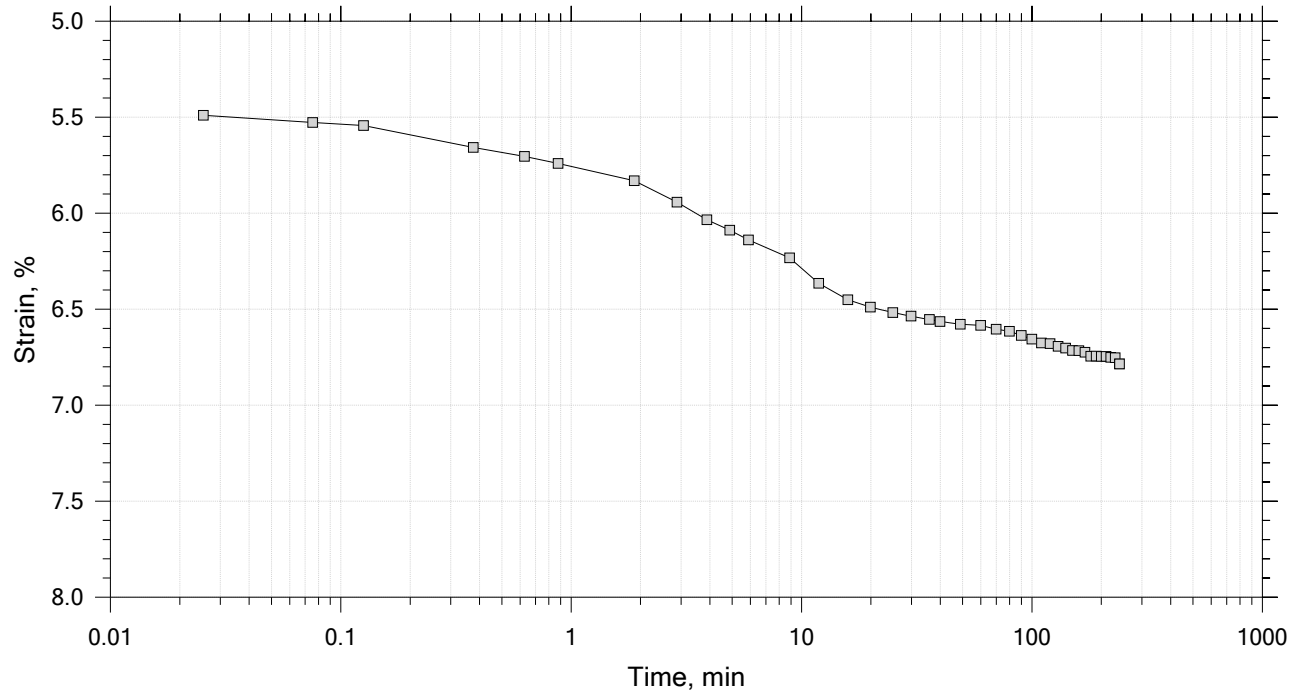
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 15

Constant Load Step

Stress: 2 tsf



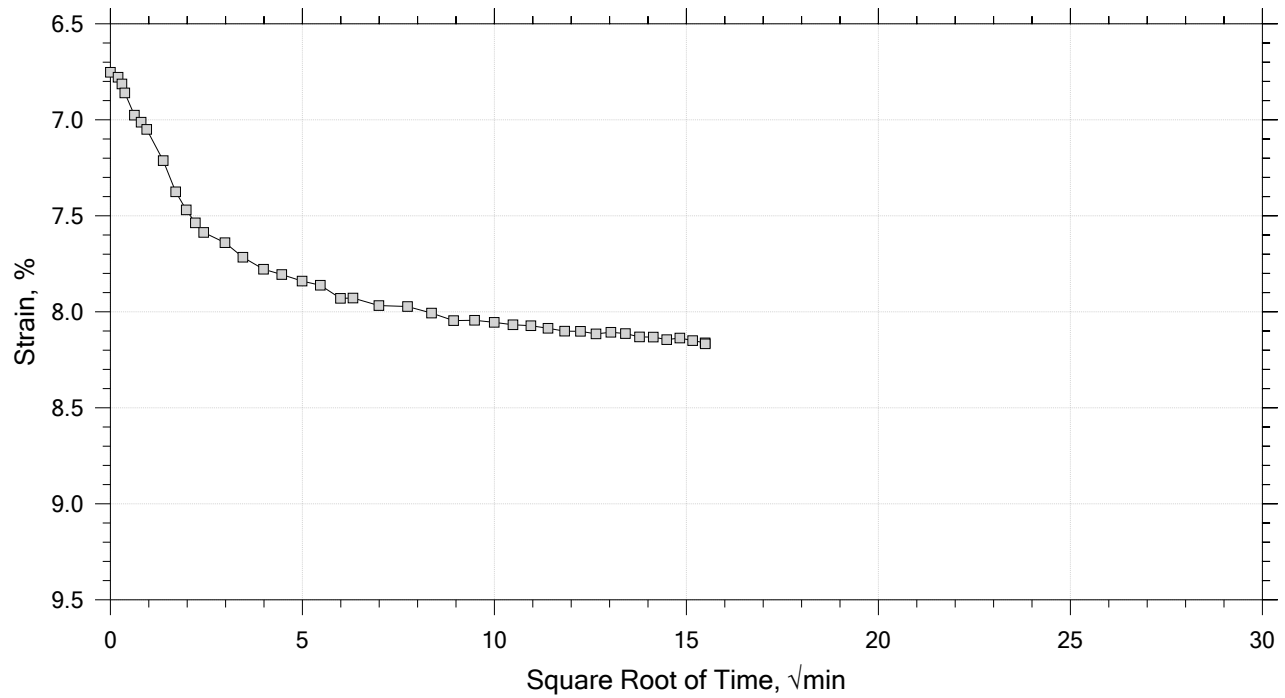
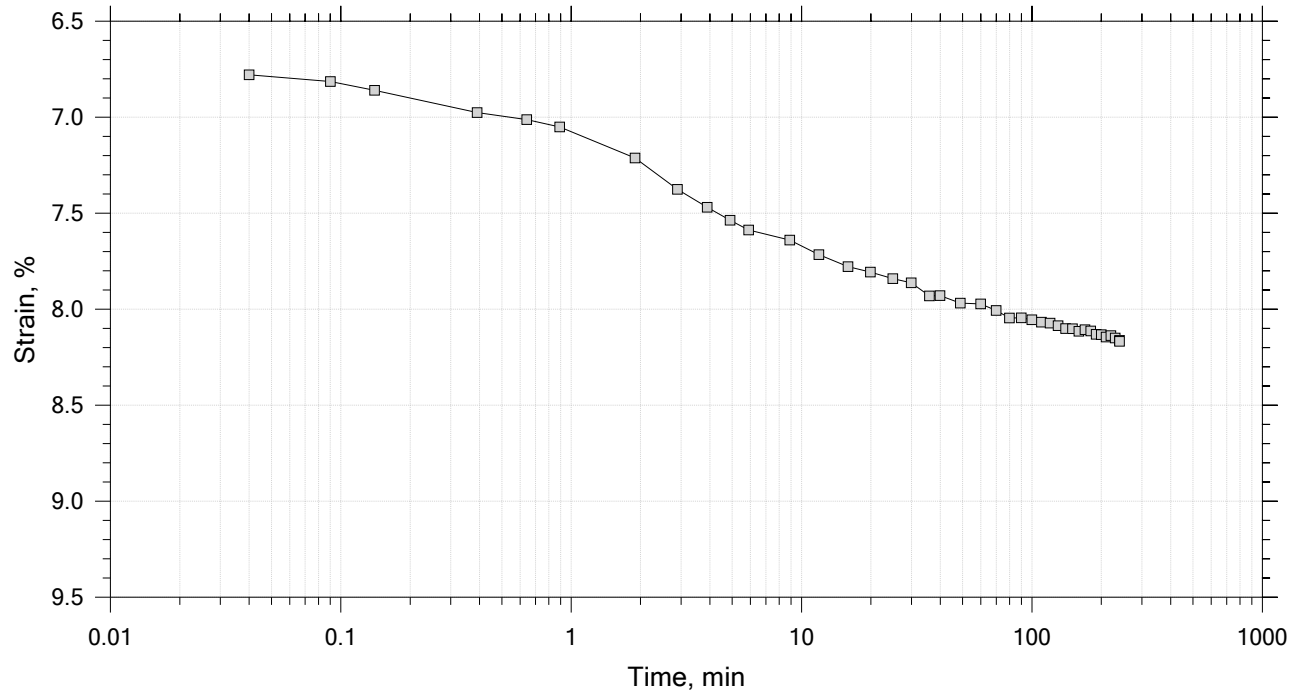
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 7 of 15

Constant Load Step

Stress: 4 tsf



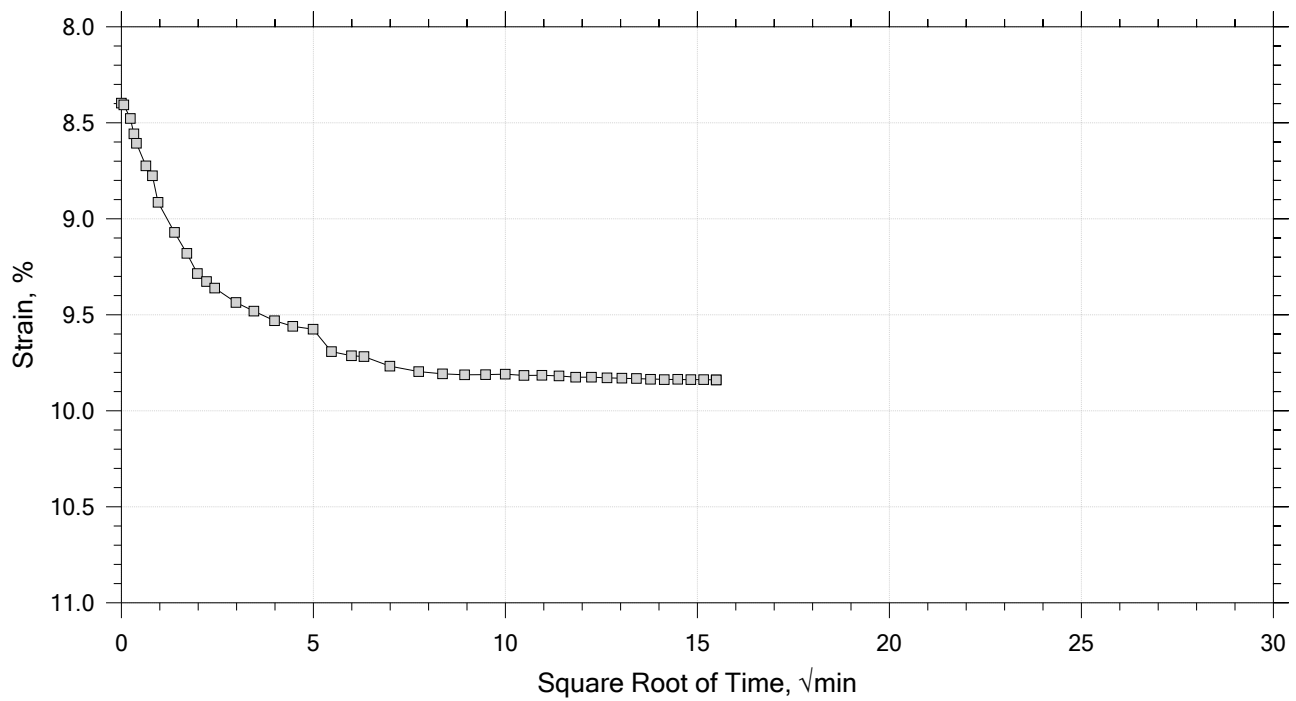
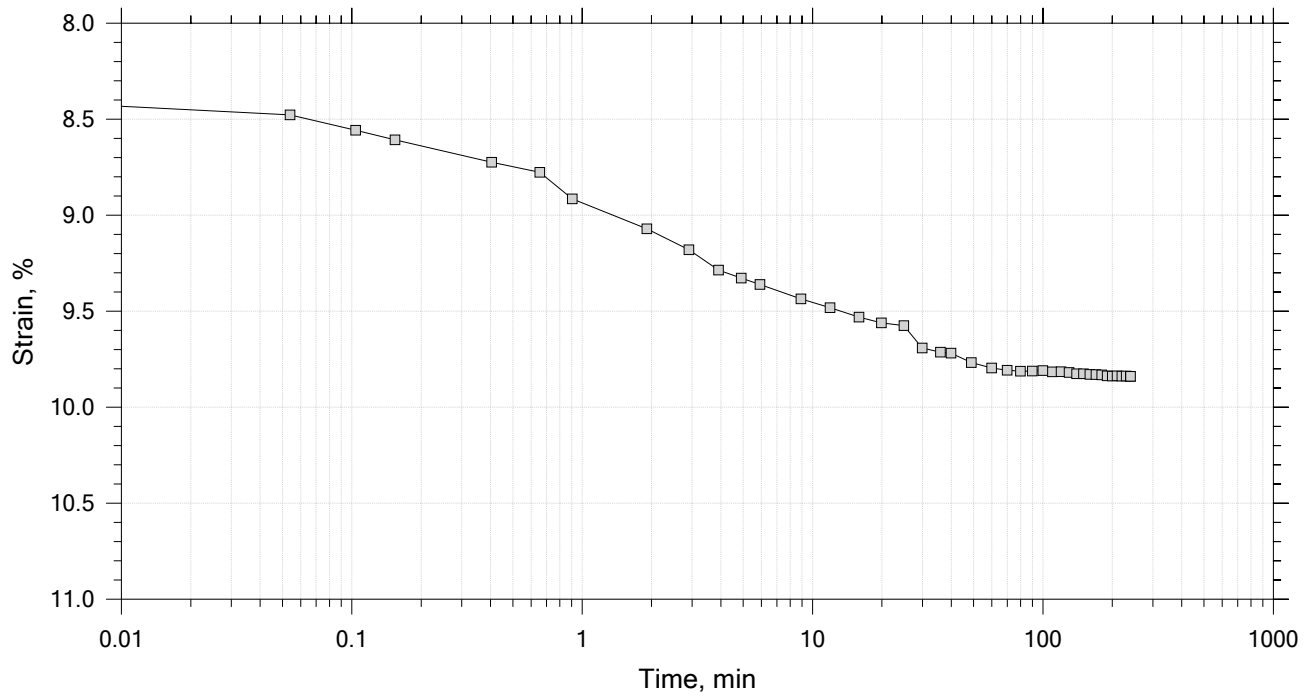
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 8 of 15

Constant Load Step

Stress: 8 tsf



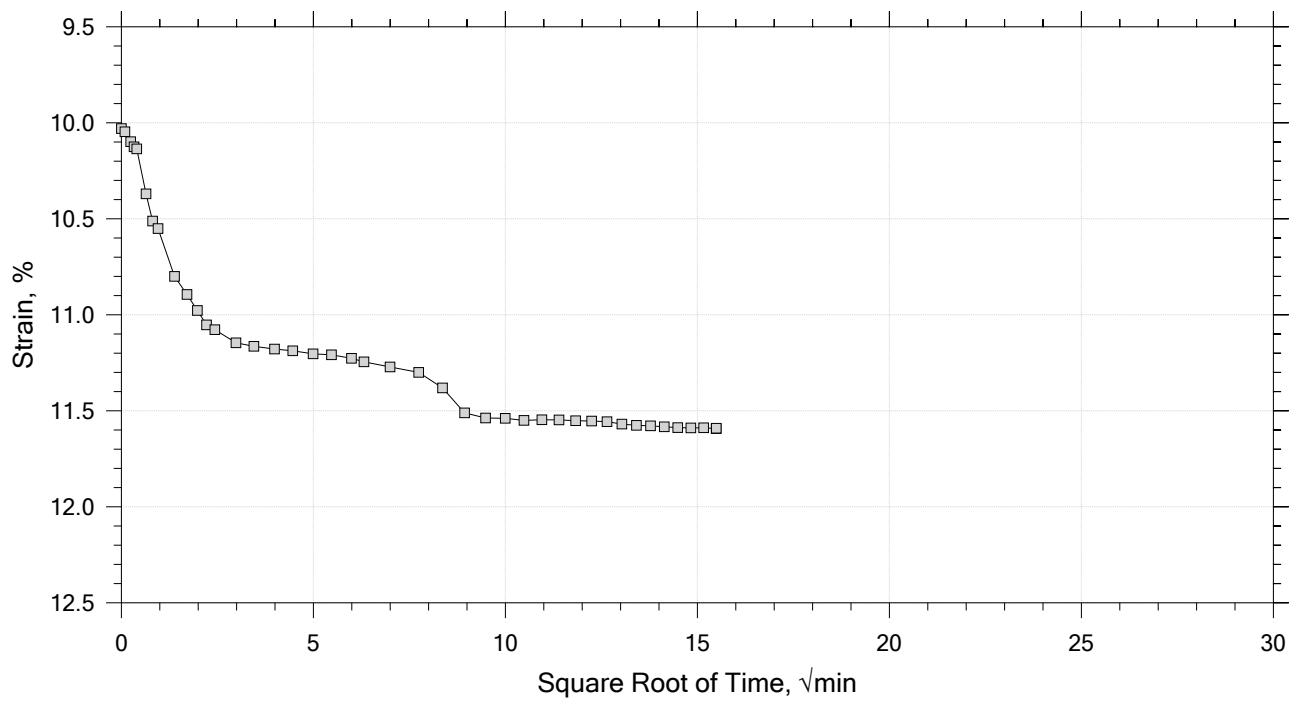
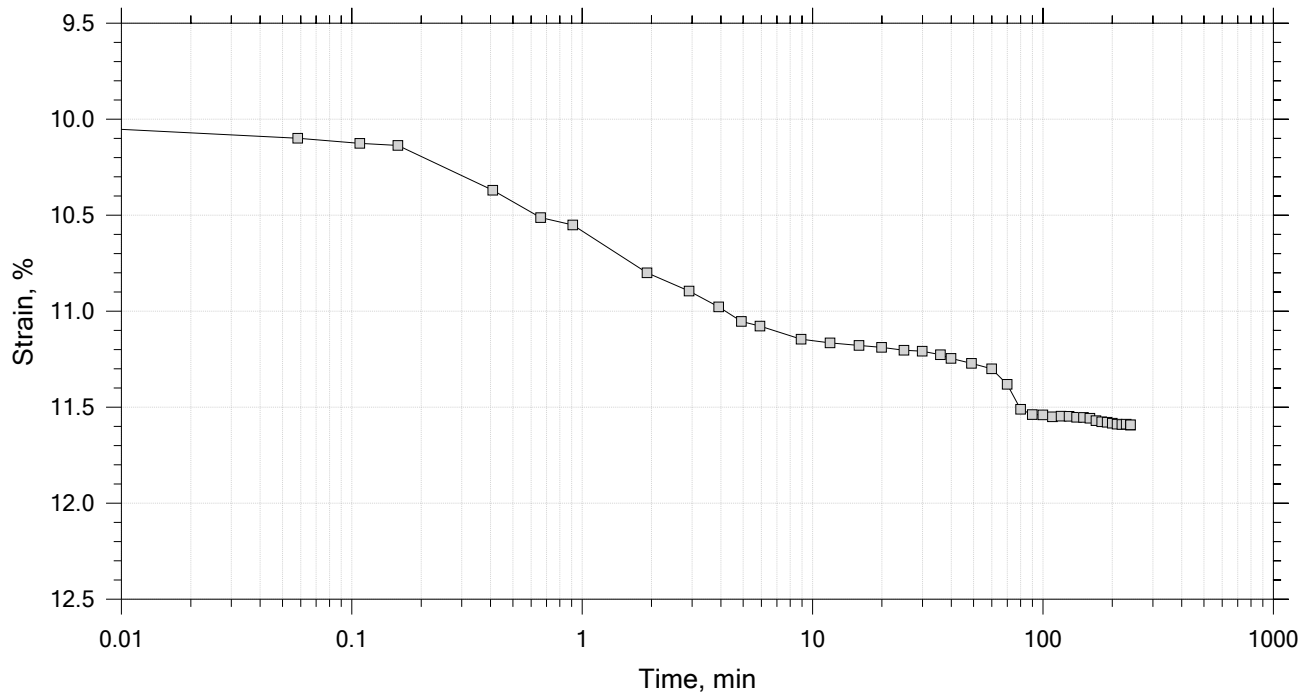
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 15

Constant Load Step

Stress: 16 tsf



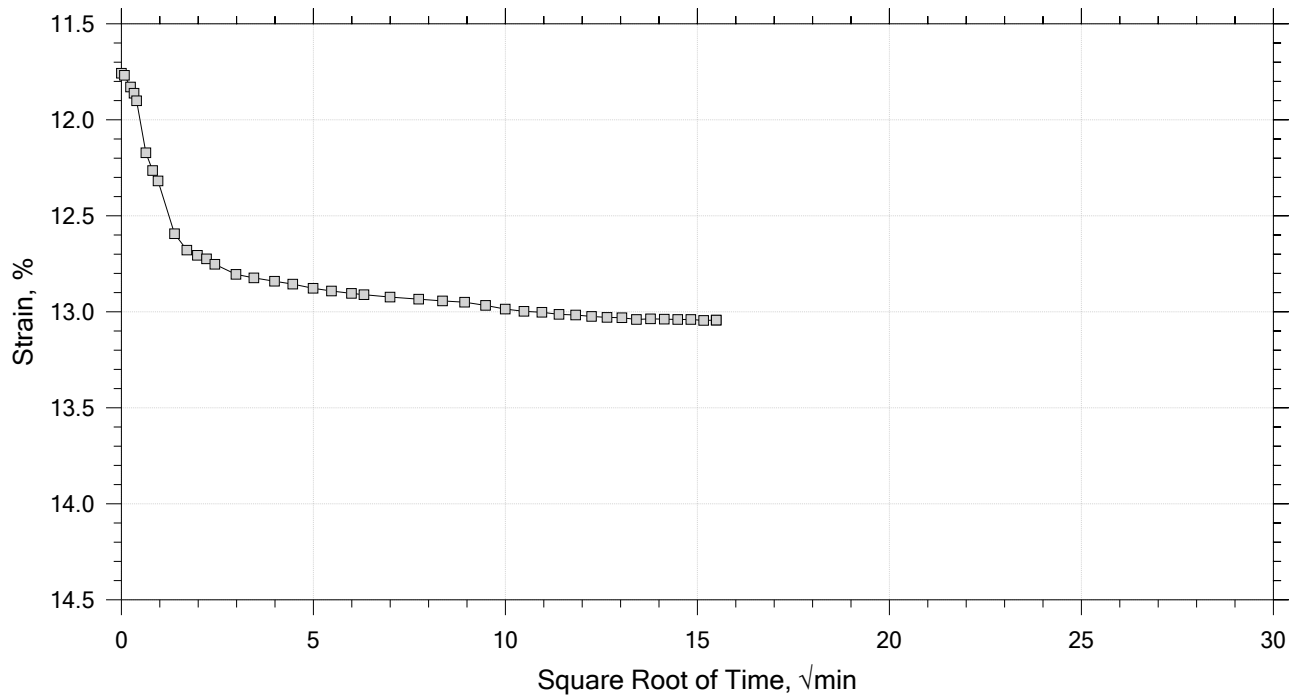
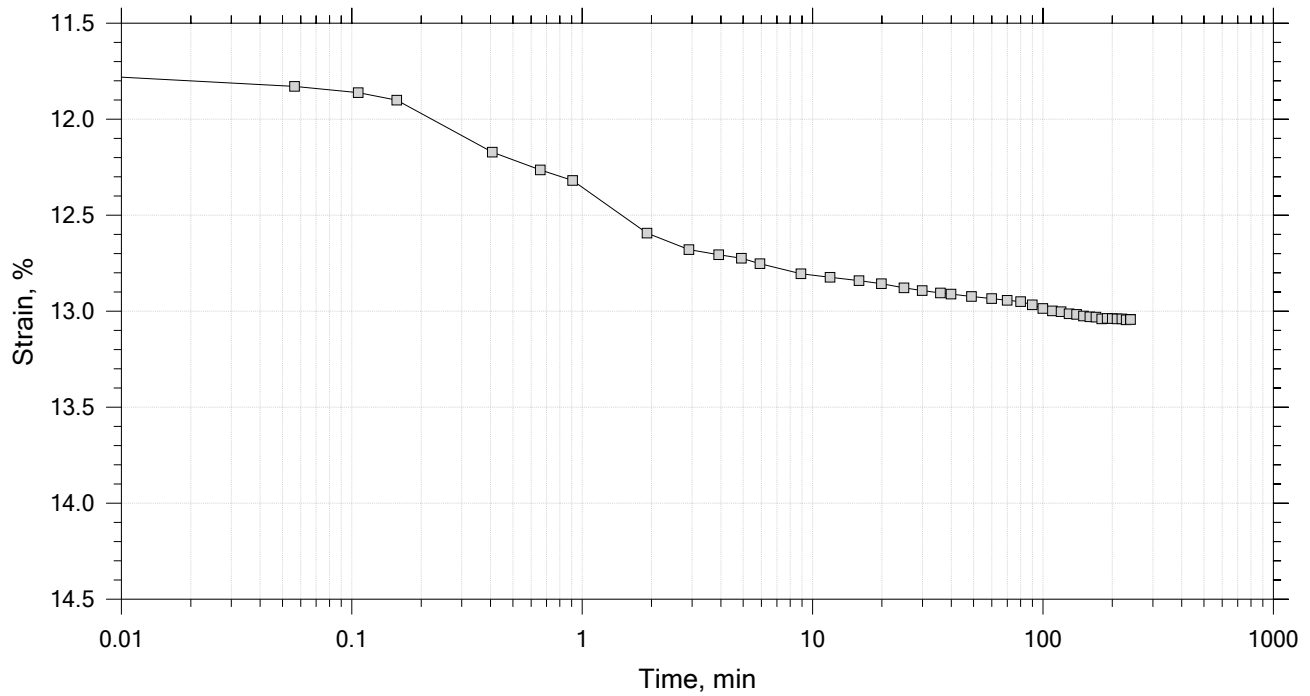
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 15

Constant Load Step

Stress: 32 tsf



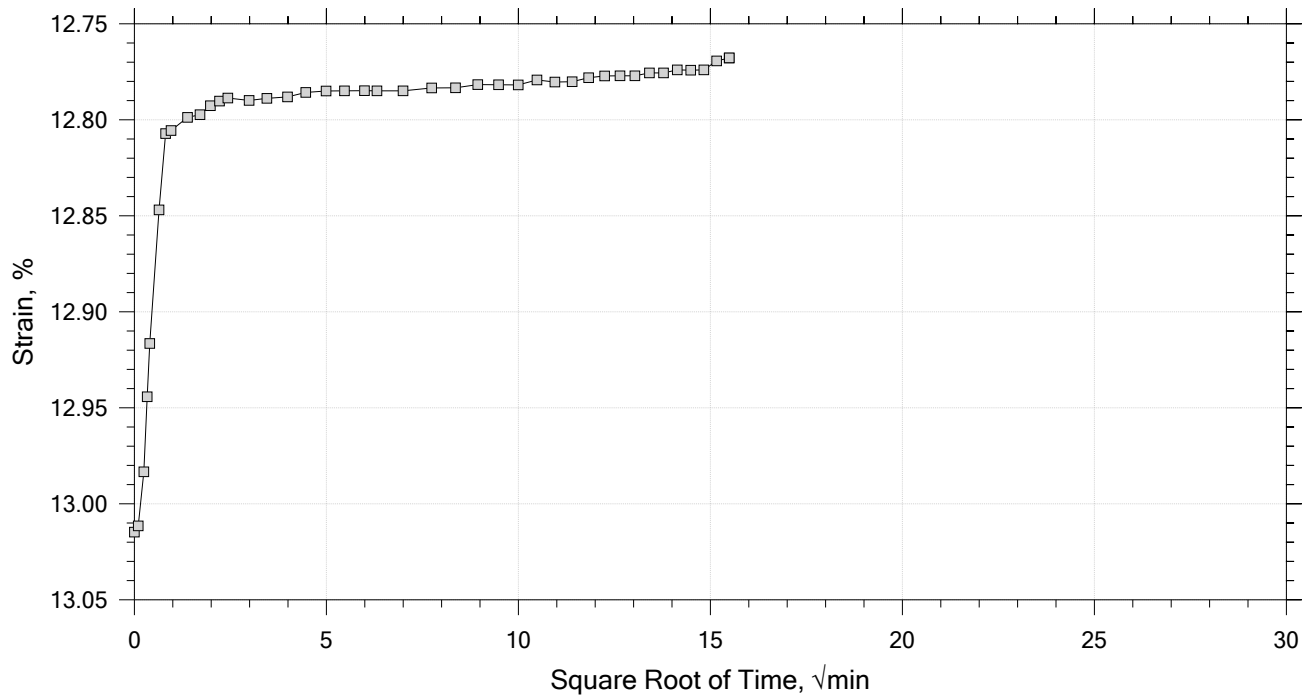
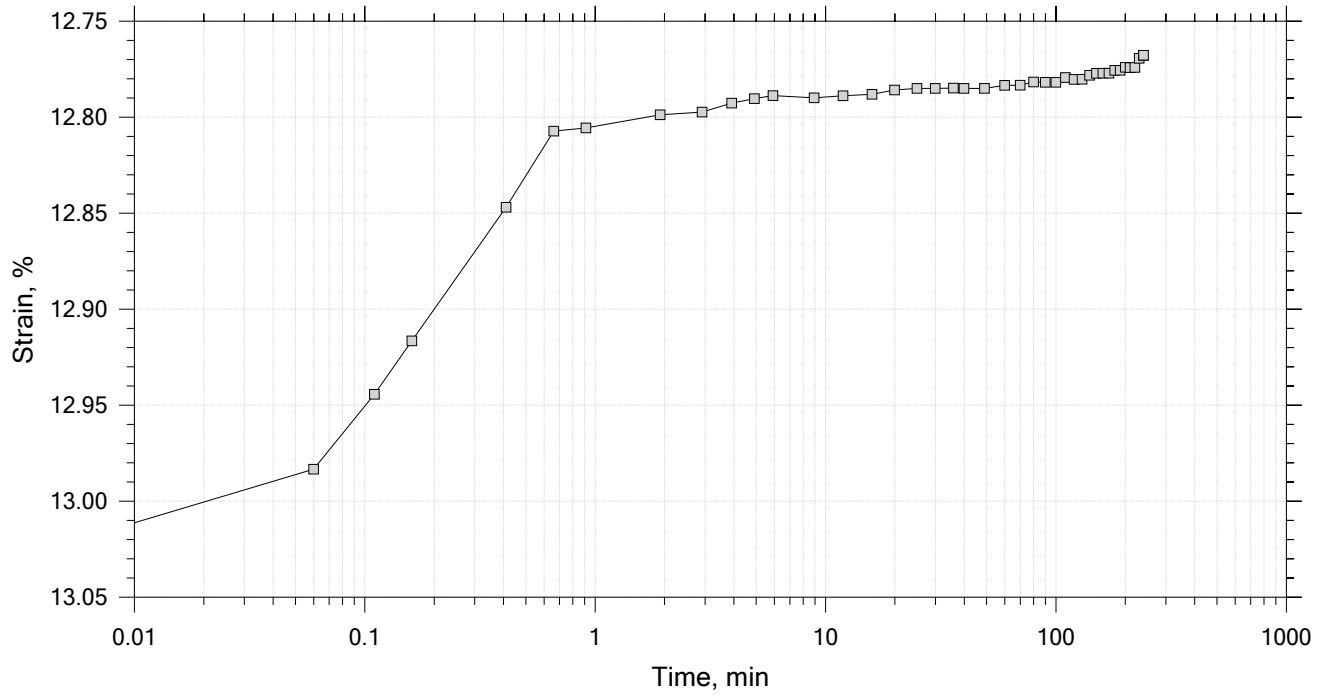
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 15

Constant Load Step

Stress: 8 tsf



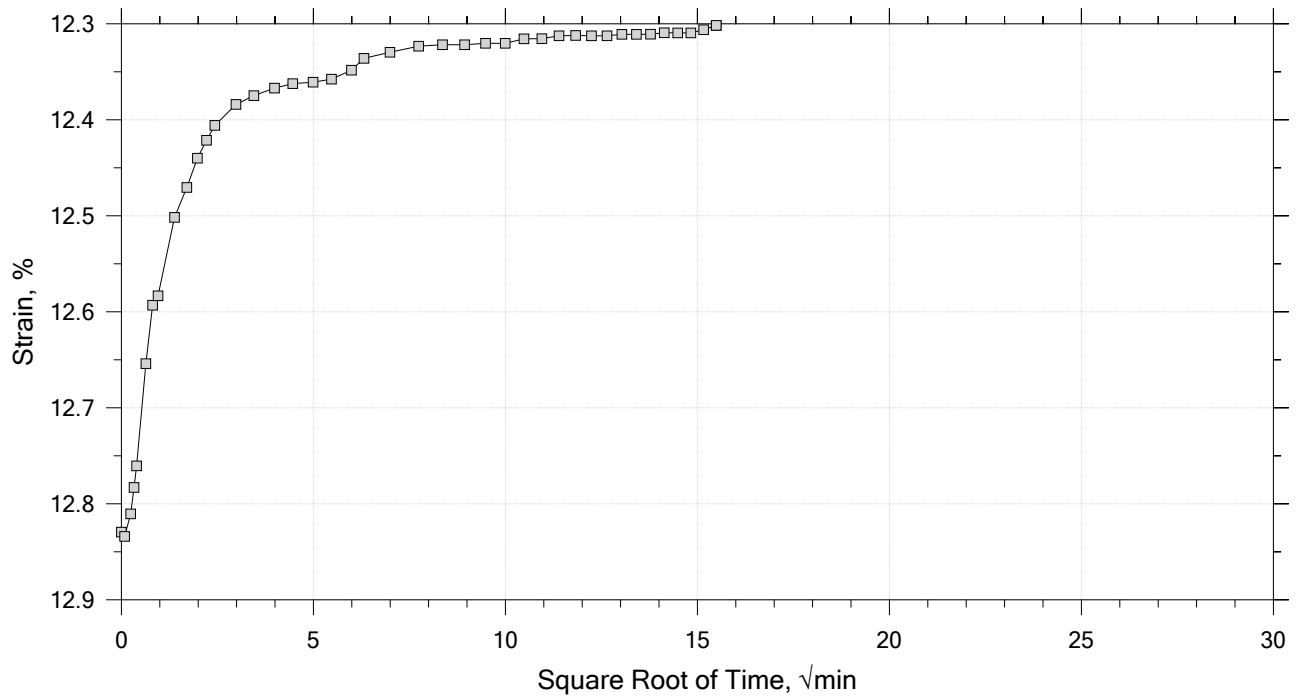
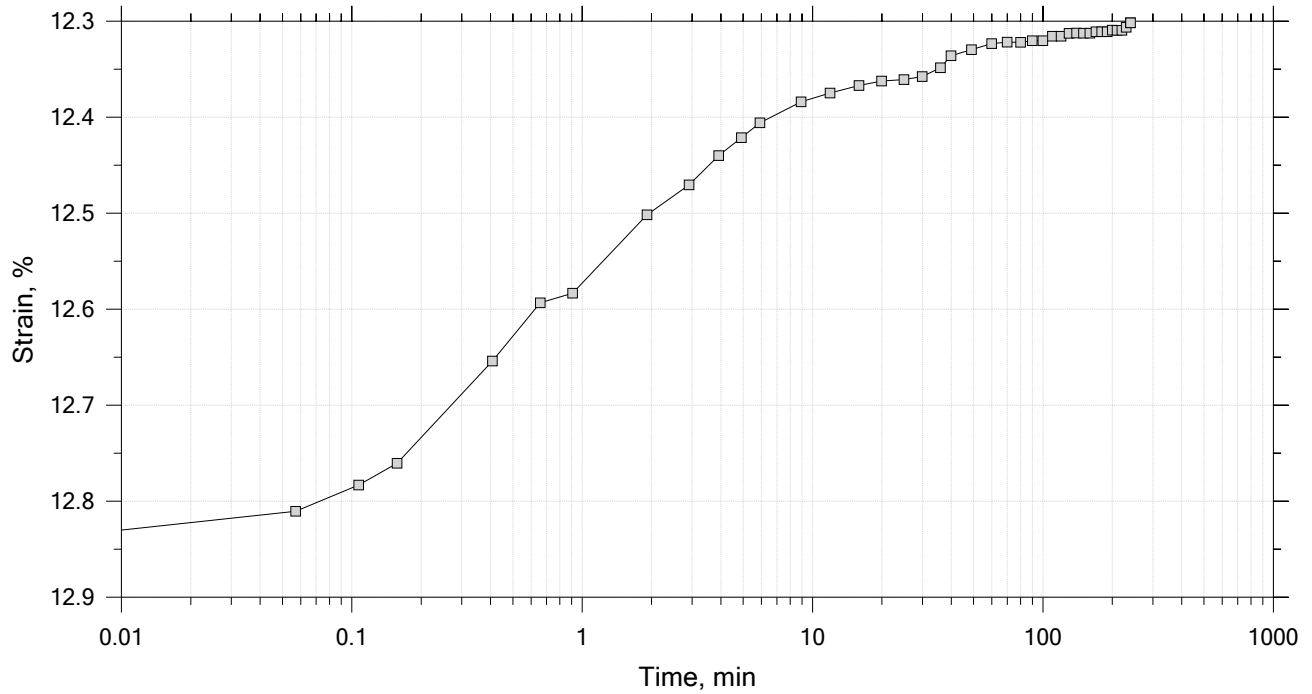
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 15

Constant Load Step

Stress: 2 tsf



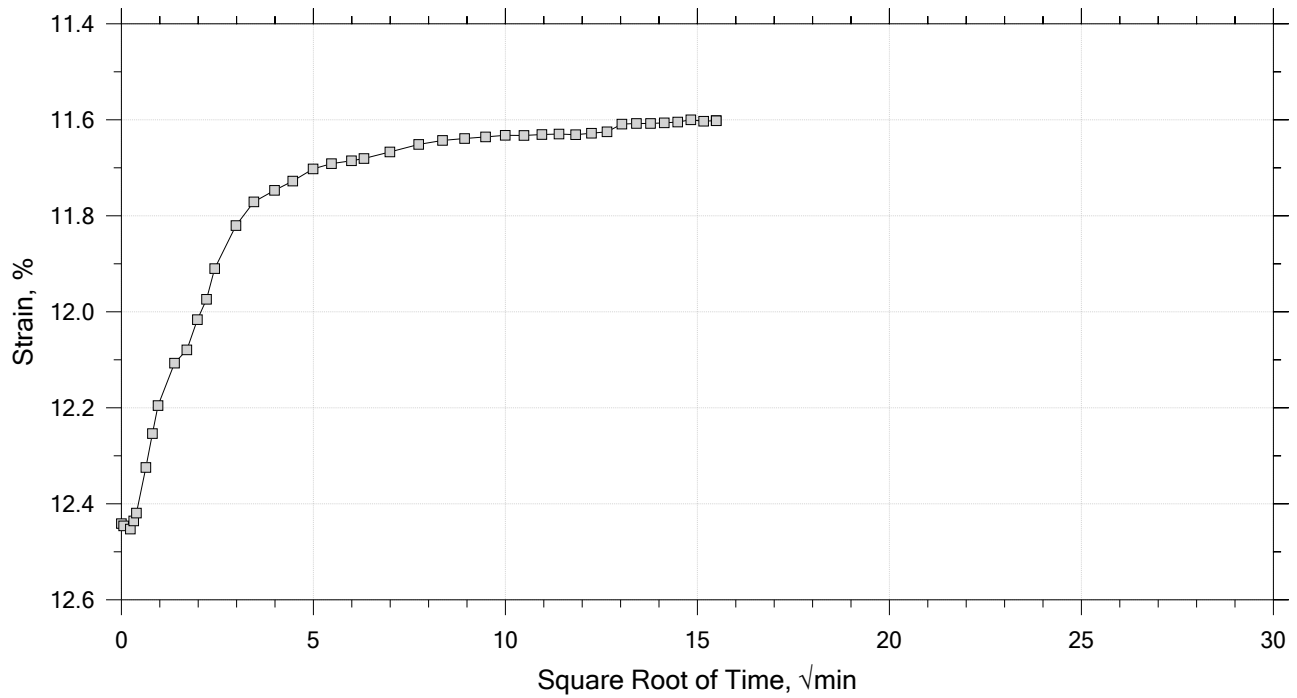
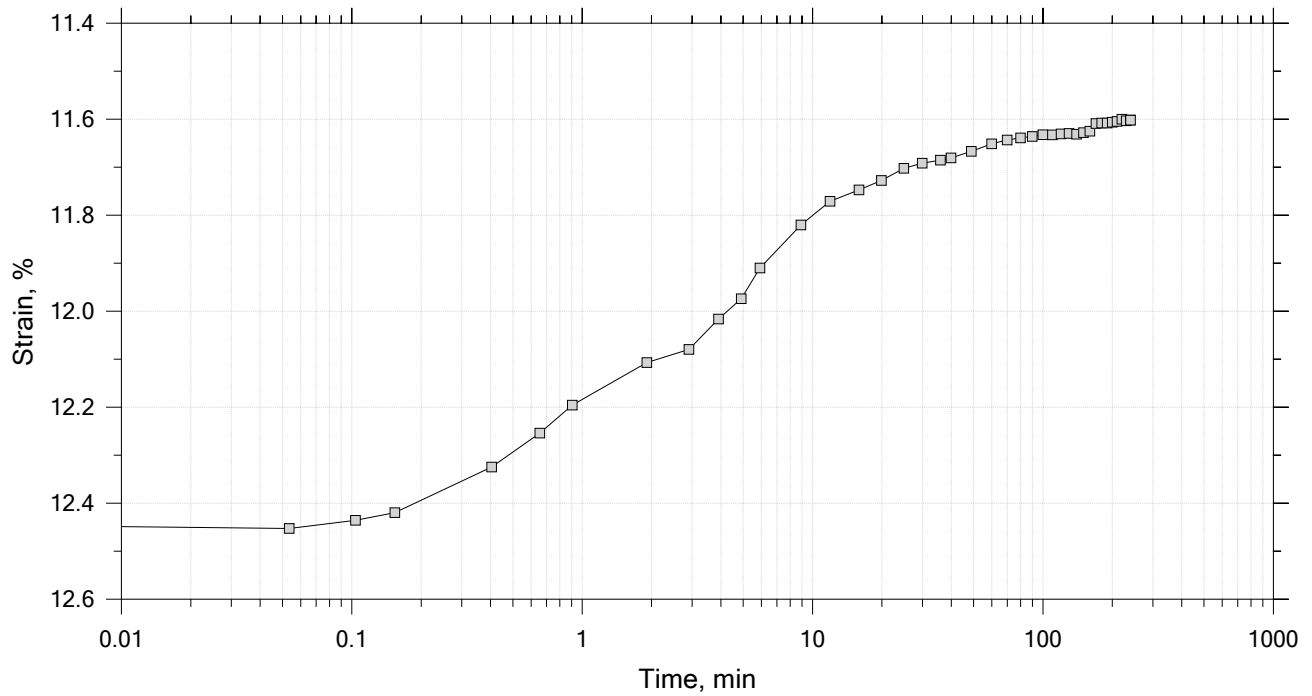
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 15

Constant Load Step

Stress: 0.5 tsf



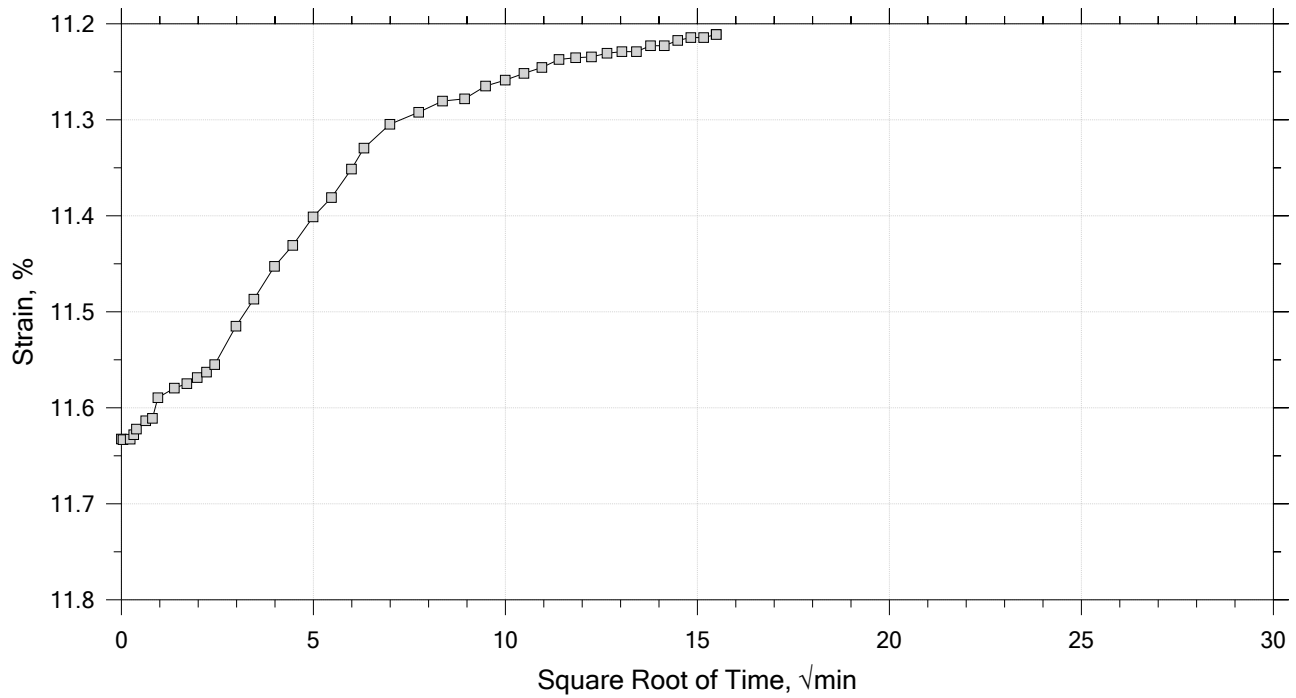
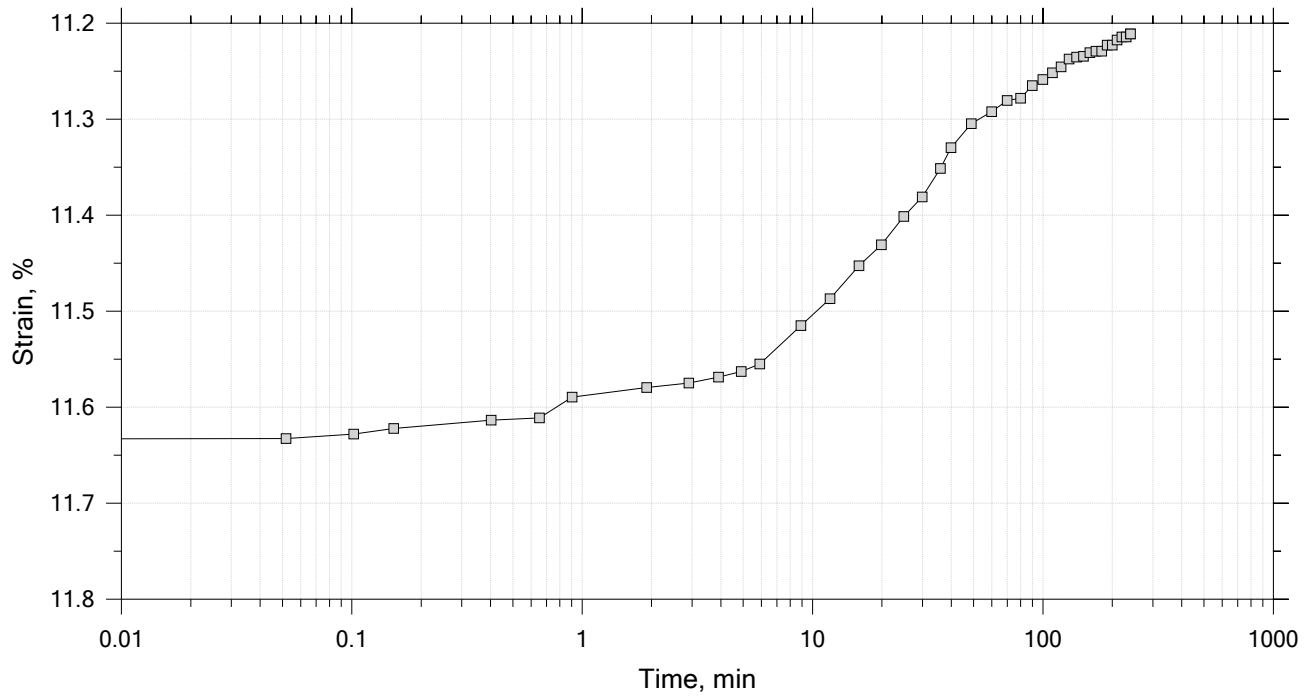
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 15

Constant Load Step

Stress: 0.25 tsf



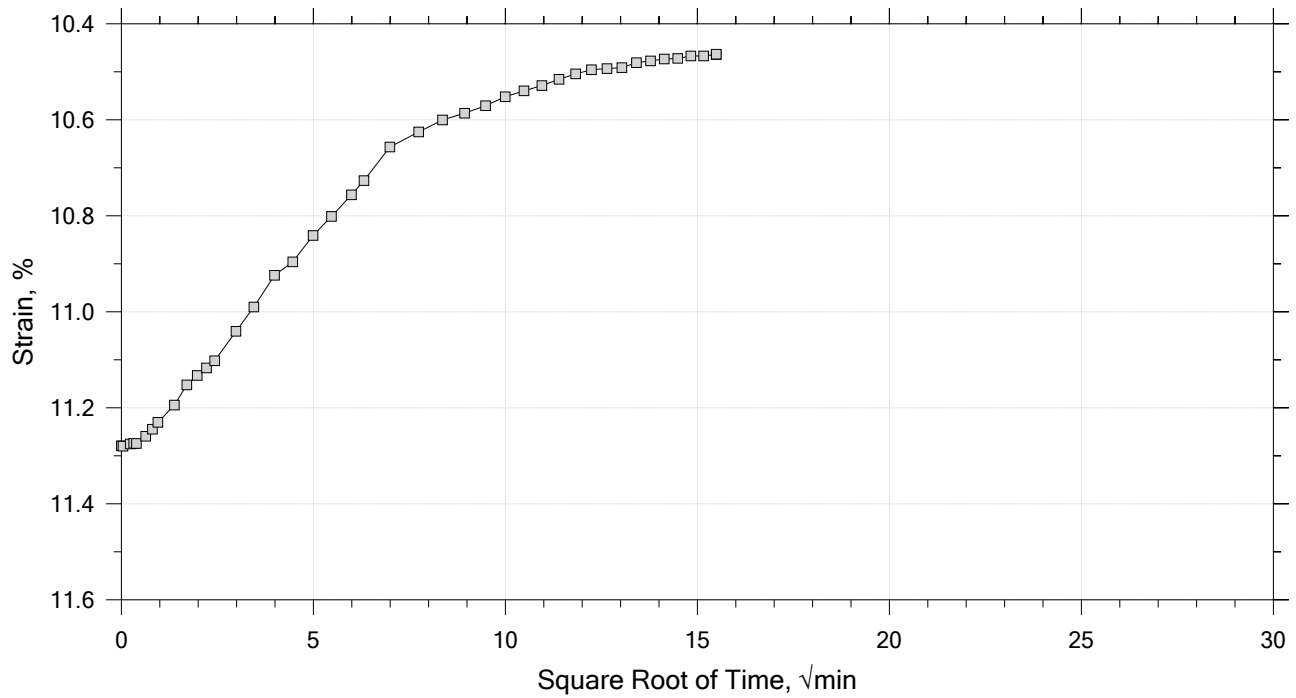
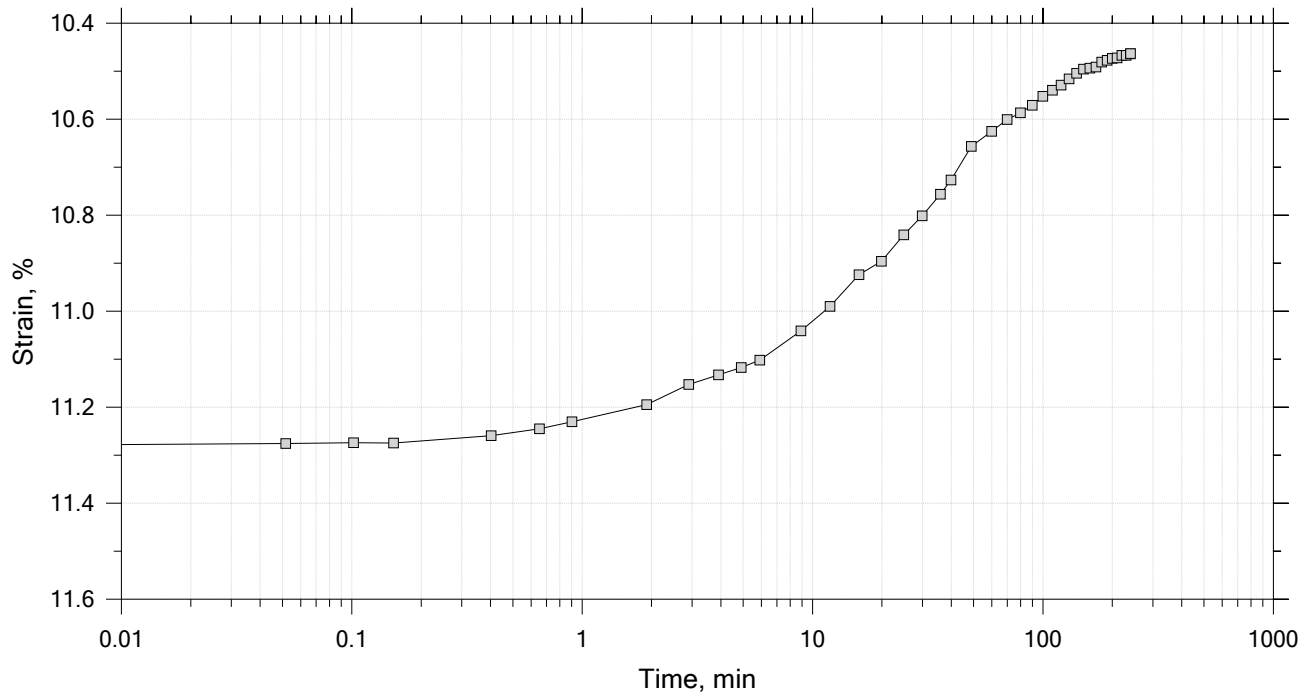
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 15

Constant Load Step

Stress: 0.0625 tsf



|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

|                            |                                  |                     |
|----------------------------|----------------------------------|---------------------|
| Specimen Diameter: 2.50 in | Estimated Specific Gravity: 2.74 | Liquid Limit: 26    |
| Initial Height: 1.00 in    | Initial Void Ratio: 0.667        | Plastic Limit: 18   |
| Final Height: 0.87 in      | Final Void Ratio: 0.45           | Plasticity Index: 8 |

|                               | Before Test<br>Trimmings | Before Test<br>Specimen | After Test<br>Specimen | After Test<br>Trimmings |
|-------------------------------|--------------------------|-------------------------|------------------------|-------------------------|
| Container ID                  | E0340                    | RING                    |                        | D3006                   |
| Mass Container, gm            | 8.22                     | 111.21                  | 111.21                 | 8.2                     |
| Mass Container + Wet Soil, gm | 180.01                   | 274.75                  | 265.13                 | 161.65                  |
| Mass Container + Dry Soil, gm | 152.76                   | 243.41                  | 243.41                 | 140                     |
| Mass Dry Soil, gm             | 144.54                   | 132.2                   | 132.2                  | 131.8                   |
| Water Content, %              | 18.85                    | 23.70                   | 16.43                  | 16.43                   |
| Void Ratio                    | ---                      | 0.67                    | 0.45                   | ---                     |
| Degree of Saturation, %       | ---                      | 97.40                   | 100.00                 | ---                     |
| Dry Unit Weight, pcf          | ---                      | 102.6                   | 117.93                 | ---                     |

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: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     |                                                         |                         |                         |

## One-Dimensional Consolidation by ASTM D2435 - Method B

### Square Root of Time Coefficients

[illegible]

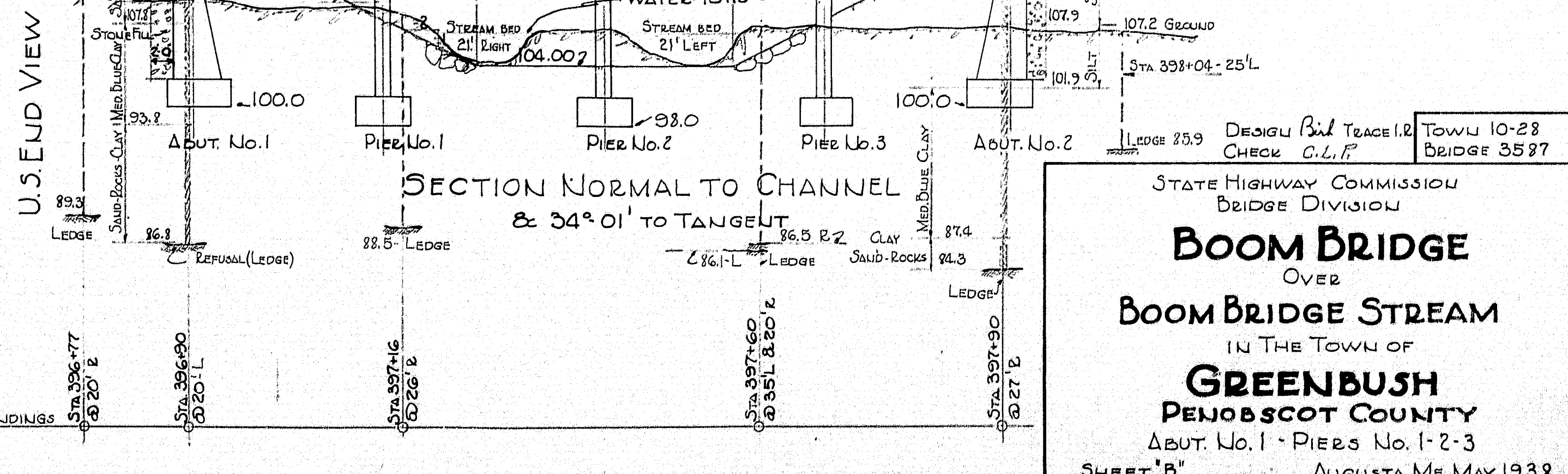
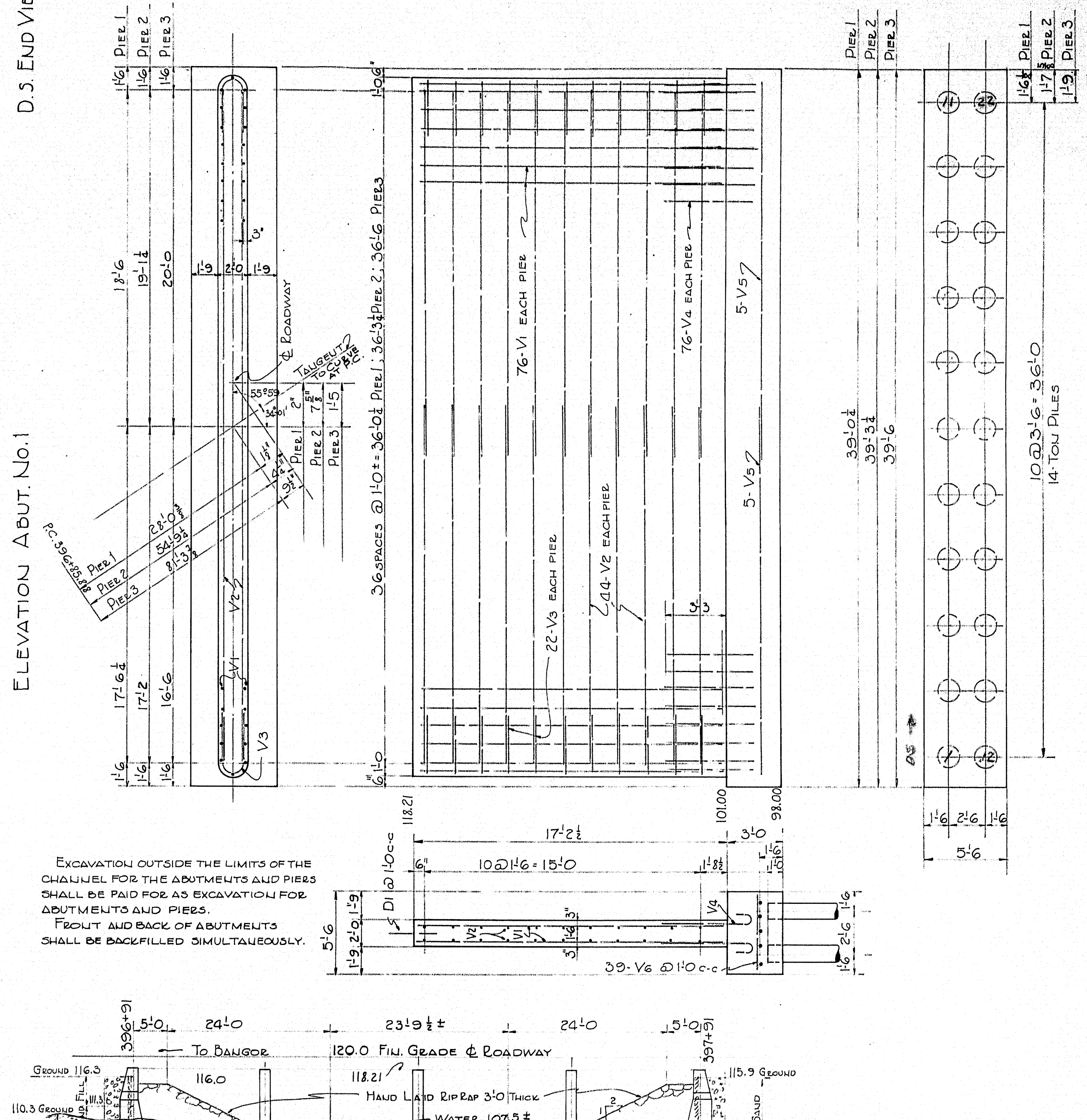
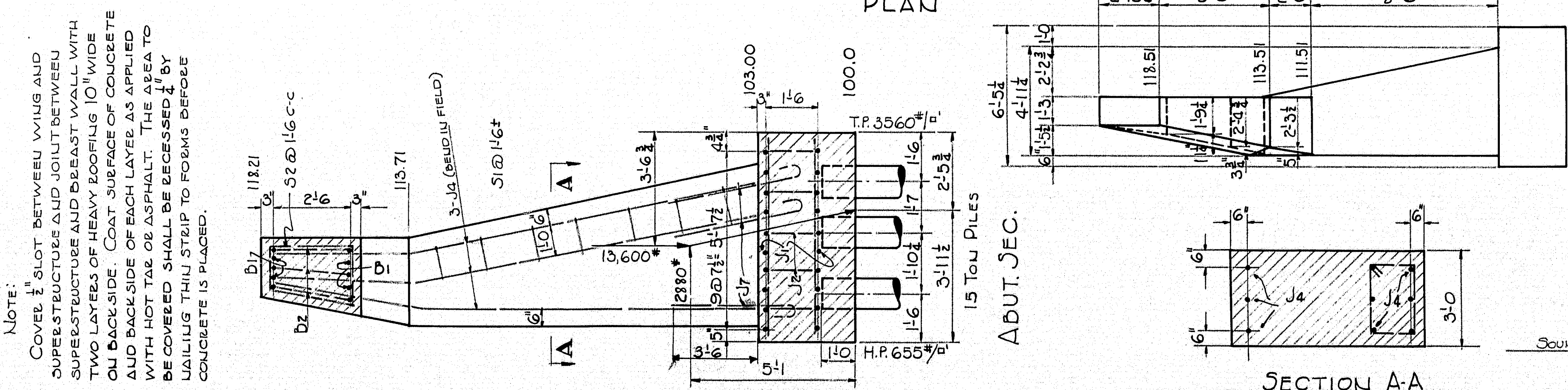
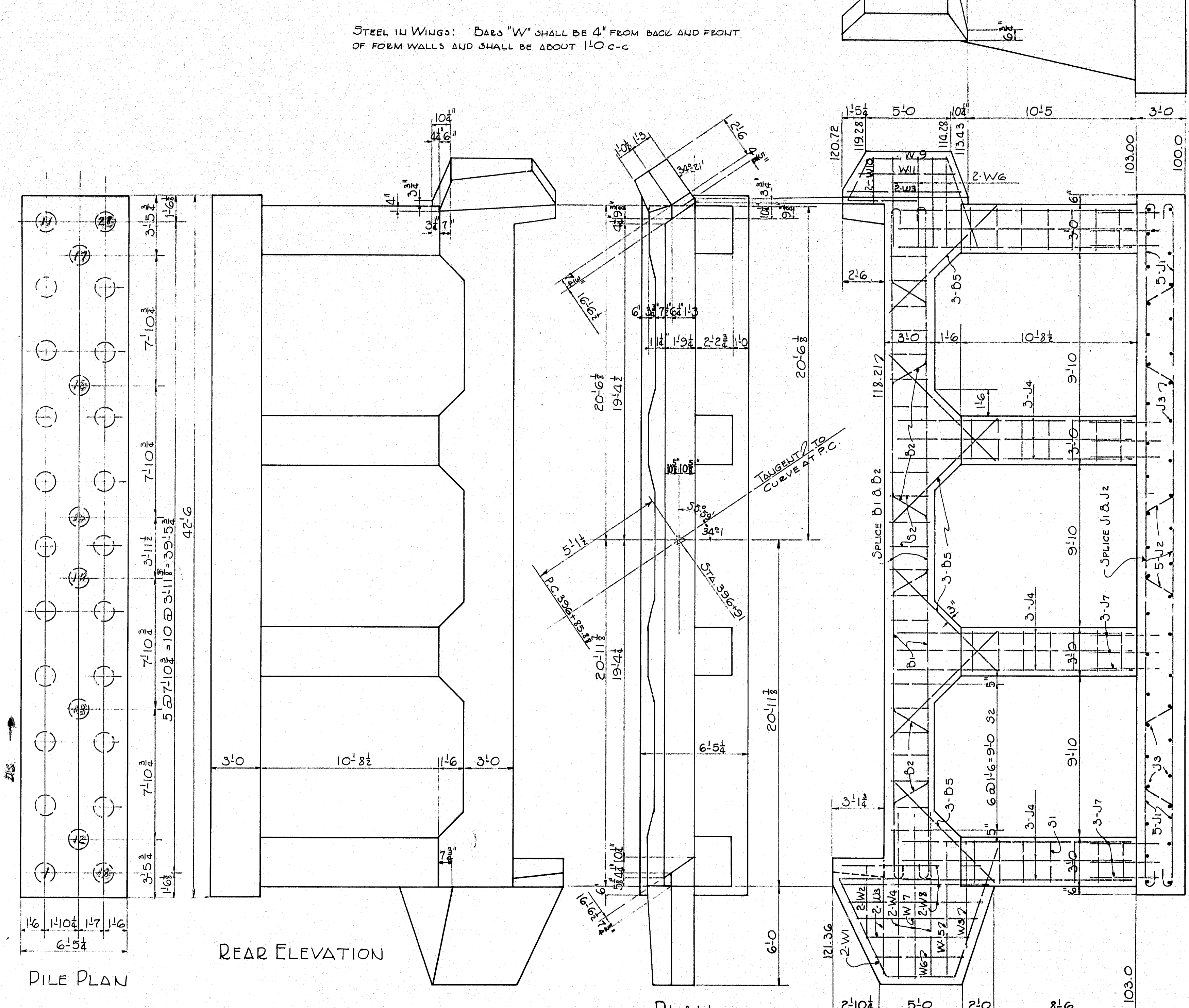
|                                                                                     |                                                         |                         |                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-------------------------|
|  | Project: US Rte 2 Bridge over Boombride                 | Location: Greenbush, ME | Project No.: GTX-313979 |
|                                                                                     | Boring No.: BB-GBB-202                                  | Tested By: trm          | Checked By: anm         |
|                                                                                     | Sample No.: 2U                                          | Test Date: 7/23/21      | Depth: 27-29            |
|                                                                                     | Test No.: IP-2                                          | Sample Type: intact     | Elevation: ---          |
|                                                                                     | Description: Moist, gray clay                           |                         |                         |
|                                                                                     | Remarks: System LTIII-0836, Swell Pressure = 0.0663 tsf |                         |                         |
|                                                                                     | Displacement at End of Increment                        |                         |                         |

## **APPENDIX C**

### **Historic Bridge Drawings**

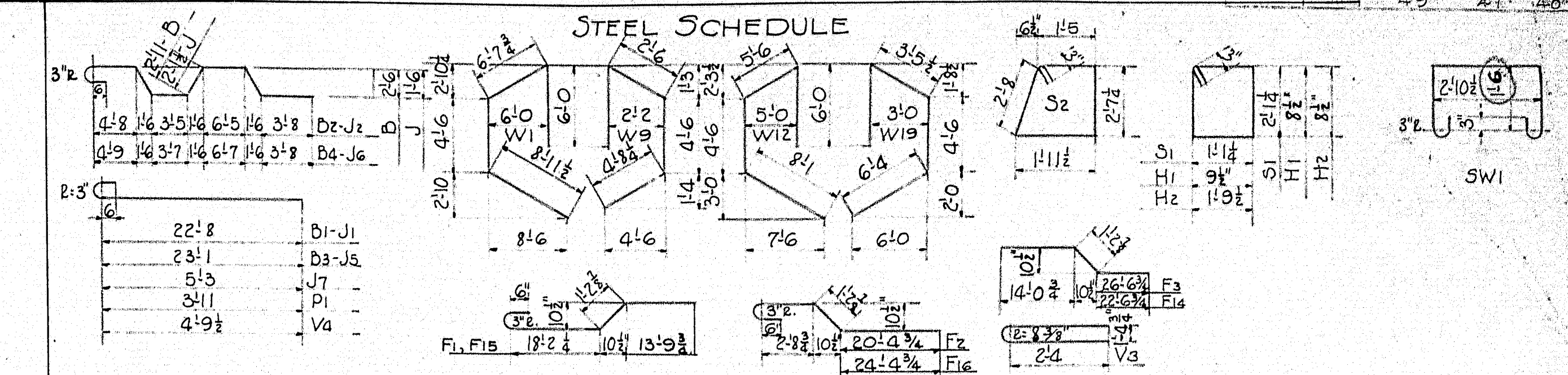
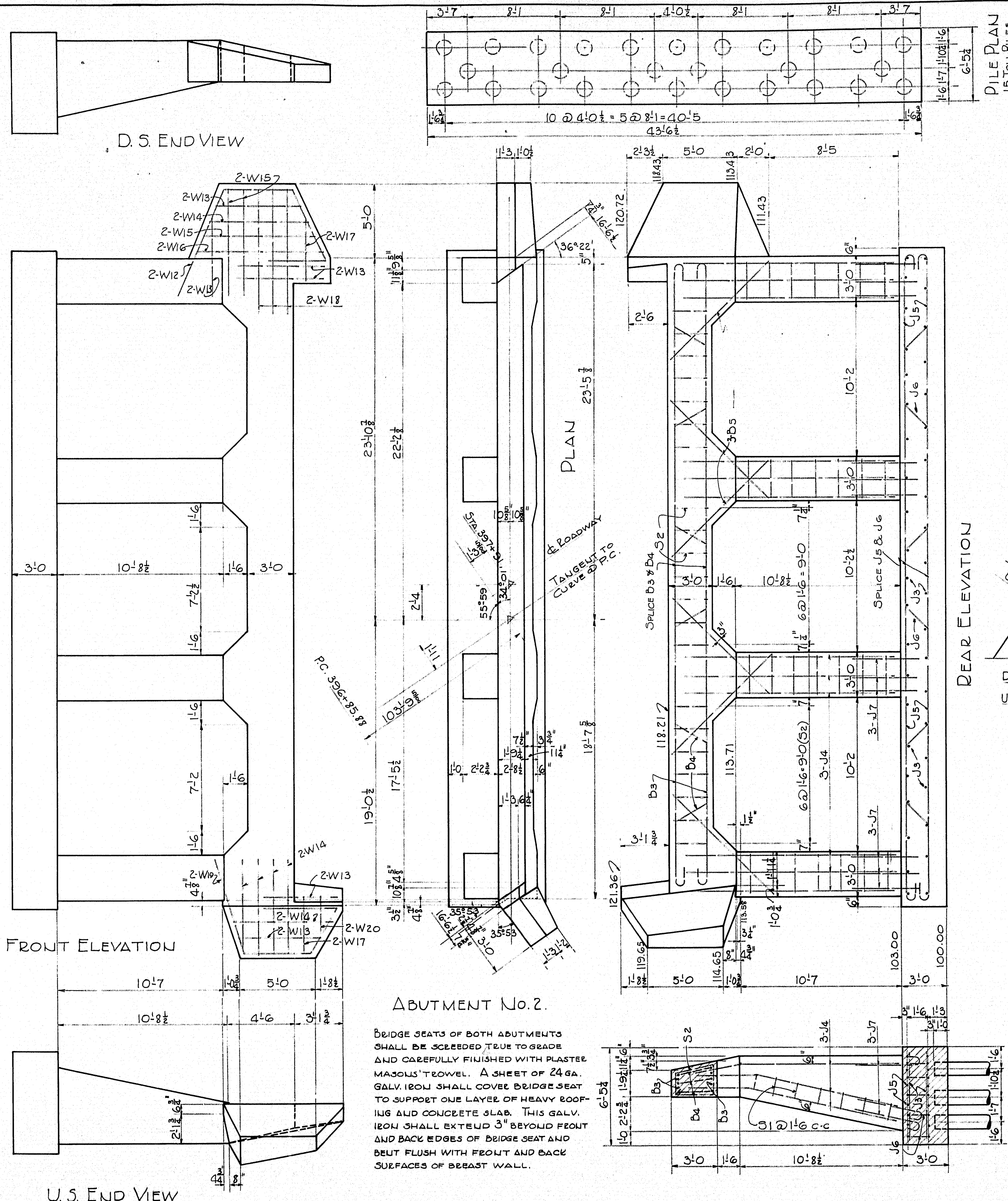


| FED. ROAD DIST. NO. | STATE | FED. AID PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---------------------|-------|--------------------|-----------|--------------|
| 8                   | MAINE | 49                 | 46        | 48           |



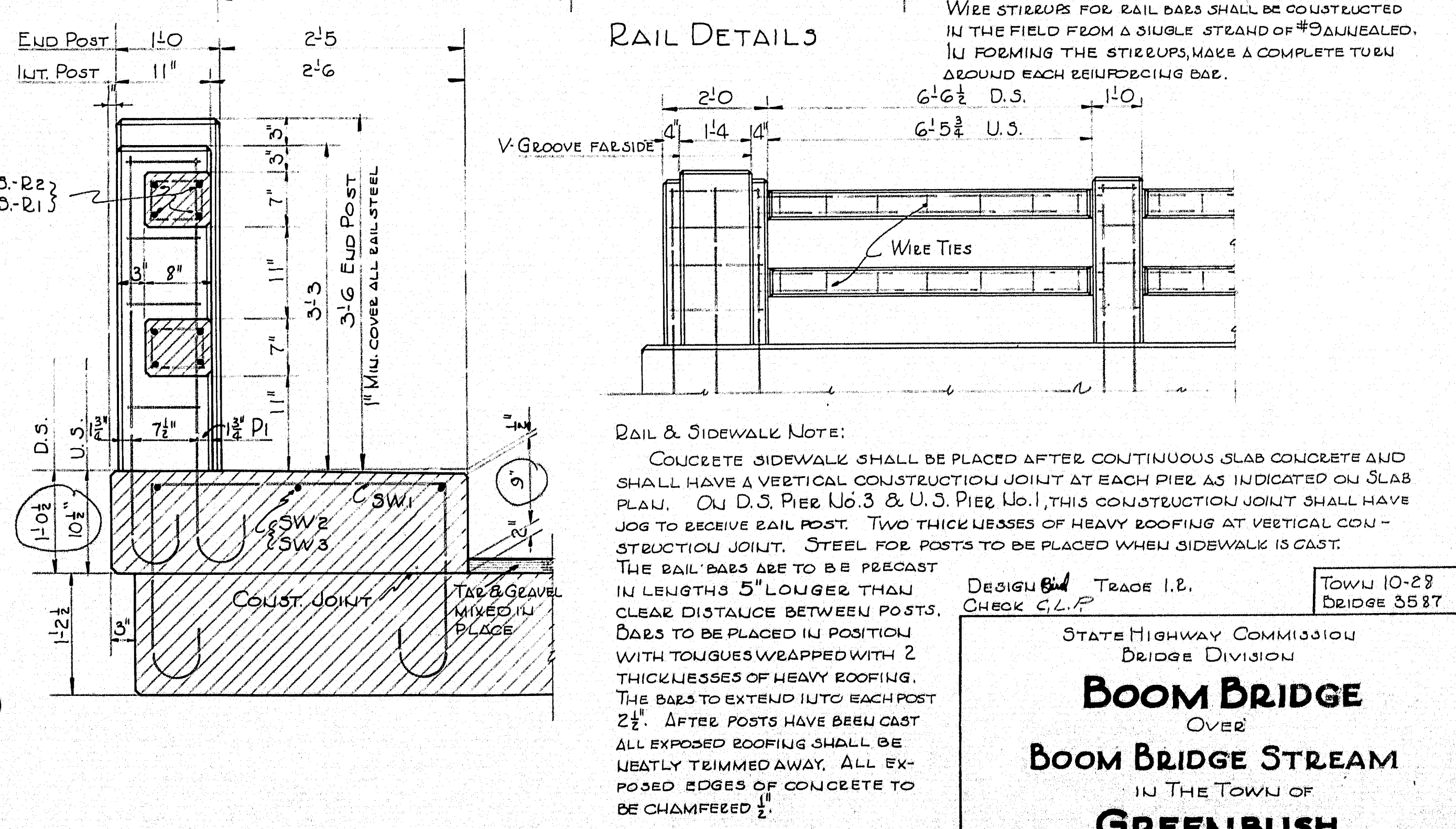
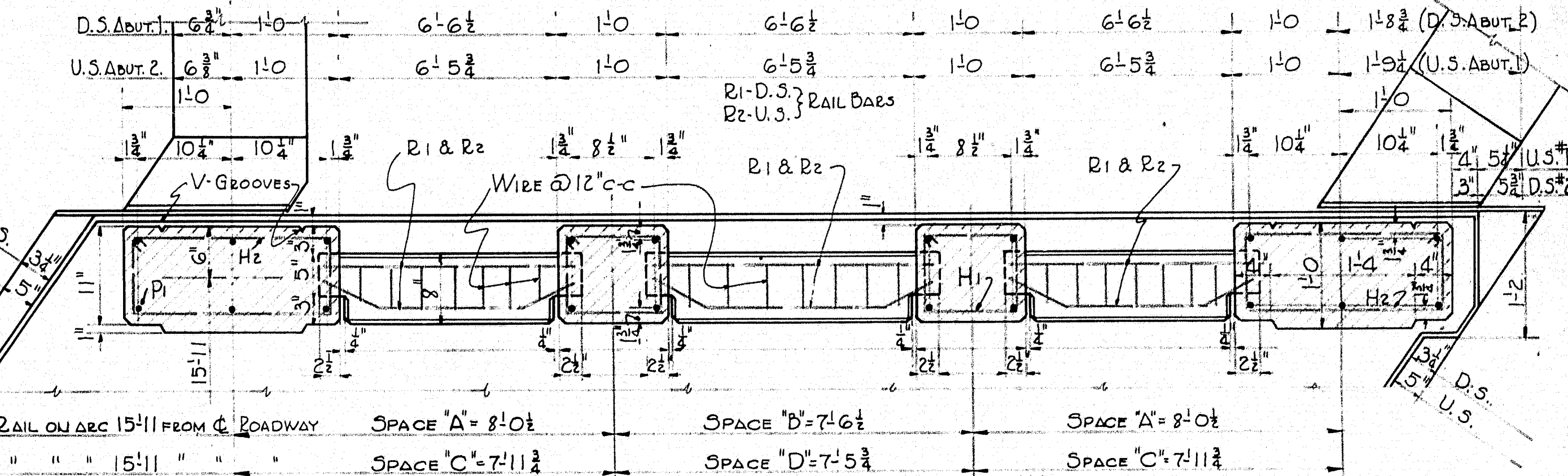
STATE HIGHWAY COMMISSION  
BRIDGE DIVISION  
**BOOM BRIDGE**  
OVER  
**BOOM BRIDGE STREAM**  
IN THE TOWN OF  
**GREENBUSH**  
PENOBSCOT COUNTY  
ABUT. NO. 1 - PILES NO. 1-2-3  
SHEET "B" AUGUSTA ME. MAY 1932

M-84



| MARK | NO. | SIZE                             | LENGTH  | REMARKS      | MARK | NO. | SIZE                            | LENGTH  | REMARKS        | MARK | NO. | SIZE                             | LENGTH  | REMARKS           | MARK | NO. | SIZE                             | LENGTH  | REMARKS        |
|------|-----|----------------------------------|---------|--------------|------|-----|---------------------------------|---------|----------------|------|-----|----------------------------------|---------|-------------------|------|-----|----------------------------------|---------|----------------|
| F1   | 33  | 1 <sup>10</sup>                  | 34'-62" | * SPAN 1     | W1   | 2   | 3 <sup>3</sup> / <sub>4</sub> " | 26'-12" | * WING ABUT. 1 | W16  | 2   | 3 <sup>3</sup> / <sub>4</sub> "  | 8'-6"   | * WING ABUT. 2    | V1   | 228 | 3 <sup>3</sup> / <sub>4</sub> "  | 17'-0"  | * PIER         |
| F2   | 32  | 1 <sup>10</sup>                  | 25'-72" | " " " "      | W2   | 2   | 3 <sup>3</sup> / <sub>4</sub> " | 4'-6"   | "              | W17  | 4   | 3 <sup>3</sup> / <sub>4</sub> "  | 3'-4"   | "                 | V2   | 132 | 1 <sup>10</sup>                  | 19'-6"  | "              |
| F3   | 66  | 1 <sup>10</sup>                  | 40'-0"  | " " 2 & 3    | W3   | 3   | 3 <sup>3</sup> / <sub>4</sub> " | 6'-6"   | "              | W18  | 6   | 3 <sup>3</sup> / <sub>4</sub> "  | 9'-0"   | "                 | V3   | 66  | 1 <sup>10</sup>                  | 6'-0"   | "              |
| F4   | 130 | 7 <sup>8</sup> / <sub>16</sub> " | 12'-3"  | SPAN 1&4 TOP | W4   | 6   | 3 <sup>3</sup> / <sub>4</sub> " | 10'-0"  | "              | W19  | 2   | 3 <sup>3</sup> / <sub>4</sub> "  | 20'-38" | "                 | V4   | 228 | 3 <sup>3</sup> / <sub>4</sub> "  | 6'-1"   | "              |
| F5   | 180 | 7 <sup>8</sup> / <sub>16</sub> " | 12'-0"  | " " 2 & 3    | W5   | 2   | 3 <sup>3</sup> / <sub>4</sub> " | 9'-0"   | "              | W20  | 2   | 3 <sup>3</sup> / <sub>4</sub> "  | 3'-0"   | "                 | V5   | 30  | 3 <sup>3</sup> / <sub>4</sub> "  | 21'-0"  | * FOOTING      |
| F6   | 106 | 3 <sup>3</sup> / <sub>4</sub> "  | 32'-2"  | TRANS. STEEL | W6   | 10  | 3 <sup>3</sup> / <sub>4</sub> " | 5'-6"   | "              |      |     |                                  |         |                   | V6   | 117 | 3 <sup>3</sup> / <sub>4</sub> "  | 5'-0"   | "              |
| F7   | 8   | 3 <sup>3</sup> / <sub>4</sub> "  | 27'-6"  | " " JR. 184  | W7   | 2   | 3 <sup>3</sup> / <sub>4</sub> " | 7'-6"   | "              | J1   | 20  | 7 <sup>8</sup> / <sub>16</sub> " | 23'-12" | * FOOTING ABUT. 1 | B1   | 8   | 7 <sup>8</sup> / <sub>16</sub> " | 23'-12" | * CAP. ABUT. 1 |
| F8   | 3   | 3 <sup>3</sup> / <sub>4</sub> "  | 23'-0"  | " " " "      | W8   | 6   | 3 <sup>3</sup> / <sub>4</sub> " | 8'-6"   | "              | J2   | 10  | 7 <sup>8</sup> / <sub>16</sub> " | 23'-0"  | "                 | B2   | 6   | 7 <sup>8</sup> / <sub>16</sub> " | 23'-2"  | " " 1          |
| F9   | 8   | 3 <sup>3</sup> / <sub>4</sub> "  | 18'-6"  | " " " "      | W9   | 2   | 3 <sup>3</sup> / <sub>4</sub> " | 17'-82" | "              | J3   | 82  | 3 <sup>3</sup> / <sub>4</sub> "  | 6'-2"   | "                 | B3   | 8   | 7 <sup>8</sup> / <sub>16</sub> " | 24'-4"  | " " 2          |
| F10  | 8   | 3 <sup>3</sup> / <sub>4</sub> "  | 14'-0"  | " " " "      | W10  | 2   | 3 <sup>3</sup> / <sub>4</sub> " | 2'-6"   | "              | J4   | 72  | 3 <sup>3</sup> / <sub>4</sub> "  | 14'-0"  | * COLS.           | B4   | 6   | 7 <sup>8</sup> / <sub>16</sub> " | 24'-4"  | " " 2          |
| F11  | 8   | 3 <sup>3</sup> / <sub>4</sub> "  | 9'-6"   | " " " "      | W11  | 2   | 3 <sup>3</sup> / <sub>4</sub> " | 6'-0"   | "              | J5   | 20  | 7 <sup>8</sup> / <sub>16</sub> " | 24'-42" | * FOOTING ABUT. 2 | B5   | 6   | 7 <sup>8</sup> / <sub>16</sub> " | 28'-72" | " " " "        |
| F12  | 5   | 3 <sup>3</sup> / <sub>4</sub> "  | 38'-9"  | " " JR. 1    | W12  | 2   | 3 <sup>3</sup> / <sub>4</sub> " | 24'-1"  | * WING ABUT. 2 | J6   | 10  | 7 <sup>8</sup> / <sub>16</sub> " | 26'-3"  | "                 | B6   | 36  | 3 <sup>3</sup> / <sub>4</sub> "  | 9'-0"   | * ABUT. HAUNCH |
| F13  | 5   | 3 <sup>3</sup> / <sub>4</sub> "  | 39'-9"  | " " JR. 4    | W13  | 12  | 3 <sup>3</sup> / <sub>4</sub> " | 5'-9"   | "              | J7   | 72  | 3 <sup>3</sup> / <sub>4</sub> "  | 6'-62"  | * ABUTS.          |      |     |                                  |         |                |
| F14  | 64  | 1 <sup>10</sup>                  | 37'-10" | * SPAN 2 & 3 | W14  | 12  | 3 <sup>3</sup> / <sub>4</sub> " | 6'-9"   | "              |      |     |                                  |         |                   | C1   | 56  | 1 <sup>10</sup>                  | 6'-11"  | * COL. ABUTS.  |
| F15  | 37  | 1 <sup>10</sup>                  | 34'-64" | " " 4        | W15  | 6   | 3 <sup>3</sup> / <sub>4</sub> " | 7'-6"   | "              | D1   | 114 | 1/4"                             | 2'-6"   | "                 | C2   | 42  | 1 <sup>10</sup>                  | 9'-12"  | * CAP.         |

\* BARS SO MARKED ARE BENT. ALL STEEL PLAIN BARS STRUCTURAL GRADE. DIMENSIONS ARE TO CENTERS OF BARS.



ANALYSIS FOR ABUT. NO. 2 SIMILAR TO THAT OF ABUT. 1. SEE ABUT. NO. 1 FOR NOTES ON SLOT COVERING & WING STEEL.

Curb Revised 7-25-38

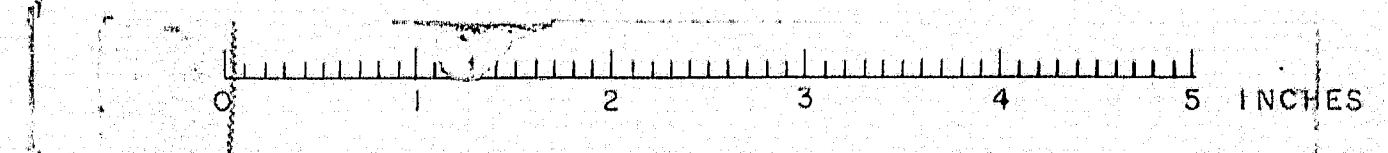
DESIGNED BY Trace 1.2.  
CHECK C.L.P.

STATE HIGHWAY COMMISSION  
Bridge Division

**BOOM BRIDGE**  
OVER  
**BOOM BRIDGE STREAM**  
IN THE TOWN OF  
**GREENBUSH**  
PENOBSCOT COUNTY

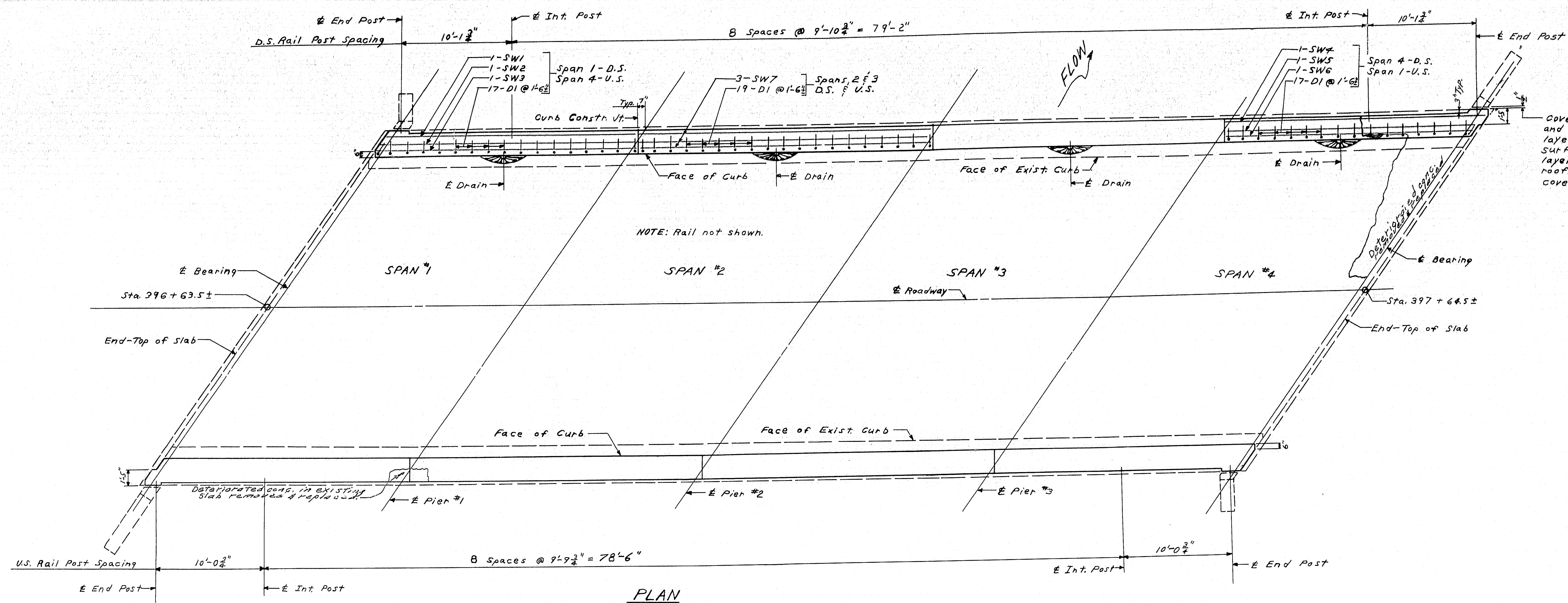
ABUT. NO. 2 - STEEL SCHEDULE - RAIL DETAILS  
SHEET "C"

AUGUSTA ME. MAY 1938

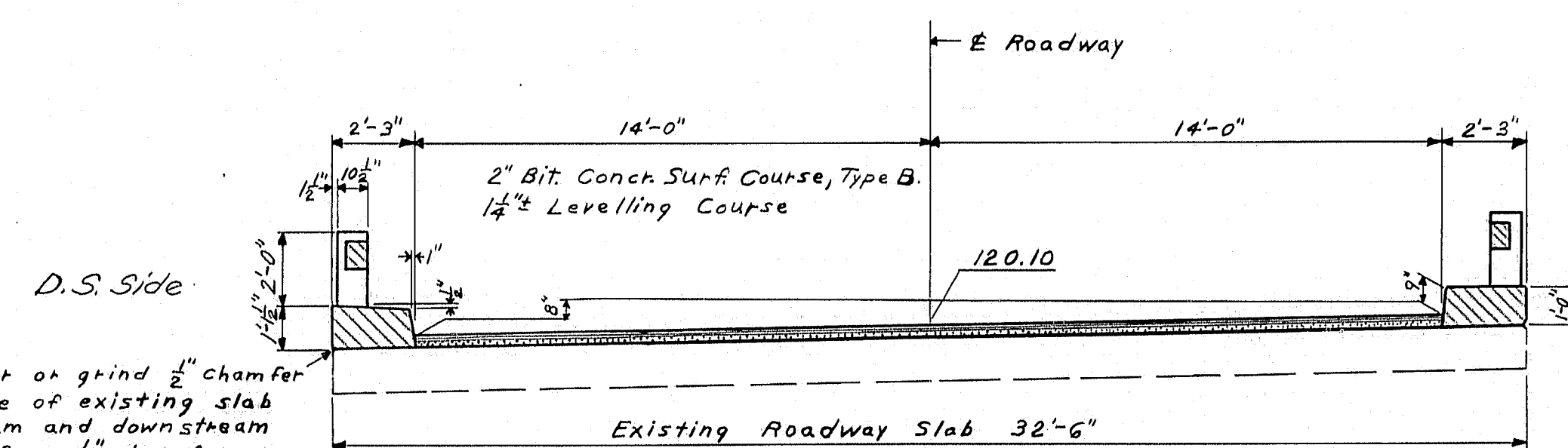




| B. P. R.<br>REG. NO. | STATE | PROJECT NUMBER | SHEET<br>NO. | TOTAL<br>SHEETS |
|----------------------|-------|----------------|--------------|-----------------|
| 1                    | MAINE | F-01-4(6)      | 10           | 11              |

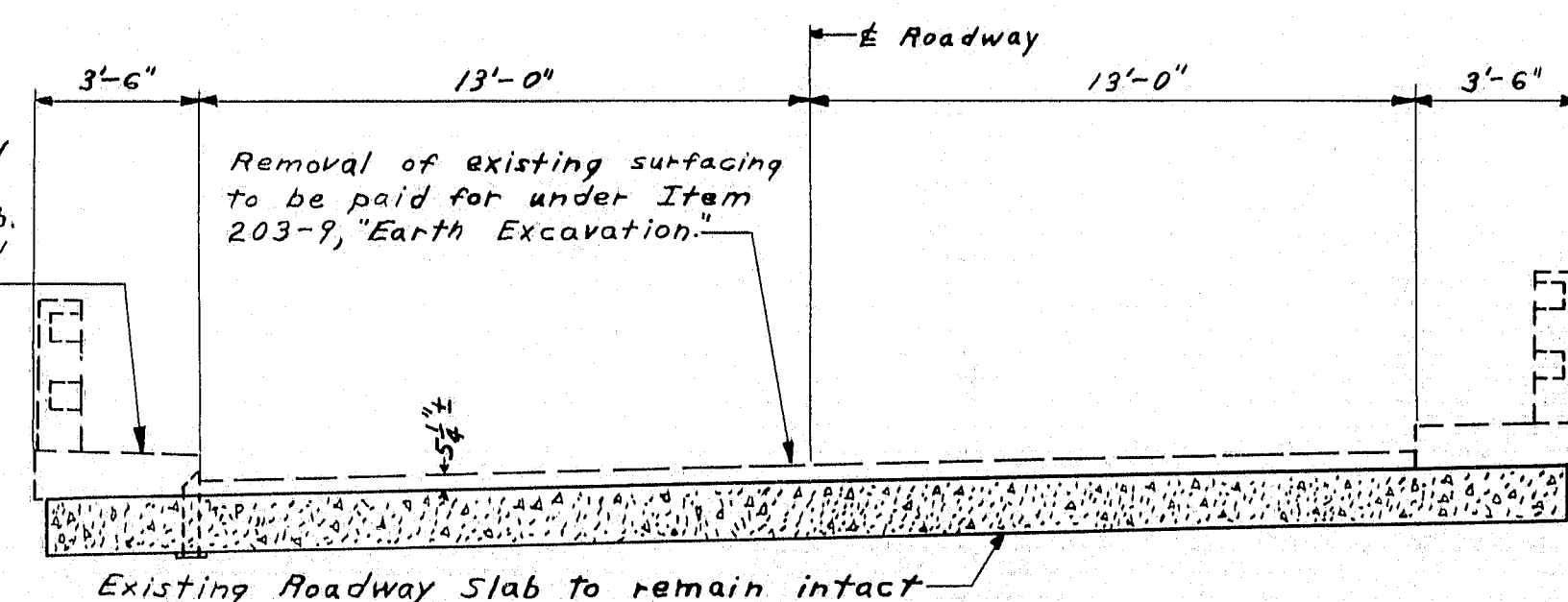


Cover the  $\frac{1}{2}$ " slots between the Superstructure and substructure on the back side with 2 layers of heavy roofing 10" wide. Coat the surface of the concrete and back of each layer, as applied, with a suitable grade of roofing cement. Recess the area to be covered  $\frac{1}{2}$ ".



Bush hammer or grind  $\frac{1}{2}$ " chamfer on top edge of existing slab at upstream and downstream sides. Also form  $\frac{1}{2}$ " chamfer on lower edge of curb to make a continuous V-groove.

Remove existing curb and rail at upstream and downstream sides to elev. of existing slab. Trim off existing drains and plug holes with concrete.



P bars to be in place before curb is cast.

Existing Reinf. to be cut off and used as indicated.

NOTE: Payment for Asphalt Seal to be included in the contract price for P.Cem. Conch. Superstr. Slabs, Item 701-39.

Seal Constr. Jt. with Asphalt on low side.

Trim off existing Galv. Iron Baffle to top of existing slab and seal with Asphalt.

Trim off existing reinf. to top of existing slab and seal with Asphalt.

Drill for  $\frac{1}{2}$ " grout in Dowels D1. Payment for drilling & grouting to be included in the contract price for Reinf. Steel, Placing, Item 705-14.

RADIAL SECTION

#### NOTES:

2" min. cover for all Reinf. in Curb. Exposed edges of Concrete to be chamfered  $\frac{1}{2}$ ".

#### ORIGINAL DESIGN DATA

Loading: H20  
 $f_r = 16,000$  psi.  
 $f_c = 900$  psi.  
 $n = 10$

#### CONCRETE CLASSIFICATION

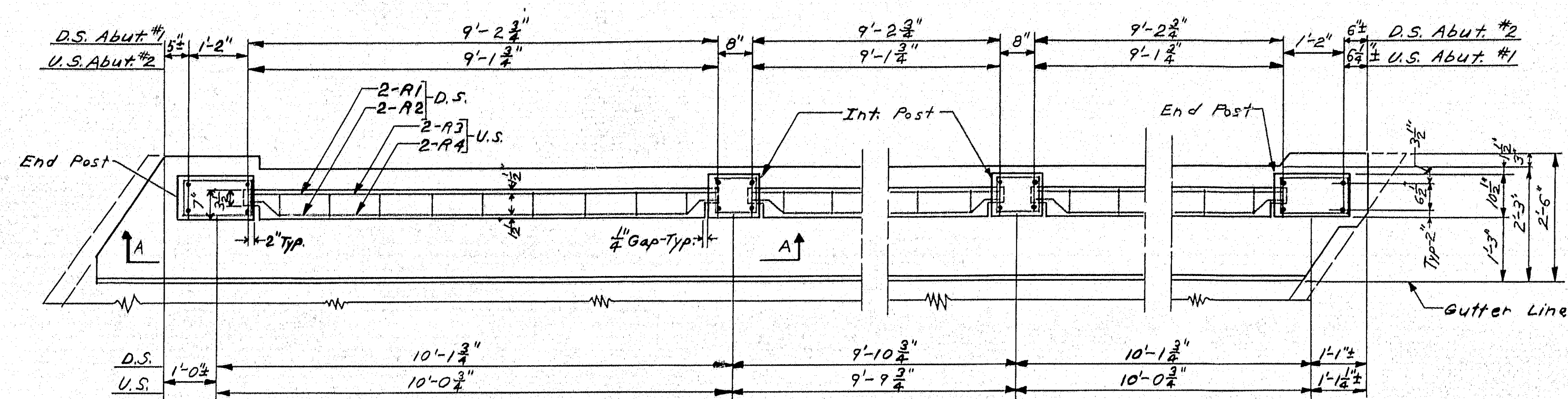
Superstructure --- Class A  
 Rail --- Class Y

Field revisions in dark green - 11/17/53 - JPH

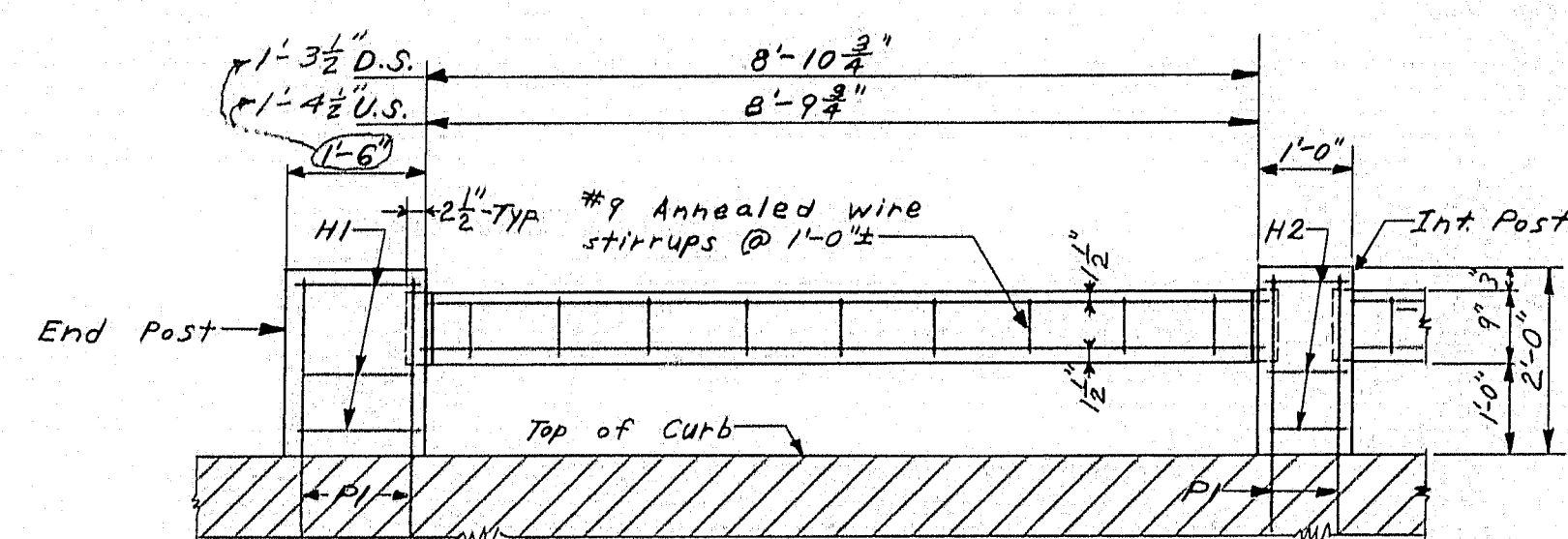
|                                                    |                                  |
|----------------------------------------------------|----------------------------------|
| DESIGN - REDMAN<br>TRACE - BLANCHARD<br>CHECK - 12 | BRIDGE NO.<br>SURVEY -<br>PLOT - |
| STATE HIGHWAY COMMISSION<br>BRIDGE DIVISION        |                                  |
| BOOM BRIDGE<br>OVER                                |                                  |
| BOOM BRIDGE STREAM<br>IN THE TOWN OF               |                                  |
| GREENBUSH<br>PENOBSCOT COUNTY                      |                                  |
| WIDENING DETAILS                                   |                                  |
| SHEET 1 OF 2 AUGUSTA, MAINE MAY 1958               |                                  |

70-85

0 1 2 3 4 5 INCHES



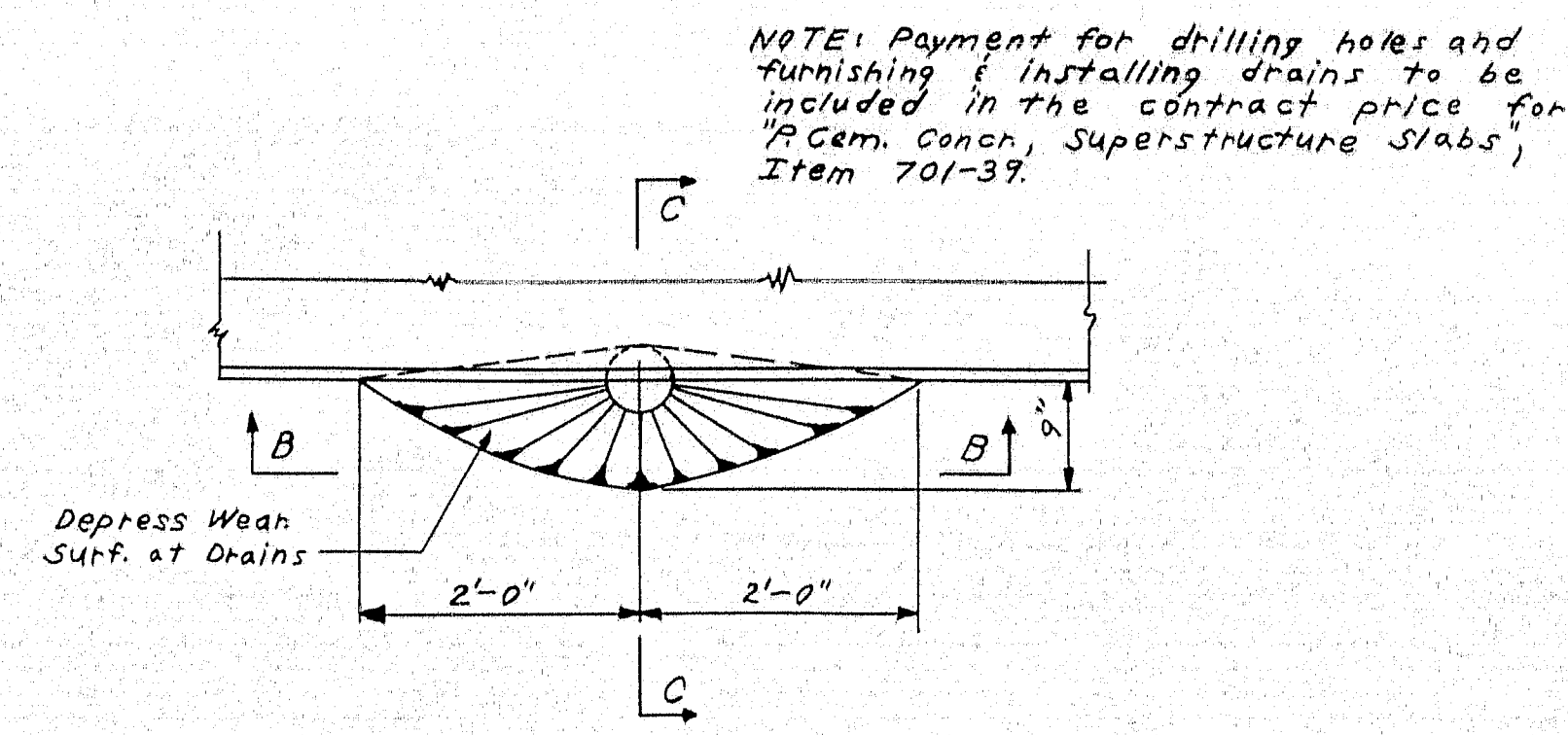
RAIL PLAN



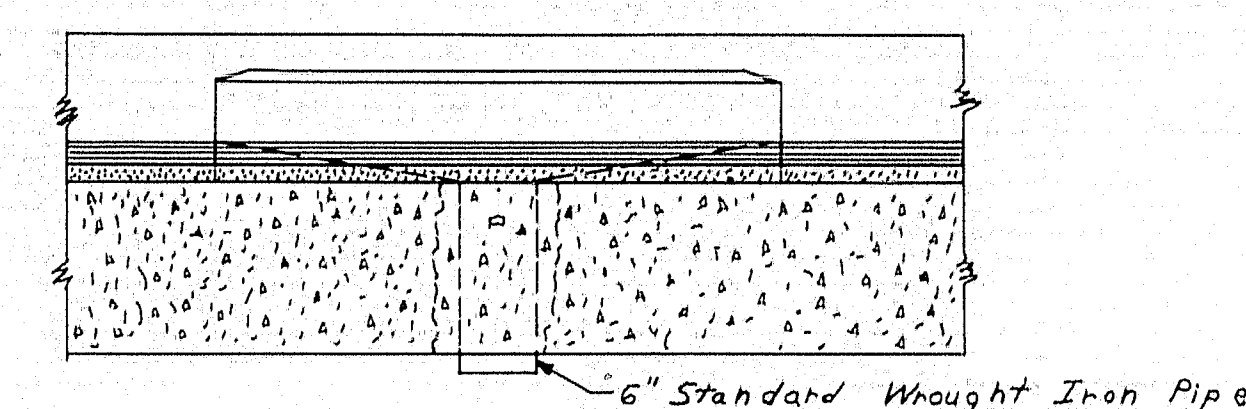
SECTION A-A

RAIL NOTES

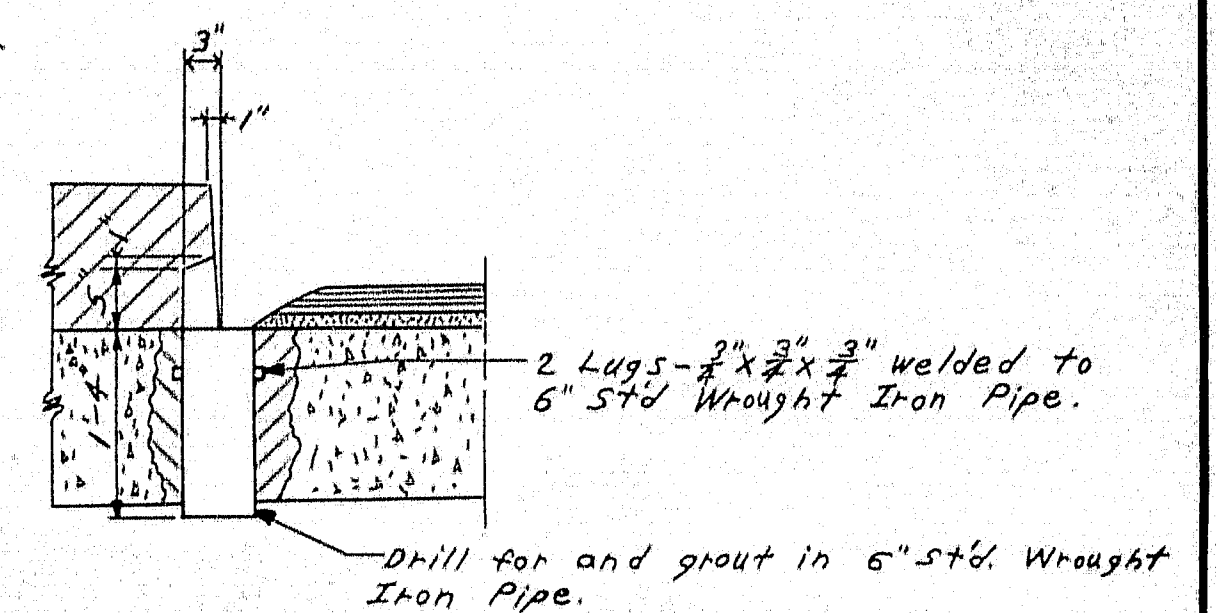
P bars to be in place before curb is cast.  
Chamfer all exposed edges  $\frac{1}{2}$ "  
Rails to be precast and ends of Rail Bars to project  $\frac{1}{2}$ " into Rail Posts and to be wrapped with 2 layers of roofing felt.  
In forming #9 annealed wire stirrups, make a complete turn around each R bar.



DRAIN PLAN  
4 REQUIRED



SECTION B-B



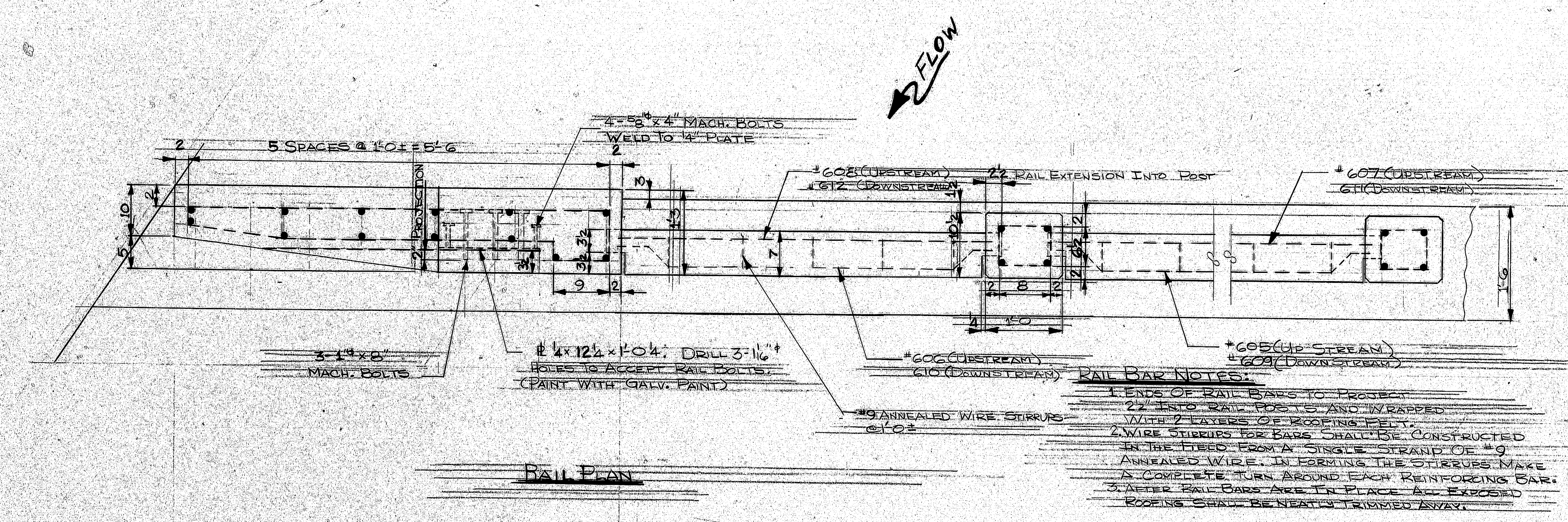
SECTION C-C

| STRAIGHT BARS |      |     |        |           | BENT BARS |      |     |        |            |
|---------------|------|-----|--------|-----------|-----------|------|-----|--------|------------|
| MARK          | SIZE | NO. | LENGTH | LOCATION  | MARK      | SIZE | NO. | LENGTH | LOCATION   |
| SW1           | #4   | 2   | 22'-9" | Curb      | D1        | #6   | 144 | 2'-4"  | Curb       |
| SW2           |      | 2   | 23'-3" | "         | P1        | #6   | 44  | 5'-10" | Rail Posts |
| SW3           |      | 2   | 23'-9" | "         | H1        | #4   | 12  | 4'-2"  | Rail Posts |
| SW4           |      | 2   | 24'-0" | "         | H2        | #4   | 54  | 3'-2"  | "          |
| SW5           |      | 2   | 23'-0" | "         | R2        | #4   | 20  | 9'-4"  | Rail Bars  |
| SW6           |      | 2   | 22'-6" | "         | R4        | #4   | 20  | 9'-3"  | "          |
| SW7           |      | 12  | 26'-8" | "         |           |      |     |        |            |
| R1            | #4   | 20  | 9'-1"  | Rail Bars |           |      |     |        |            |
| R3            | #4   | 20  | 9'-0"  | "         |           |      |     |        |            |

Field revisions in dark green-11/17/59-JRM

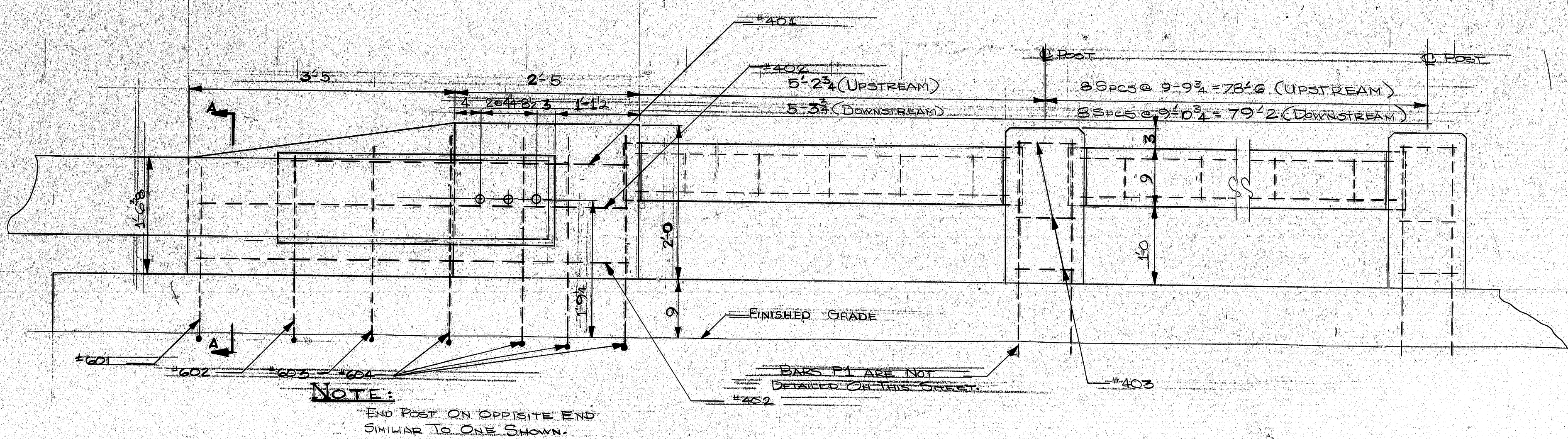
|                                              |                              |
|----------------------------------------------|------------------------------|
| DESIGN-REDMAN<br>TRACE-BLANCHARD<br>CHECK-JC | BRIDGE NO.<br>SURVEY<br>PLOT |
| STATE HIGHWAY COMMISSION<br>BRIDGE DIVISION  |                              |
| BOOM BRIDGE                                  |                              |
| OVER                                         |                              |
| BOOM BRIDGE STREAM                           |                              |
| IN THE TOWN OF                               |                              |
| GREENBUSH                                    |                              |
| PENOBSCOT COUNTY                             |                              |
| WIDENING DETAILS                             |                              |
| SHEET 2 OF 2                                 | AUGUSTA, MAINE MAY 1958      |

| F.W.A.<br>REQ. NO. | STATE | PROJECT NUMBER | SHEET NO. | TOTAL<br>SHEETS |
|--------------------|-------|----------------|-----------|-----------------|
| 1                  | MAINE |                |           |                 |



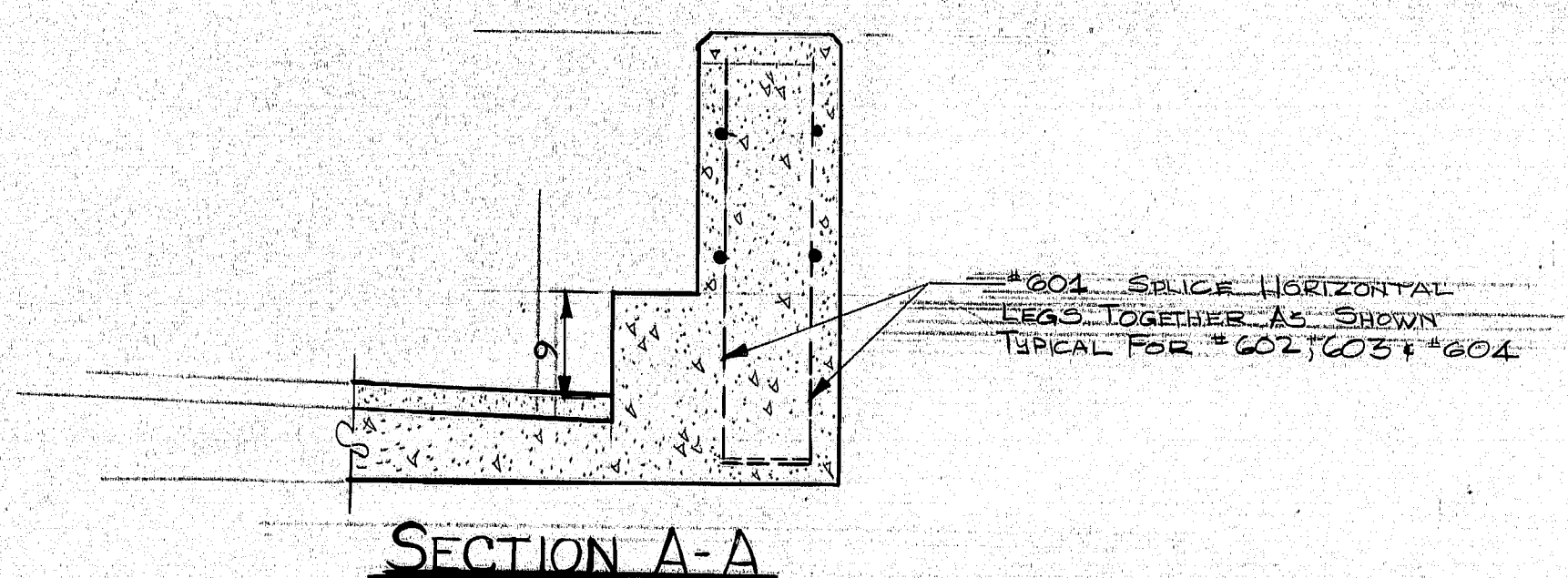
**RAIL BAR NOTES:**  
 1. ENDS OF RAIL BARS TO PROTECT  
 2. INTO RAIL POSTS AND WRAPPED  
 WITH 2 LAYERS OF ROOFING FELT.  
 3. WIRE STIRRUPS FOR BARS SHALL BE CONSTRUCTED  
 IN THE FIELD FROM A SINGLE STRAND OF #9  
 ANNEALED WIRE. IN FORMING THE STIRRUPS MAKE  
 A COMPLETE TURN AROUND EACH REINFORCING BAR.  
 4. AFTER RAIL BARS ARE IN PLACE ALL EXPOSED  
 ROOFING SHALL BE NEATLY TRIMMED AWAY.

**GENERAL NOTES**  
 1. MIN. COVER OF REINFORCING STEEL TO  
 BE 2" UNLESS OTHERWISE NOTED.  
 2. ALL EXPOSED EDGES TO BE CHAMFERED 2".



**NOTE:**  
 END POST ON OPPOSITE END  
 SIMILAR TO ONE SHOWN.

**RAIL PLAN ELEVATION**  
 BOOM BRIDGE & DOWNSTREAM



**SECTION A-A**

**NOTE:**  
 DEPRESS CONCRETE  
 AROUND PIPE AS SHOWN  
 WITH ARROWS.  
 6" STD. WT. PIPE  
 12' BELONG

| REINFORCING SCHEDULE |      |     |        |                       |
|----------------------|------|-----|--------|-----------------------|
| MARK                 | SIZE | NO. | LENGTH | LOCATION              |
| *401                 | 4    | 2   | 11'-0" | END POST STIRRUP      |
| *402                 | 4    | 4   | 13'-4" | do                    |
| *403                 | 4    | 27  | 3'-1"  | INT. POST STIRRUP     |
| *601                 | 6    | 4   | 2'-0"  | END POST VERTICAL     |
| *602                 | 6    | 4   | 3'-0"  | do                    |
| *603                 | 6    | 4   | 3'-2"  | do                    |
| *604                 | 6    | 14  | 3'-4"  | END POST VERTICAL     |
| *605                 | 6    | 16  | 9'-3"  | RAIL BAR (UPSTREAM)   |
| *606                 | 6    | 4   | 5'-2"  | do                    |
| *607                 | 6    | 16  | 9'-0"  | do                    |
| *608                 | 6    | 4   | 5'-0"  | RAIL BAR (UPSTREAM)   |
| *609                 | 6    | 16  | 9'-4"  | RAIL BAR (DOWNSTREAM) |
| *610                 | 6    | 4   | 5'-3"  | do                    |
| *611                 | 6    | 16  | 9'-1"  | do                    |
| *612                 | 6    | 4   | 5'-1"  | RAIL BAR (DOWNSTREAM) |

\* DENOTES BENT BARS  
 ALL DIMENSIONS ARE OUT-TO-OUT OF BARS

| PROJECT DESIGN ENGINEER | DATE               |
|-------------------------|--------------------|
| BY <i>[Signature]</i>   | 9-14-79            |
| DESIGN - DETAILED       | CHECKED            |
| <i>[Signature]</i>      | <i>[Signature]</i> |
| REVISIONS               | FIELD CHANGES      |
|                         |                    |

2 Copies sent to L. Page 9-3-79

STATE OF MAINE  
 DEPARTMENT OF TRANSPORTATION  
  
**BOOM BRIDGE**  
 OVER  
**BOOM BRIDGE STREAM**  
 IN THE TOWN OF  
**GREENBUSH**  
 IN  
**PENOBSCOT COUNTY**  
 NEW CONCRETE RAIL  
 AUGUSTA, MAINE 9/14/79

**166-188**

## **APPENDIX D**

### **Geotechnical Design Calculations**

## Seismic Site Class

|         |                                                            |
|---------|------------------------------------------------------------|
| Client  | Maine Department of Transportation                         |
| Project | US Route 2 Bridge over Boombridge Brook - Greenbush, Maine |
| Subject | Seismic Site Class                                         |

### PROBLEM STATEMENT & OBJECTIVE

Determine the Seismic Site Class using available subsurface, SPT N or shear wave velocity (Vs) information.

### EXECUTIVE SUMMARY

Based on the subsurface conditions encountered at the 4 test borings near the proposed substructures (BB-GBB-101, BB-GBB-102, BB-GBB-201, BB-GBB-202), recommend a **Seismic Site Class D**.

### REFERENCES

1. AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020.

### AVAILABLE INFORMATION

1. Phase I and II test boring logs; boring nos. BB-GBB-101, BB-GBB-102, BB-GBB-201, BB-GBB-202.
2. Consolidated undrained triaxial test performed on relatively undisturbed soil samples by GeoTesting Express of Acton, Massachusetts.

### ASSUMPTIONS

1. Where SPT N, Vs or su data was available to depths less than 100 ft, the subsurface profile was extended to 100 ft. The SPT N, Vs or su for the extended profile was then assumed based on the available information.
2. Where Su data was not available for a cohesive soil sample the closest Su from the field vane or lab testing was assumed for that sample.
3. An SPT N value equal to 100 was selected for samples that encountered refusal or had an SPT N value greater than 100.

### PROCEDURE

1. Check the site against the three categories of Site Class F (see attached Table 3.4.2.1-1), requiring site-specific ground motion response evaluation. If the site corresponds to any of these categories, classify the site as Site Class F and conduct a site-specific ground motion response evaluation.
2. Categorize the site using one of the following three methods (Method A, B, or C).

#### Method A

Average shear wave velocity for the upper 100 ft of the soil profile:

$$\bar{V}_s = \frac{\sum_{i=1}^n d_i}{\sum_{i=1}^n \frac{d_i}{V_{si}}}$$

where

$V_{si}$  = shear wave velocity of  $i$  th soil (ft/s).

$d_i$  = thickness of  $i$  th soil layer (ft).

$n$  = total number of distinctive soil layers in the upper 100 ft of the site profile.

$i$  = any one of the layers between 1 and  $n$ .

|             |            |
|-------------|------------|
| File No.    | 127991-003 |
| Sheet       | 2 of 8     |
| Date        | 29-Mar-22  |
| Computed by | TPJ        |
| Checked by  | MMB        |

|         |                                                            |
|---------|------------------------------------------------------------|
| Client  | Maine Department of Transportation                         |
| Project | US Route 2 Bridge over Boombridge Brook - Greenbush, Maine |
| Subject | Seismic Site Class                                         |

### PROCEDURE

#### Method B

Average standard penetration test (SPT) for the upper 100 ft of the soil profile:

$$\bar{N} = \frac{\sum_{i=1}^n d_i}{\sum_{i=1}^n \frac{d_i}{N_i}}$$

where

$N_i$  = standard penetration resistance as measured directly in the field, uncorrected blow count, of  $i$  th soil layer not to exceed 100 ft (blows/ft).

$d_i$  = thickness of  $i$  th soil layer (ft).

$n$  = total number of distinctive soil layers in the upper 100 ft of the site profile.

$i$  = any one of the layers between 1 and  $n$ .

#### Method C

Average standard penetration test (SPT) for the cohesionless layers in the upper 100 ft of the soil profile:

$$\bar{N}_{ch} = \frac{\sum_{i=1}^m d_i}{\sum_{i=1}^m \frac{d_i}{N_i}}$$

where

$N_i$  = standard penetration resistance as measured directly in the field, uncorrected blow count, of  $i$  th cohesionless soil layer (blows/ft).

$d_i$  = thickness of  $i$  th cohesionless soil layer (ft).

$m$  = total number of distinctive cohesionless soil layers in the upper 100 ft of the site profile.

$i$  = any one of the layers between 1 and  $m$ .

Average undrained shear strength for the cohesive layers in the upper 100 ft of the soil profile:

$$\bar{s}_u = \frac{\sum_{i=1}^k d_i}{\sum_{i=1}^k \frac{d_i}{s_{ui}}}$$

where

$s_{ui}$  = undrained shear strength of  $i$  th cohesive soil layer (psf), not to exceed 5000 psf

$d_i$  = thickness of  $i$  th cohesive soil layer (ft).

$k$  = total number of distinctive cohesive soil layers in the upper 100 ft of the site profile.

$i$  = any one of the layers between 1 and  $k$ .

Based on the available information, Methods B and C will be used for the seismic Site Class evaluation.

|         |                                                            |
|---------|------------------------------------------------------------|
| Client  | Maine Department of Transportation                         |
| Project | US Route 2 Bridge over Boombridge Brook - Greenbush, Maine |
| Subject | Seismic Site Class                                         |

## SITE CLASS DEFINITIONS

(Table from AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020.).

Table 3.10.3.1-1—Site Class Definitions

| Site Class | Soil Type and Profile                                                                                                                                                                                                                                                                                                                                                                                             |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A          | Hard rock with measured shear wave velocity, $\bar{v}_s > 5,000$ ft/s                                                                                                                                                                                                                                                                                                                                             |
| B          | Rock with $2,500$ ft/sec $< \bar{v}_s < 5,000$ ft/s                                                                                                                                                                                                                                                                                                                                                               |
| C          | Very dense soil and soil rock with $1,200$ ft/sec $< \bar{v}_s < 2,500$ ft/s, or with either $\bar{N} > 50$ blows/ft, or $\bar{s}_u > 2.0$ ksf                                                                                                                                                                                                                                                                    |
| D          | Stiff soil with $600$ ft/s $< \bar{v}_s < 1,200$ ft/s, or with either $15 < \bar{N} < 50$ blows/ft, or $1.0 < \bar{s}_u < 2.0$ ksf                                                                                                                                                                                                                                                                                |
| E          | Soil profile with $\bar{v}_s < 600$ ft/s or with either $\bar{N} < 15$ blows/ft or $\bar{s}_u < 1.0$ ksf, or any profile with more than 10.0 ft of soft clay defined as soil with $PI > 20$ , $w > 40$ percent and $\bar{s}_u < 0.5$ ksf                                                                                                                                                                          |
| F          | Soils requiring site-specific evaluations, such as: <ul style="list-style-type: none"> <li>Peats or highly organic clays (<math>H &gt; 10.0</math> ft of peat or highly organic clay where <math>H</math> = thickness of soil)</li> <li>Very high plasticity clays (<math>H &gt; 25.0</math> ft with <math>PI &gt; 75</math>)</li> <li>Very thick soft/medium stiff clays (<math>H &gt; 120</math> ft)</li> </ul> |

Exceptions: Where the soil properties are not known in sufficient detail to determine the site class, a site investigation shall be undertaken sufficient to determine the site class. Site classes E or F should not be assumed unless the authority having jurisdiction determines that site classes E or F could be present at the site or in the event that site classes E or F are established by geotechnical data.

where:

|             |   |                                                                                                                     |
|-------------|---|---------------------------------------------------------------------------------------------------------------------|
| $\bar{v}_s$ | = | average shear wave velocity for the upper 100 ft of the soil profile                                                |
| $\bar{N}$   | = | average Standard Penetration Test (SPT) blow count (blows/ft) (ASTM D1586) for the upper 100 ft of the soil profile |
| $\bar{s}_u$ | = | average undrained shear strength in ksf (ASTM D2166 or ASTM D2850) for the upper 100 ft of the soil profile         |
| $PI$        | = | plasticity index (ASTM D4318)                                                                                       |
| $w$         | = | moisture content (ASTM D2216)                                                                                       |



Sheet 4 of 8

Computed by TPJ

Checked by MMB

|         |                    |
|---------|--------------------|
| Subject | Seismic Site Class |
|---------|--------------------|

|                     |            |
|---------------------|------------|
| Exploration ID:     | BB-GBB-101 |
| Ground Surface El.: | 119.5      |

[illegible]

Total Thickness of Cohesionless (ft) = 100.0

$$N_{ch-bar} \text{ (blows/ft)} = 19$$
Site Class<sub>N</sub> = D



Sheet 5 of 8

|             |     |
|-------------|-----|
| Computed by | TPJ |
|-------------|-----|

Checked by MMB

|         |                    |
|---------|--------------------|
| Subject | Seismic Site Class |
|---------|--------------------|

|                     |            |
|---------------------|------------|
| Exploration ID:     | BB-GBB-102 |
| Ground Surface El.: | 119.8      |

[illegible]

Total Thickness of Cohesionless (ft) = 100.0

$$N_{ch-bar} \text{ (blows/ft)} = 20$$
Site Class<sub>N</sub> = D

## CALCULATIONS



Client Maine Department of Transportation

Date 29-Mar-22

Project US Route 2 Bridge over Boombridge Brook - Greenbush, Maine

Computed by TPJ

Subject Seismic Site Class

Checked by MMB

## RESULTS SUMMARY

| Boring Number | SPT N                             |                         | Su                          |                          | Selected Site Class |
|---------------|-----------------------------------|-------------------------|-----------------------------|--------------------------|---------------------|
|               | N <sub>ch-bar</sub><br>(blows/ft) | Site Class <sub>N</sub> | S <sub>u-bar</sub><br>(psf) | Site Class <sub>Su</sub> |                     |
| BB-GBB-101    | 19                                | D                       | N/A                         | N/A                      | <b>D</b>            |
| BB-GBB-102    | 20                                | D                       | N/A                         | N/A                      | <b>D</b>            |
| BB-GBB-201    | 17                                | D                       | 1446                        | D                        | <b>D</b>            |
| BB-GBB-202    | 14                                | E                       | 1183                        | D                        | <b>E</b>            |

## CONCLUSIONS &amp; RECOMMENDATIONS

Based on the subsurface conditions encountered at the 4 test borings near the proposed substructures (BB-GBB-101, BB-GBB-102, BB-GBB-201, BB-GBB-202), recommend a **Seismic Site Class D**.

## RECOMMENDED SEISMIC DESIGN PARAMETERS FROM UNITED STATES GEOLOGICAL SURVEY (USGS) SEISMIC DESIGN WEB SERVICE

```
{
  "request": {
    "date": "2022-03-31T12:45:26.346Z",
    "referenceDocument": "AASHTO-2009",
    "status": "success",
    "url": "https://earthquake.usgs.gov/ws/designmaps/aashto-2009.json?latitude=45.052722&longitude=-68.656409&siteClass=D&title=Boombridge Brook Greenbush",
    "parameters": {
      "latitude": 45.052722,
      "longitude": -68.656409,
      "siteClass": "D",
      "title": "Boombridge Brook Greenbush"
    }
  },
  "response": {
    "data": {
      "pga": 0.07,
      "fpga": 1.6,
      "as": 0.111,
      "ss": 0.15,
      "fa": 1.6,
      "sds": 0.24,
      "s1": 0.045,
      "fv": 2.4,
      "sd1": 0.108,
      "sdc": "A",
      "ts": 0.449,
      "t0": 0.09,
    }
  }
}
```

## **Liquefaction**

Client: Maine Department of Transportation

Date: 31-Mar-2022

Project: Boom Bridge, US Route 2 Over Boombridge Brook, Greenbush Maine

Computed by: TPJ

Subject: Liquefaction Analysis

Checked by: MMB

**PROBLEM STATEMENT & OBJECTIVE**

Estimate the liquefaction resistance using the Youd and Idriss (2001) method for calculating factor of safety (FS) against liquefaction.

**REFERENCES**

1. Youd and Idriss, "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils," 2001
2. United States Geological Survey (USGS) website
3. Maine DOT Bridge Manual

**AVAILABLE INFORMATION/ASSUMPTIONS**

1. Maine Department of Transportation boring logs BB-GBB-101, BB-GBB-102, BB-GBB-201, and BB-GBB-202.
2. Grain-size distribution laboratory test results for the following samples:

| Boring No. | Sample No. | Depth (ft) | % Fines |
|------------|------------|------------|---------|
| BB-GBB-101 | 4D         | 8 to 10    | 38      |
| BB-GBB-101 | 5D         | 13 to 15   | 38      |
| BB-GBB-102 | 5D         | 10 to 12   | 33      |
| BB-GBB-102 | 6D         | 15 to 17   | 99      |
| BB-GBB-201 | 4D         | 8 to 10    | 42      |
| BB-GBB-201 | 5D/B       | 10 to 12   | 36      |
| BB-GBB-202 | 4D         | 8 to 10    | 39      |
| BB-GBB-202 | 5D         | 10 to 12   | 28      |

3. De-aggregation plot from the USGS Earthquake Hazards website using a  $M_{avg}$  of 5.6.
4. As of 0.111 g from the seismic site class calculations.
5. The groundwater condition used in the evaluations was the higher groundwater elevation between the Q1.1 elevation (El. 105.7) and the measured groundwater elevation in the specific boring during drilling.
6. The lab testing results were used for the percentage of fines content for the samples that were submitted for lab testing. For samples that were not submitted for lab testing, the low-end of the range in the soil classification based on the MaineDOT soil classification system was assumed for the percentage of fines.
7. Elevations are in feet and reference the North American Vertical Datum of 1988 (NAVD88).
8. Total unit weights were estimated as follows: Fill 120 pcf, Marine Deposit 115 pcf, Glacial Till 130 pcf, and Weathered Bedrock 140 pcf.

**CALCULATIONS**

See pages 2 and 3 for calculations

Boring Name: **BB-GBB-101**

GS El. = 119.5

Measured GW El. = 111.7

Soil Overburden (ft) = 32.5

Total Boring Depth (ft) = 49.2

PGA = 0.111

Mag. = 5.6

MSF = 2.11

Borehole Diameter (in) = 4

Hoist Type = Winch

Hammer Type = Automatic Hammer

GW El. Used = 111.7

\*groundwater level was assumed to be the same as BB-GBB-201

| Stress Calculations |                |               |                        |                         |               |                   | SPT N Corrections    |                      |                      |                      |                       |                |                | Liquefaction Analysis, Youd & Idriss (2001) |                |                |                         |                                         |      |      |                                            |                                         |                      |                                             |                |      |                               |                        |                                      |
|---------------------|----------------|---------------|------------------------|-------------------------|---------------|-------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|----------------|----------------|---------------------------------------------|----------------|----------------|-------------------------|-----------------------------------------|------|------|--------------------------------------------|-----------------------------------------|----------------------|---------------------------------------------|----------------|------|-------------------------------|------------------------|--------------------------------------|
| Depth (ft)          | Elevation (ft) | Sample Number | Geological Description | Sublayer Thickness (ft) | SPT N (bl/ft) | Fines Content (%) | γ <sub>t</sub> (pcf) | γ <sub>w</sub> (pcf) | σ <sub>v</sub> (psf) | p <sub>w</sub> (psf) | σ' <sub>v</sub> (psf) | C <sub>N</sub> | C <sub>E</sub> | C <sub>R</sub>                              | C <sub>B</sub> | C <sub>S</sub> | N <sub>60</sub> (bl/ft) | (N <sub>1</sub> ) <sub>60</sub> (bl/ft) | α    | β    | (N <sub>1</sub> ) <sub>60 CS</sub> (bl/ft) | (N <sub>1</sub> ) <sub>CS</sub> (bl/ft) | CRR <sub>M=7.5</sub> | CRR <sub>M</sub> =CRR <sub>M=7.5</sub> *MSF | r <sub>d</sub> | CSR  | CSR <sub>M=7.5</sub> =CSR/MSF | τ <sub>AVE</sub> (psf) | FS= (CRR <sub>M=7.5</sub> /CSR)x MSF |
| 3                   | 116.5          | 1D            | FILL                   | 4.0                     | 28            | 0                 | 120                  | 62.4                 | 360                  | 0                    | 360                   | 1.70           | 0.68           | 0.75                                        | 1.00           | 1.00           | 32                      | 54.4                                    | 0.00 | 1.00 | 54.4                                       | 107.1                                   | NL                   | NL                                          | 0.99           | 0.07 | 0.03                          | 25.8                   | NL                                   |
| 5                   | 114.5          | 2D            | FILL                   | 2.0                     | 12            | 0                 | 120                  | 62.4                 | 600                  | 0                    | 600                   | 1.70           | 0.68           | 0.75                                        | 1.00           | 1.00           | 14                      | 23.8                                    | 0.00 | 1.00 | 23.8                                       | 46.9                                    | 0.27                 | 0.57                                        | 0.99           | 0.07 | 0.03                          | 42.8                   | NL                                   |
| 7                   | 112.5          | 3D            | FILL                   | 2.0                     | 6             | 0                 | 120                  | 62.4                 | 840                  | 0                    | 840                   | 1.58           | 0.68           | 0.75                                        | 1.00           | 1.00           | 7                       | 11.0                                    | 0.00 | 1.00 | 11.0                                       | 21.7                                    | 0.12                 | 0.26                                        | 0.98           | 0.07 | 0.03                          | 59.6                   | NL                                   |
| 9                   | 110.5          | 4D            | FILL                   | 2.0                     | 4             | 38                | 120                  | 62.4                 | 1080                 | 75                   | 1005                  | 1.44           | 0.68           | 0.75                                        | 1.00           | 1.00           | 5                       | 7.2                                     | 5.00 | 1.20 | 13.6                                       | 26.9                                    | 0.15                 | 0.31                                        | 0.98           | 0.08 | 0.04                          | 76.3                   | 4.1                                  |
| 11                  | 108.5          | MD            | FILL                   | 2.5                     | 3             | 21                | 120                  | 62.4                 | 1320                 | 200                  | 1120                  | 1.37           | 0.68           | 0.80                                        | 1.00           | 1.00           | 3                       | 4.1                                     | 3.78 | 1.09 | 8.2                                        | 15.2                                    | 0.10                 | 0.21                                        | 0.97           | 0.08 | 0.04                          | 92.8                   | 2.5                                  |
| 14                  | 105.5          | 5D            | FILL                   | 2.5                     | 9             | 38                | 120                  | 62.4                 | 1680                 | 387                  | 1293                  | 1.27           | 0.68           | 0.85                                        | 1.00           | 1.00           | 10                      | 12.7                                    | 5.00 | 1.20 | 20.2                                       | 35.2                                    | 0.22                 | 0.46                                        | 0.97           | 0.09 | 0.04                          | 117.3                  | 5.1                                  |
| 16                  | 103.5          | 6D            | FILL                   | 3.0                     | 4             | 36                | 120                  | 62.4                 | 1920                 | 512                  | 1408                  | 1.22           | 0.68           | 0.85                                        | 1.00           | 1.00           | 5                       | 6.1                                     | 5.00 | 1.20 | 12.3                                       | 21.4                                    | 0.13                 | 0.28                                        | 0.96           | 0.09 | 0.04                          | 133.4                  | 3.0                                  |
| 21                  | 98.5           | 7D            | MARINE DEPOSIT         | 4.5                     | 10            | 50                | 115                  | 62.4                 | 2495                 | 824                  | 1671                  | 1.12           | 0.68           | 0.95                                        | 1.00           | 1.00           | 11                      | 12.3                                    | 5.00 | 1.20 | 19.8                                       | 30.7                                    | 0.21                 | 0.45                                        | 0.95           | 0.10 | 0.05                          | 171.2                  | 4.4                                  |
| 24                  | 95.5           | 8D            | MARINE DEPOSIT         | 2.5                     | 5             | 50                | 115                  | 62.4                 | 2840                 | 1011                 | 1829                  | 1.07           | 0.68           | 0.95                                        | 1.00           | 1.00           | 6                       | 6.4                                     | 5.00 | 1.20 | 12.7                                       | 19.7                                    | 0.14                 | 0.29                                        | 0.94           | 0.11 | 0.05                          | 193.4                  | 2.7                                  |
| 26                  | 93.5           | 9D            | MARINE DEPOSIT         | 2.4                     | 6             | 50                | 115                  | 62.4                 | 3070                 | 1136                 | 1934                  | 1.04           | 0.68           | 0.95                                        | 1.00           | 1.00           | 7                       | 7.3                                     | 5.00 | 1.20 | 13.7                                       | 21.3                                    | 0.15                 | 0.31                                        | 0.94           | 0.11 | 0.05                          | 208.1                  | 2.9                                  |
| 31                  | 88.5           | 10D           | GLACIAL TILL           | 5.1                     | 39            | 0                 | 130                  | 62.4                 | 3720                 | 1448                 | 2272                  | 0.96           | 0.68           | 1.00                                        | 1.00           | 1.00           | 44                      | 42.2                                    | 0.00 | 1.00 | 42.2                                       | 62.3                                    | NL                   | NL                                          | 0.92           | 0.11 | 0.05                          | 247.4                  | NL                                   |

Boring Name: **BB-GBB-102**

GS El. = 119.8

Measured GW El. = 109.8

Soil Overburden (ft) = 38.1

Total Boring Depth (ft) = 57.1

PGA = 0.111

Mag. = 5.6

MSF = 2.11

Borehole Diameter (in) = 4

Hoist Type = Winch

Hammer Type = Automatic Hammer

GW El. Used = 109.8

| Stress Calculations |                |               |                        |                         |               |                   | SPT N Corrections    |                      |                      |                      |                       |                |                | Liquefaction Analysis, Youd & Idriss (2001) |                |                |                         |                                         |      |      |                                            |                                         |                      |                                             |                |      |                               |                        |                                      |
|---------------------|----------------|---------------|------------------------|-------------------------|---------------|-------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|----------------|----------------|---------------------------------------------|----------------|----------------|-------------------------|-----------------------------------------|------|------|--------------------------------------------|-----------------------------------------|----------------------|---------------------------------------------|----------------|------|-------------------------------|------------------------|--------------------------------------|
| Depth (ft)          | Elevation (ft) | Sample Number | Geological Description | Sublayer Thickness (ft) | SPT N (bl/ft) | Fines Content (%) | γ <sub>t</sub> (pcf) | γ <sub>w</sub> (pcf) | σ <sub>v</sub> (psf) | p <sub>w</sub> (psf) | σ' <sub>v</sub> (psf) | C <sub>N</sub> | C <sub>E</sub> | C <sub>R</sub>                              | C <sub>B</sub> | C <sub>S</sub> | N <sub>60</sub> (bl/ft) | (N <sub>1</sub> ) <sub>60</sub> (bl/ft) | α    | β    | (N <sub>1</sub> ) <sub>60 CS</sub> (bl/ft) | (N <sub>1</sub> ) <sub>CS</sub> (bl/ft) | CRR <sub>M=7.5</sub> | CRR <sub>M</sub> =CRR <sub>M=7.5</sub> *MSF | r <sub>d</sub> | CSR  | CSR <sub>M=7.5</sub> =CSR/MSF | τ <sub>AVE</sub> (psf) | FS= (CRR <sub>M=7.5</sub> /CSR)x MSF |
| 2                   | 117.8          | 1D            | FILL                   | 3.5                     | 100           | 0                 | 120                  | 62.4                 | 240                  | 0                    | 240                   | 1.70           | 0.68           | 0.75                                        | 1.00           | 1.00           | 100                     | 170.0                                   | 0.00 | 1.00 | 170.0                                      | 334.8                                   | NL                   | NL                                          | 1.00           | 0.07 | 0.03                          | 17.2                   | NL                                   |
| 5                   | 114.8          | 2D            | FILL                   | 2.5                     | 12            | 0                 | 120                  | 62.4                 | 600                  | 0                    | 600                   | 1.70           | 0.68           | 0.75                                        | 1.00           | 1.00           | 14                      | 23.8                                    | 0.00 | 1.00 | 23.8                                       | 46.9                                    | 0.27                 | 0.57                                        | 0.99           | 0.07 | 0.03                          | 42.8                   | NL                                   |
| 7                   | 112.8          | 3D            | FILL                   | 2.0                     | 5             | 0                 | 120                  | 62.4                 | 840                  | 0                    | 840                   | 1.58           | 0.68           | 0.75                                        | 1.00           | 1.00           | 6                       | 9.5                                     | 0.00 | 1.00 | 9.5                                        | 18.6                                    | 0.11                 | 0.23                                        | 0.98           | 0.07 | 0.03                          | 59.6                   | NL                                   |
| 9                   | 110.8          | 4D            | FILL                   | 2.0                     | 3             | 0                 | 120                  | 62.4                 | 1080                 | 0                    | 1080                  | 1.39           | 0.68           | 0.75                                        | 1.00           | 1.00           | 3                       | 4.2                                     | 0.00 | 1.00 | 4.2                                        | 8.2                                     | 0.07                 | 0.14                                        | 0.98           | 0.07 | 0.03                          | 76.3                   | NL                                   |
| 11                  | 108.8          | 5D            | FILL                   | 4.0                     | 15            | 33                | 120                  | 62.4                 | 1320                 | 62                   | 1258                  | 1.29           | 0.68           | 0.80                                        | 1.00           | 1.00           | 17                      | 21.9                                    | 4.88 | 1.18 | 30.7                                       | 56.7                                    | NL                   | NL                                          | 0.97           | 0.07 | 0.03                          | 92.8                   | NL                                   |
| 16                  | 103.8          | 6D            | MARINE DEPOSIT         | 4.5                     | 5             | 99                | 115                  | 62.4                 | 1895                 | 374                  | 1521                  | 1.17           | 0.68           | 0.85                                        | 1.00           | 1.00           | 6                       | 7.0                                     | 5.00 | 1.20 | 13.4                                       | 23.4                                    | 0.14                 | 0.31                                        | 0.96           | 0.09 | 0.04                          | 131.6                  | 3.5                                  |
| 21                  | 98.8           | 7D            | MARINE DEPOSIT         | 8.8                     | 5             | 50                | 115                  | 62.4                 | 2470                 | 686                  | 1784                  | 1.08           | 0.68           | 0.95                                        | 1.00           | 1.00           | 6                       | 6.5                                     | 5.00 | 1.20 | 12.8                                       | 19.9                                    | 0.14                 | 0.29                                        | 0.95           | 0.10 | 0.04                          | 169.5                  | 3.1                                  |
| 26                  | 93.8           | 8D            | GLACIAL TILL           | 2.2                     | 39            | 36                | 130                  | 62.4                 | 3120                 | 998                  | 2122                  | 0.99           | 0.68           | 0.95                                        | 1.00           | 1.00           | 44                      | 43.7                                    | 5.00 | 1.20 | 57.4                                       | 89.2                                    | NL                   | NL                                          | 0.94           | 0.10 | 0.05                          | 211.5                  | NL                                   |
| 28                  | 91.8           | 9D            | GLACIAL TILL           | 4.0                     | 51            | 0                 | 130                  | 62.4                 | 3380                 | 1123                 | 2257                  | 0.96           | 0.68           | 0.95                                        | 1.00           | 1.00           | 58                      | 55.8                                    | 0.00 | 1.00 | 55.8                                       | 86.7                                    | NL                   | NL                                          | 0.93           | 0.10 | 0.05                          | 227.9                  | NL                                   |
| 31                  | 88.8           | 10D           | GLACIAL TILL           | 2.4                     | 100           | 0                 | 130                  | 62.4                 | 3770                 | 1310                 | 2460                  | 0.92           | 0.68           | 1.00                                        | 1.00           | 1.00           | 100                     | 92.1                                    | 0.00 | 1.00 | 92.1                                       | 136.1                                   | NL                   | NL                                          | 0.92           | 0.10 | 0.05                          | 250.7                  | NL                                   |
| 35.5                | 84.35          | 11D           | WEATHERED BEDROCK      | 2.2                     | 100           | 0                 | 140                  | 62.4                 | 4393                 | 1588                 | 2805                  | 0.86           | 0.68           | 1.00                                        | 1.00           | 1.00           | 100                     | 86.3                                    | 0.00 | 1.00 | 86.3                                       | 127.4                                   | NL                   | NL                                          | 0.89           | 0.10 | 0.05                          | 280.7                  | NL                                   |

Client: Maine Department of Transportation

Computed by: TPJ

Checked by: MMB

Sheet: 2 of 4

**HALEY**  
**ALDRICH**

Project: US Route 2 over Boombridge Brook, Greenbush, Maine

Subject: Liquefaction Analysis

File No.: 127991-003

Date: 31-Mar-2022

\\haleyaldrich.com\share\por\_common\PROJECTS\127991 - Greenbush\003\Calculations\Liquefaction\[2022-0331-HAI-Greenbush Liquefaction-d2.xlsm]Liquefaction Plots

Boring Name: **BB-GBB-201**

GS El. = 120

Measured GW El. = 111.7 GW El. Used = 111.7

Soil Overburden (ft) = 33.3

Total Boring Depth (ft) = 42.3

PGA = 0.111

Mag. = 5.6

MSF = 2.11

Borehole Diameter (in) = 4

Hoist Type = Winch

Hammer Type = Automatic Hammer

| Stress Calculations |                |               |                        |                         |               |                   |                  |                  |                  | SPT N Corrections |                   |       |       |       | Liquefaction Analysis, Youd & Idriss (2001) |       |                  |                      |          |         |                                |                      |               |                         |       |      |                       |                    |                                 |
|---------------------|----------------|---------------|------------------------|-------------------------|---------------|-------------------|------------------|------------------|------------------|-------------------|-------------------|-------|-------|-------|---------------------------------------------|-------|------------------|----------------------|----------|---------|--------------------------------|----------------------|---------------|-------------------------|-------|------|-----------------------|--------------------|---------------------------------|
| Depth (ft)          | Elevation (ft) | Sample Number | Geological Description | Sublayer Thickness (ft) | SPT N (bl/ft) | Fines Content (%) | $\gamma_t$ (pcf) | $\gamma_w$ (pcf) | $\sigma_v$ (psf) | $p_w$ (psf)       | $\sigma'_v$ (psf) | $C_N$ | $C_E$ | $C_R$ | $C_B$                                       | $C_S$ | $N_{60}$ (bl/ft) | $(N_1)_{60}$ (bl/ft) | $\alpha$ | $\beta$ | $(N_1)_{60\text{ CS}}$ (bl/ft) | $(N_1)_{CS}$ (bl/ft) | $CRR_{M=7.5}$ | $CRR_M=CRR_{M=7.5}*MSF$ | $r_d$ | CSR  | $CSR_{M=7.5}=CSR/MSF$ | $\tau_{AVE}$ (psf) | FS=<br>$(CRR_{M=7.5}/CSR)x$ MSF |
| 3                   | 117            | 1D            | FILL                   | 4.0                     | 45            | 0                 | 120              | 62.4             | 360              | 0                 | 360               | 1.70  | 0.87  | 0.75  | 1.00                                        | 1.00  | 65               | 110.5                | 0.00     | 1.00    | 110.5                          | 169.9                | NL            | NL                      | 0.99  | 0.07 | 0.03                  | 25.8               | NL                              |
| 5                   | 115            | 2D            | FILL                   | 2.0                     | 13            | 0                 | 120              | 62.4             | 600              | 0                 | 600               | 1.70  | 0.87  | 0.75  | 1.00                                        | 1.00  | 19               | 32.3                 | 0.00     | 1.00    | 32.3                           | 49.7                 | NL            | NL                      | 0.99  | 0.07 | 0.03                  | 42.8               | NL                              |
| 7                   | 113            | 3D            | FILL                   | 2.0                     | 6             | 0                 | 120              | 62.4             | 840              | 0                 | 840               | 1.58  | 0.87  | 0.75  | 1.00                                        | 1.00  | 9                | 14.2                 | 0.00     | 1.00    | 14.2                           | 21.8                 | 0.15          | 0.32                    | 0.98  | 0.07 | 0.03                  | 59.6               | NL                              |
| 9                   | 111            | 4D            | FILL                   | 2.0                     | 3             | 42                | 120              | 62.4             | 1080             | 44                | 1036              | 1.42  | 0.87  | 0.75  | 1.00                                        | 1.00  | 4                | 5.7                  | 5.00     | 1.20    | 11.8                           | 18.2                 | 0.13          | 0.27                    | 0.98  | 0.07 | 0.03                  | 76.3               | 3.7                             |
| 11                  | 109            | 5D/B          | FILL                   | 3.0                     | 1             | 36                | 120              | 62.4             | 1320             | 168               | 1152              | 1.35  | 0.87  | 0.80  | 1.00                                        | 1.00  | 1                | 1.3                  | 5.00     | 1.20    | 6.6                            | 9.5                  | 0.08          | 0.18                    | 0.97  | 0.08 | 0.04                  | 92.8               | 2.2                             |
| 14                  | 106            | 6D            | FILL                   | 2.2                     | 1             | 50                | 120              | 62.4             | 1680             | 356               | 1324              | 1.26  | 0.87  | 0.85  | 1.00                                        | 1.00  | 1                | 1.3                  | 5.00     | 1.20    | 6.5                            | 8.8                  | 0.08          | 0.18                    | 0.97  | 0.09 | 0.04                  | 117.3              | 2.0                             |
| 16                  | 104            | 7D            | MARINE DEPOSIT         | 3.3                     | 8             | 50                | 115              | 62.4             | 1910             | 480               | 1430              | 1.21  | 0.87  | 0.85  | 1.00                                        | 1.00  | 12               | 14.5                 | 5.00     | 1.20    | 22.4                           | 30.4                 | 0.25          | 0.52                    | 0.96  | 0.09 | 0.04                  | 132.7              | 5.6                             |
| 21                  | 99             | 8D            | MARINE DEPOSIT         | 5.0                     | 4             | 50                | 115              | 62.4             | 2485             | 792               | 1693              | 1.11  | 0.87  | 0.95  | 1.00                                        | 1.00  | 6                | 6.7                  | 5.00     | 1.20    | 13.0                           | 15.8                 | 0.14          | 0.30                    | 0.95  | 0.10 | 0.05                  | 170.5              | 2.9                             |
| 31                  | 89             | 10D           | GLACIAL TILL           | 2.9                     | 25            | 0                 | 130              | 62.4             | 3785             | 1416              | 2369              | 0.94  | 0.87  | 1.00  | 1.00                                        | 1.00  | 36               | 33.8                 | 0.00     | 1.00    | 33.8                           | 39.0                 | NL            | NL                      | 0.92  | 0.11 | 0.05                  | 251.7              | NL                              |
| 32.6                | 87.45          | --            | WEATHERED BEDROCK      | 1.5                     | 100           | 0                 | 140              | 62.4             | 4002             | 1513              | 2489              | 0.92  | 0.87  | 1.00  | 1.00                                        | 1.00  | 100              | 91.6                 | 0.00     | 1.00    | 91.6                           | 105.6                | NL            | NL                      | 0.91  | 0.11 | 0.05                  | 262.5              | NL                              |

Boring Name: **BB-GBB-202**

GS El. = 119.5

Measured GW El. = 106.1 GW El. Used = 106.1

Soil Overburden (ft) = 34.9

Total Boring Depth (ft) = 45

PGA = 0.111

Mag. = 5.6

MSF = 2.11

Borehole Diameter (in) = 4

Hoist Type = Winch

Hammer Type = Automatic Hammer

| Stress Calculations |                |               |                        |                         |               |                   |                  |                  |                  | SPT N Corrections |                   |       |       |       | Liquefaction Analysis, Youd & Idriss (2001) |       |                  |                      |          |         |                                |                      |               |                         |       |      |                       |                    |                                 |
|---------------------|----------------|---------------|------------------------|-------------------------|---------------|-------------------|------------------|------------------|------------------|-------------------|-------------------|-------|-------|-------|---------------------------------------------|-------|------------------|----------------------|----------|---------|--------------------------------|----------------------|---------------|-------------------------|-------|------|-----------------------|--------------------|---------------------------------|
| Depth (ft)          | Elevation (ft) | Sample Number | Geological Description | Sublayer Thickness (ft) | SPT N (bl/ft) | Fines Content (%) | $\gamma_t$ (pcf) | $\gamma_w$ (pcf) | $\sigma_v$ (psf) | $p_w$ (psf)       | $\sigma'_v$ (psf) | $C_N$ | $C_E$ | $C_R$ | $C_B$                                       | $C_S$ | $N_{60}$ (bl/ft) | $(N_1)_{60}$ (bl/ft) | $\alpha$ | $\beta$ | $(N_1)_{60\text{ CS}}$ (bl/ft) | $(N_1)_{CS}$ (bl/ft) | $CRR_{M=7.5}$ | $CRR_M=CRR_{M=7.5}*MSF$ | $r_d$ | CSR  | $CSR_{M=7.5}=CSR/MSF$ | $\tau_{AVE}$ (psf) | FS=<br>$(CRR_{M=7.5}/CSR)x$ MSF |
| 3                   | 116.5          | 1D            | FILL                   | 4.0                     | 17            | 0                 | 120              | 62.4             | 360              | 0                 | 360               | 1.70  | 0.87  | 0.75  | 1.00                                        | 1.00  | 11.1             | 18.8                 | 0.00     | 1.00    | 18.8                           | 28.9                 | 0.20          | 0.42                    | 0.99  | 0.07 | 0.03                  | 25.8               | NL                              |
| 5                   | 114.5          | 2D            | FILL                   | 2.0                     | 7             | 0                 | 120              | 62.4             | 600              | 0                 | 600               | 1.70  | 0.87  | 0.75  | 1.00                                        | 1.00  | 4.6              | 7.7                  | 0.00     | 1.00    | 7.7                            | 11.9                 | 0.09          | 0.20                    | 0.99  | 0.07 | 0.03                  | 42.8               | NL                              |
| 7                   | 112.5          | 3D            | FILL                   | 2.0                     | 5             | 0                 | 120              | 62.4             | 840              | 0                 | 840               | 1.58  | 0.87  | 0.75  | 1.00                                        | 1.00  | 3.3              | 5.1                  | 0.00     | 1.00    | 5.1                            | 7.9                  | 0.07          | 0.15                    | 0.98  | 0.07 | 0.03                  | 59.6               | NL                              |
| 9                   | 110.5          | 4D            | FILL                   | 2.0                     | 3             | 39                | 120              | 62.4             | 1080             | 0                 | 1080              | 1.39  | 0.87  | 0.75  | 1.00                                        | 1.00  | 2.0              | 2.7                  | 5.00     | 1.20    | 8.3                            | 12.7                 | 0.10          | 0.21                    | 0.98  | 0.07 | 0.03                  | 76.3               | NL                              |
| 11                  | 108.5          | 5D            | FILL                   | 2.0                     | 4             | 28                | 120              | 62.4             | 1320             | 0                 | 1320              | 1.26  | 0.87  | 0.80  | 1.00                                        | 1.00  | 2.8              | 3.5                  | 4.56     | 1.14    | 8.5                            | 12.3                 | 0.10          | 0.21                    | 0.97  | 0.07 | 0.03                  | 92.8               | NL                              |
| 13                  | 106.5          | 6D            | FILL                   | 2.5                     | 4             | 21                | 120              | 62.4             | 1560             | 0                 | 1560              | 1.16  | 0.87  | 0.85  | 1.00                                        | 1.00  | 2.9              | 3.4                  | 3.78     | 1.09    | 7.5                            | 10.2                 | 0.09          | 0.19                    | 0.97  | 0.07 | 0.03                  | 109.1              | NL                              |
| 16                  | 103.5          | 7D            | FILL                   | 2.5                     | 1             | 36                | 120              | 62.4             | 1920             | 162               | 1758              | 1.09  | 0.87  | 0.85  | 1.00                                        | 1.00  | 0.7              | 0.8                  | 5.00     | 1.20    | 6.0                            | 8.1                  | 0.08          | 0.17                    | 0.96  | 0.08 | 0.04                  | 133.4              | 2.2                             |
| 18                  | 101.5          | 8D            | FILL                   | 1.3                     | 3             | 36                | 115              | 62.4             | 2150             | 287               | 1863              | 1.06  | 0.87  | 0.85  | 1.00                                        | 1.00  | 2.2              | 2.3                  | 5.00     | 1.20    | 7.8                            | 10.6                 | 0.09          | 0.20                    | 0.96  | 0.08 | 0.04                  | 148.6              | 2.5                             |
| 31                  | 88.5           | 10D           | GLACIAL TILL           | 5.2                     | 50            | 0                 | 130              | 62.4             | 3840             | 1098              | 2742              | 0.87  | 0.87  | 1.00  | 1.00                                        | 1.00  | 43.4             | 37.8                 | 0.00     | 1.00    | 37.8                           | 43.6                 | NL            | NL                      | 0.92  | 0.09 | 0.04                  | 255.4              | NL                              |
| 34.4                | 85.15          | --            | WEATHERED BEDROCK      | 1.1                     | 100           | 0                 | 140              | 62.4             | 4309             | 1307              | 3002              | 0.83  | 0.87  | 1.00  | 1.00                                        | 1.00  | 86.7             | 72.3                 | 0.00     | 1.00    | 72.3                           | 83.4                 | NL            | NL                      | 0.89  | 0.09 | 0.04                  | 278.1              | NL                              |

Client: 

Maine Department of Transportation

Computed by: 

TPJ

Checked by: 

MMB

Sheet: 

3 of 4

HALEY

ALDRICH

Project: 

US Route 2 over Boombridge Brook, Greenbush, Maine

Subject: 

Liquefaction Analysis

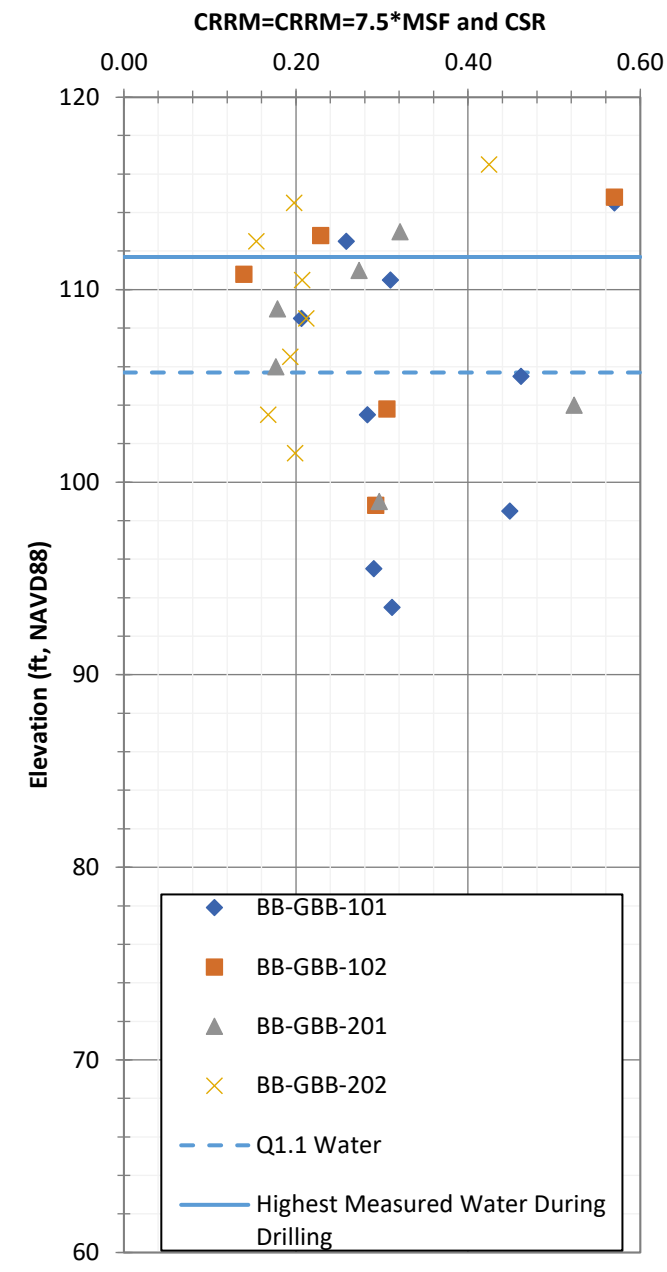
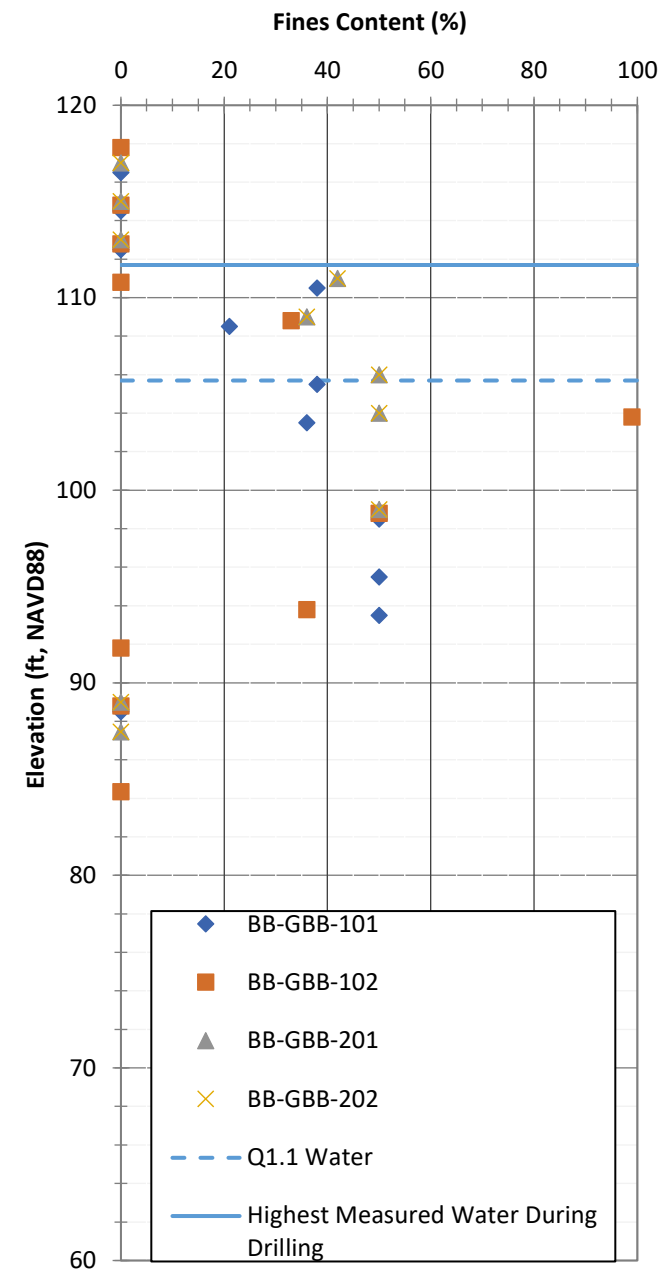
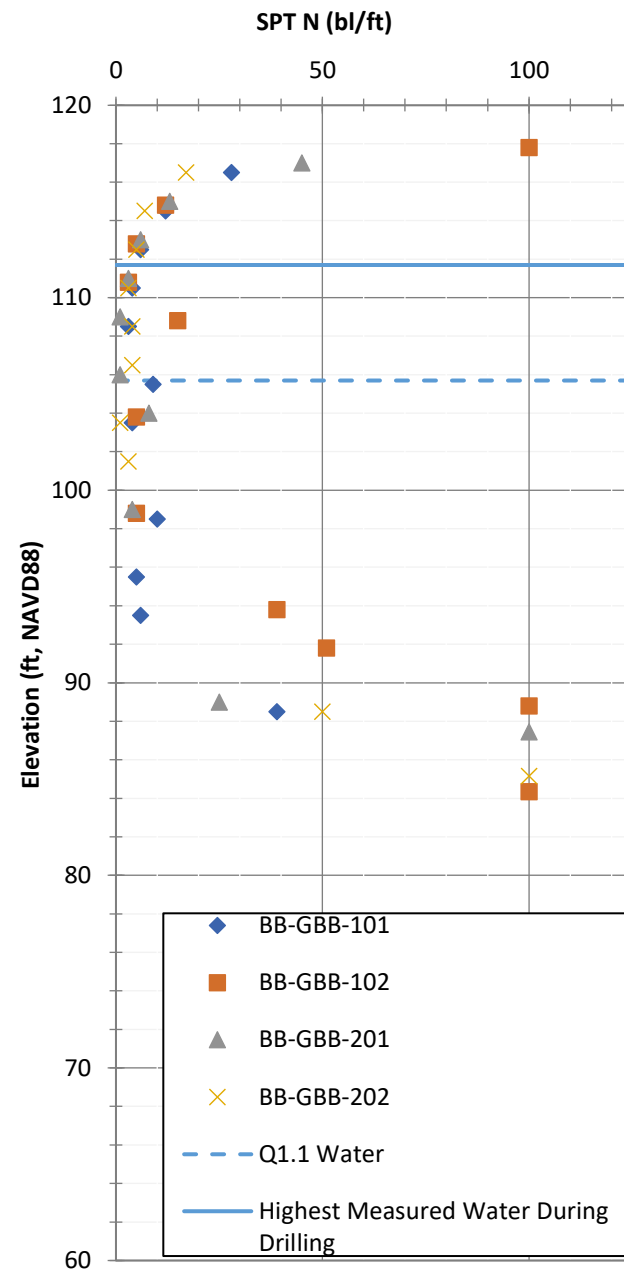
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127991-003

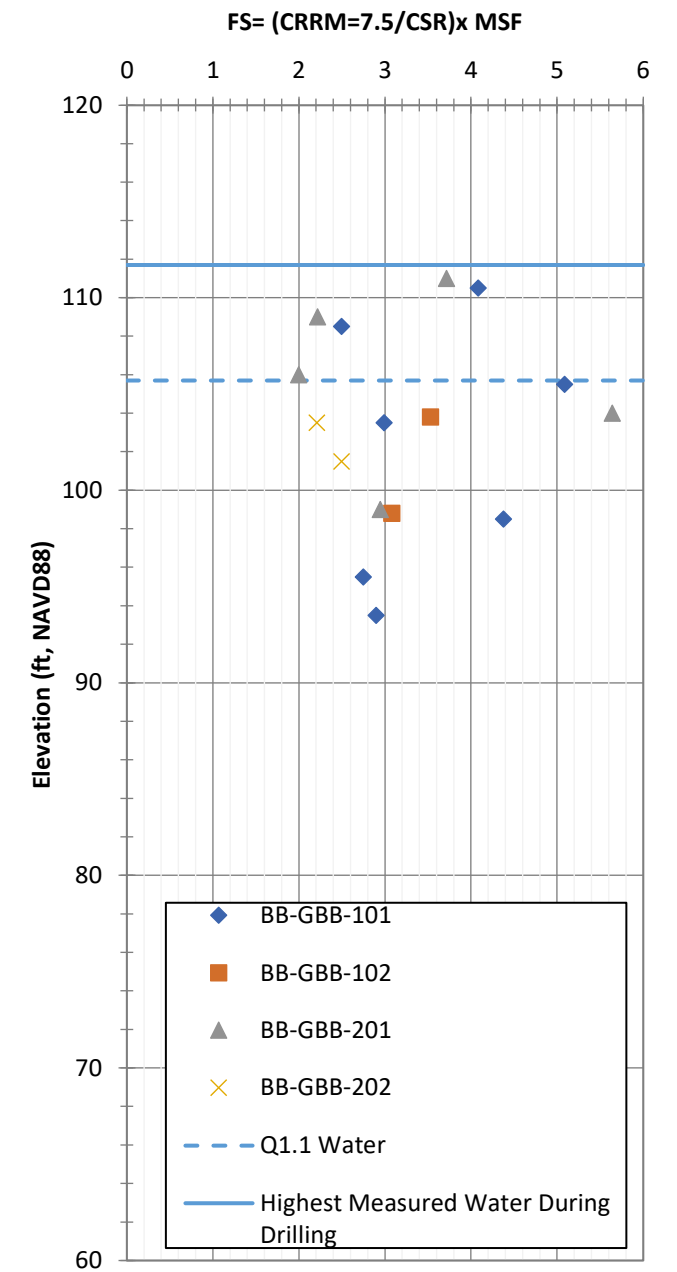
Date: 

31-Mar-2022

\\haleyaldrich.com\share\por\_common\PROJECTS\127991 - Greenbush\003\Calculations\Liquefaction\[2022-0331-HAI-Greenbush Liquefaction-d2.xlsm]Liquefaction Plots



Note: non-liquefied samples ("NL") are not plotted above



Note: non-liquefied samples ("NL") are not plotted above

## **Global Stability**

Client: Maine Department of Transportation

Project: Boom Bridge, US Route 2 Over Boombridge Brook - Greenbush Maine

Subject: Global Stability

### PROBLEM STATEMENT AND OBJECTIVE

Calculate the global stability minimum factor of safety for the proposed bridge structure and approach embankments.

### REFERENCES

1. AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020.
2. Slide2 version 9 by RocScience.
3. MaineDOT Bridge Design Guide, 2003 with interim revisions through June 2018.

### AVAILABLE INFORMATION

1. Draft 50% plan set prepared by Fuss & O'Neill received December 2021.
2. Boring logs BB-GBB-101, BB-GBB-102, BB-GBB-201, and BB-GBB-202.

### ASSUMPTIONS

1. Water level in the river will be modeled at El. 105.7 (Q1.1 elevation).
2. Seismic cases will have a seismic force of  $A_s/2$  ( $0.111 \text{ g}/2$ ) =  $0.0555 \text{ g}$  based on the seismic site class calculations.
3. A 250 psf traffic surcharge will be modeled.
4. A "worst case scenario" soil profile base on BB-GBB-202 was considered (deepest fill). The lowest field vane  $S_u$  of 815 psf for the marine clay was selected for the strength of the marine clay.
5. Station 105+00 longitudinal and 104+75 transverse sections were modeled as the "worst case scenario."
6. Piles will not be modeled.

### SOIL PROPERTIES

| Material              | Unit Weight<br>(pcf) | Friction Angle<br>(degrees) | Undrained Shear<br>Strength (psf) |
|-----------------------|----------------------|-----------------------------|-----------------------------------|
| Granular Borrow       | 125                  | 32                          | 0                                 |
| Rip Rap               | 140                  | 45                          | 0                                 |
| Existing Fill         | 120                  | 28                          | 0                                 |
| Marine Deposit (Clay) | 115                  | 0                           | 815                               |
| Glacial Till          | 130                  | 36                          | 0                                 |
| Weathered Bedrock     | 140                  | 38                          | 0                                 |
| Bedrock               | 160                  | infinite strength           |                                   |

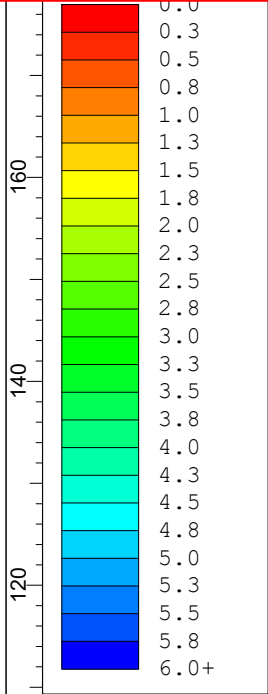
### RESULTS AND CONCLUSIONS

| Structure                   | F.S.   |         |
|-----------------------------|--------|---------|
|                             | Static | Seismic |
| Station 105+00 Longitudinal | 1.4    | 1.2     |
| Station 104+75 Transverse   | 1.3    | 1.1     |

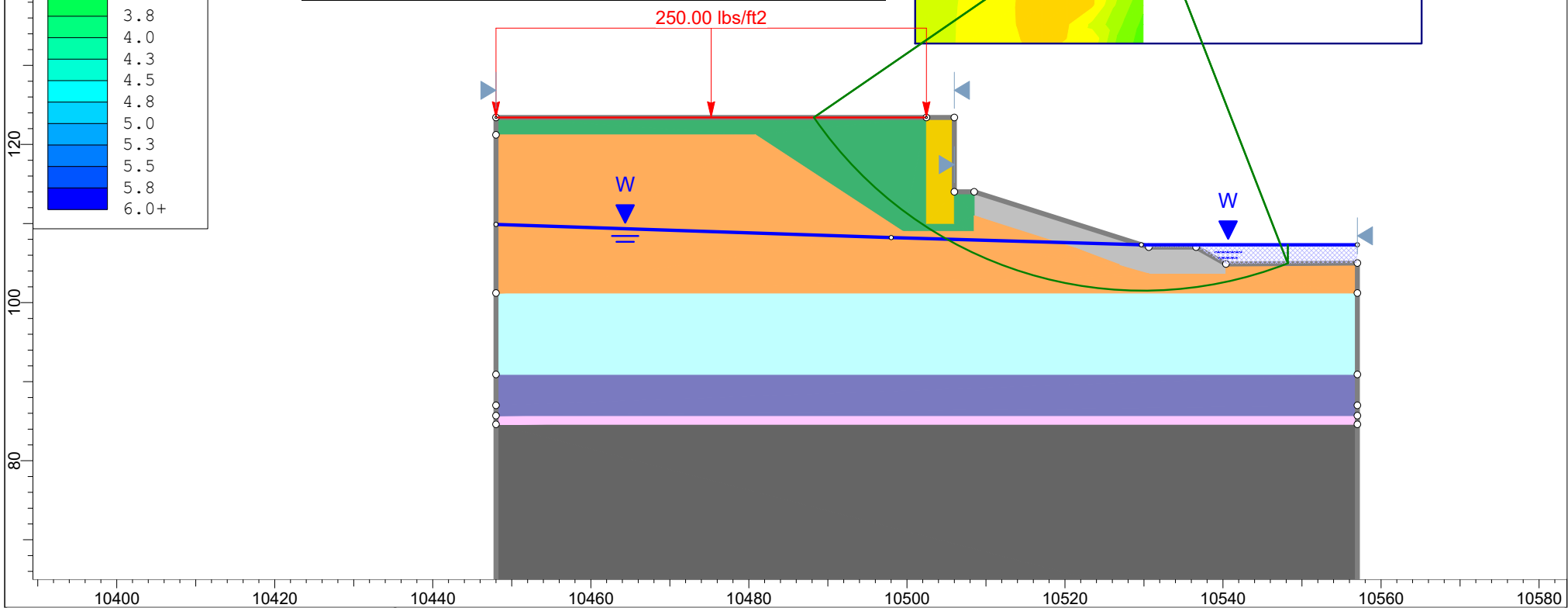
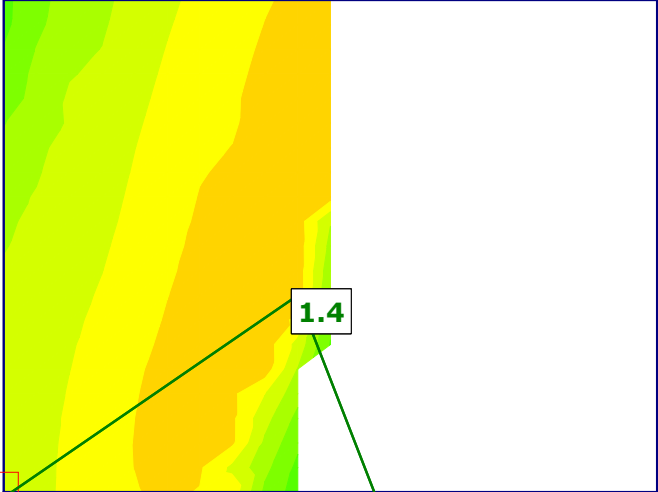
Based on AASHTO LRFD Section 11.6.3.7, an acceptable resistance factor for where the geotechnical parameters and subsurface stratigraphy are well defined is 0.75 (F.S. =  $1/0.75 = 1.3$ ).

Based on FHWA GEC No. 3, a minimum seismic factor of safety of 1.1 is acceptable for slope stability.

STATION 105+00  
LONGITUDINAL  
STATIC

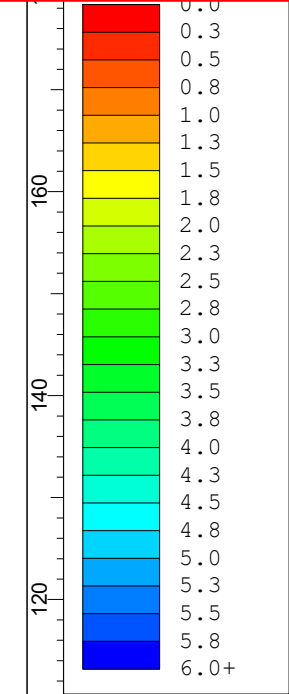


| Material Name         | Color | Unit Weight (lbs/ft3) | Strength Type     | Cohesion (psf) | Phi (deg) | Water Surface |
|-----------------------|-------|-----------------------|-------------------|----------------|-----------|---------------|
| Abutment              |       | 0.01                  | Infinite strength |                |           | Water Surface |
| Granular Borrow       |       | 125                   | Mohr-Coulomb      | 0              | 32        | Water Surface |
| RipRap                |       | 140                   | Mohr-Coulomb      | 0              | 45        | Water Surface |
| Existing Fill         |       | 120                   | Mohr-Coulomb      | 0              | 28        | Water Surface |
| Marine Deposit (Clay) |       | 115                   | Mohr-Coulomb      | 815            | 0         | Water Surface |
| Glacial Till          |       | 130                   | Mohr-Coulomb      | 0              | 36        | Water Surface |
| Weathered Bedrock     |       | 140                   | Mohr-Coulomb      | 0              | 38        | Water Surface |
| Bedrock               |       | 160                   | Infinite strength |                |           | Water Surface |

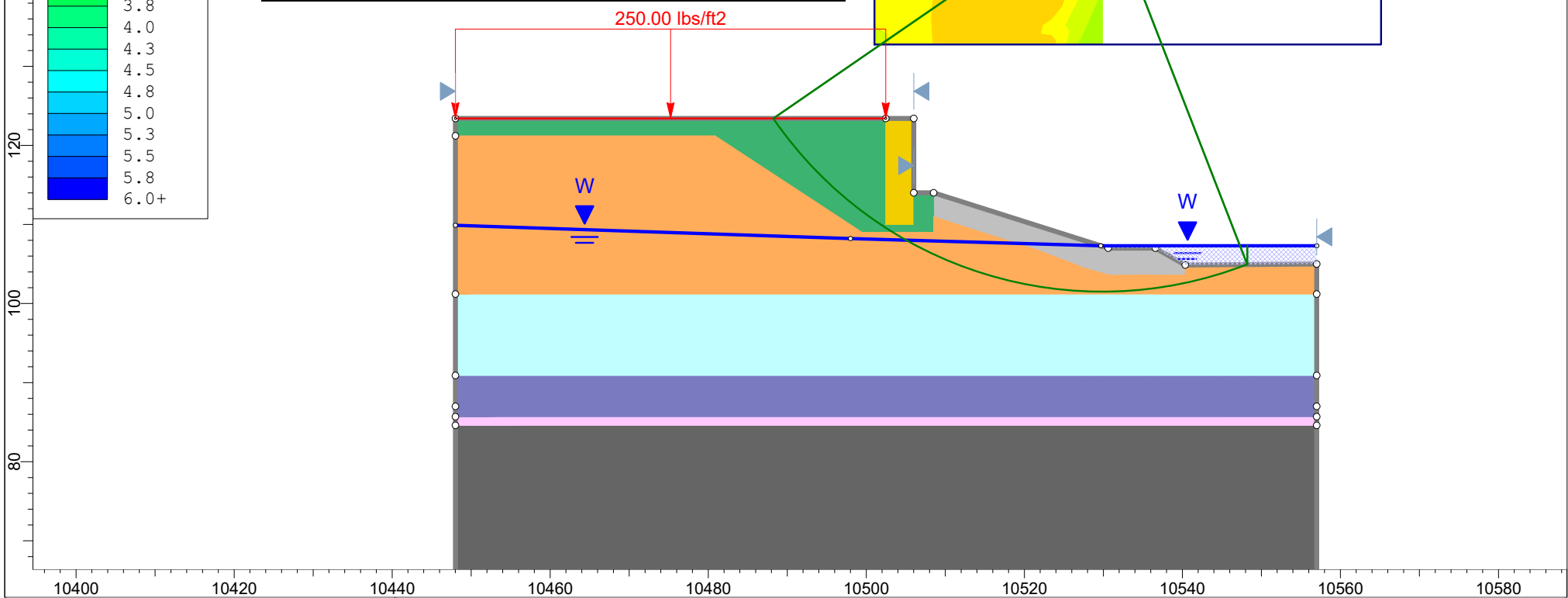
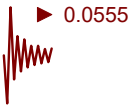
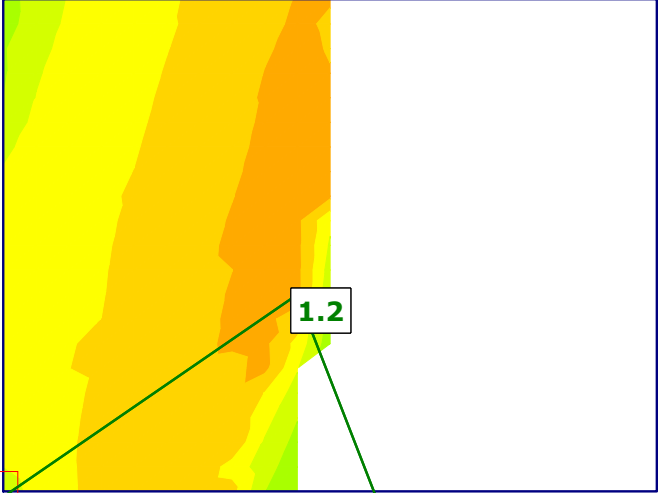


|  |                                            |                                                                              |
|--|--------------------------------------------|------------------------------------------------------------------------------|
|  | Project Boombridge Brook, Greenbush, Maine |                                                                              |
|  | Group Group 1                              | Scenario Master Scenario                                                     |
|  | Drawn By                                   | Company Haley & Aldrich, Inc.                                                |
|  | Date March 2022                            | File Name 2021-0330-HAI-Station 105_00 Longitudinal Global Stability-D1.slmd |

STATION 105+00  
LONGITUDINAL  
SEISMIC

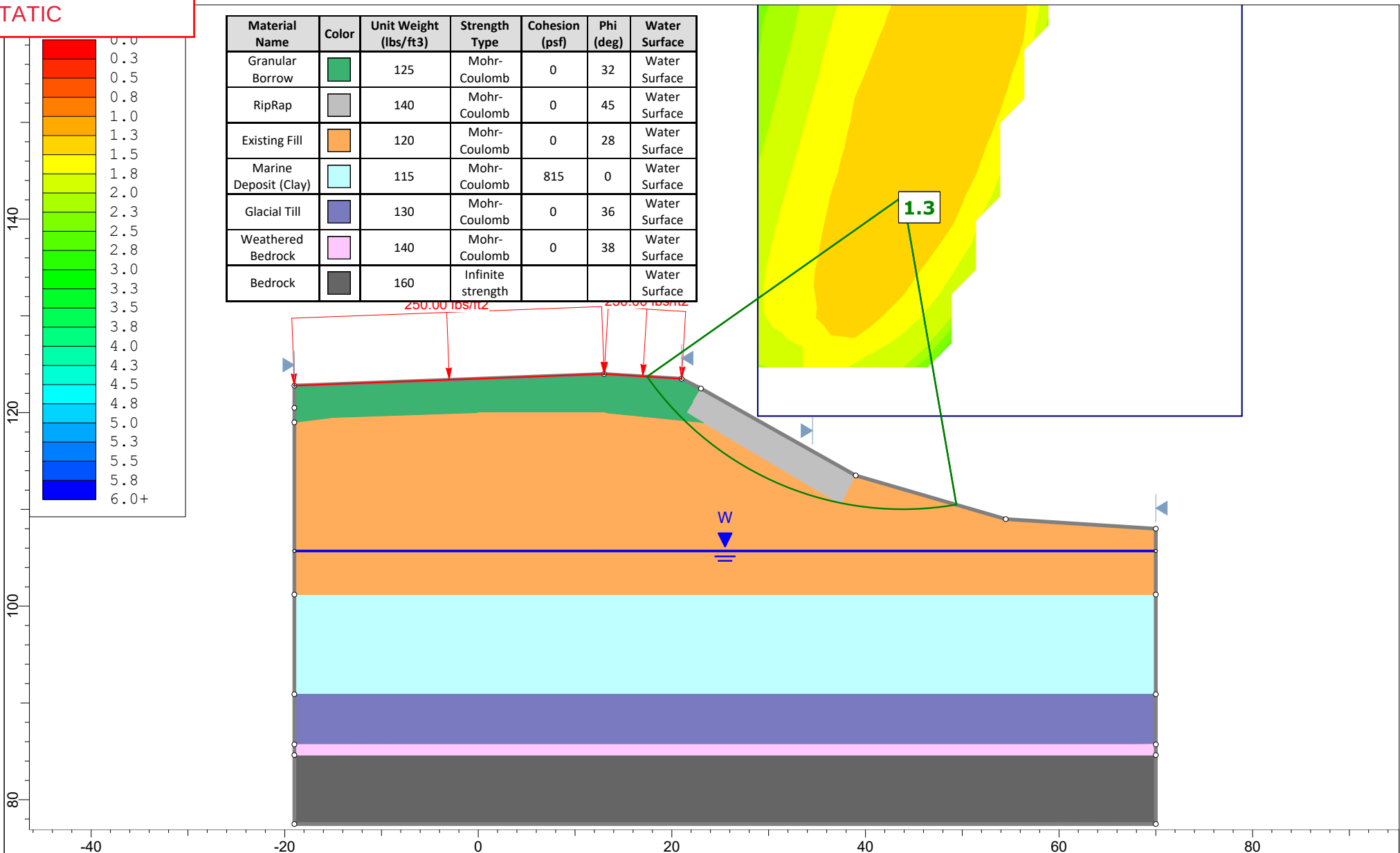


| Material Name         | Color | Unit Weight (lbs/ft3) | Strength Type     | Cohesion (psf) | Phi (deg) | Water Surface |
|-----------------------|-------|-----------------------|-------------------|----------------|-----------|---------------|
| Abutment              |       | 0.01                  | Infinite strength |                |           | Water Surface |
| Granular Borrow       |       | 125                   | Mohr-Coulomb      | 0              | 32        | Water Surface |
| RipRap                |       | 140                   | Mohr-Coulomb      | 0              | 45        | Water Surface |
| Existing Fill         |       | 120                   | Mohr-Coulomb      | 0              | 28        | Water Surface |
| Marine Deposit (Clay) |       | 115                   | Mohr-Coulomb      | 815            | 0         | Water Surface |
| Glacial Till          |       | 130                   | Mohr-Coulomb      | 0              | 36        | Water Surface |
| Weathered Bedrock     |       | 140                   | Mohr-Coulomb      | 0              | 38        | Water Surface |
| Bedrock               |       | 160                   | Infinite strength |                |           | Water Surface |



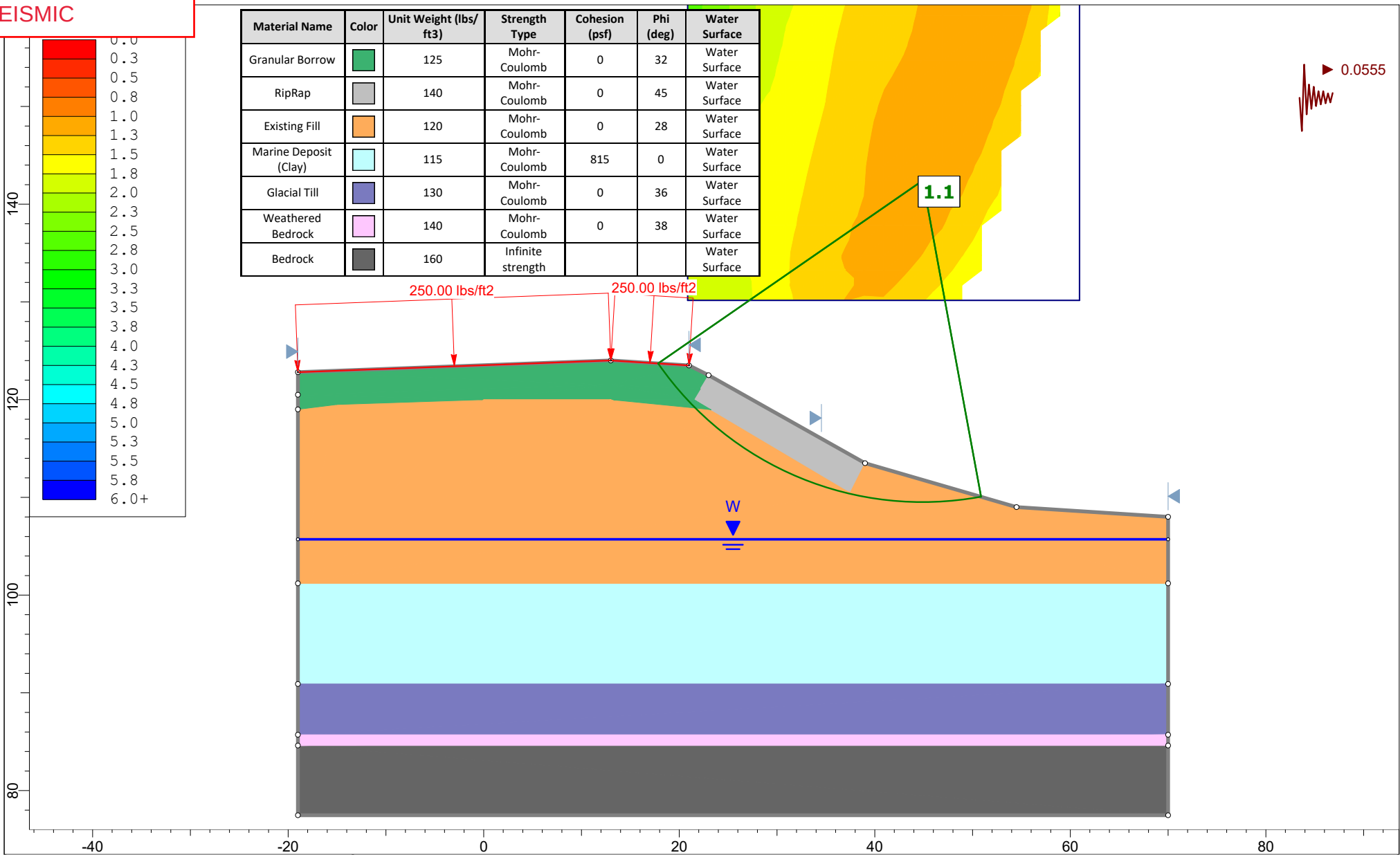
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|--|----------------------|------------|------------------------------------|----------------------------------------------------------------------------|
|  | Project              |            | Boombridge Brook, Greenbush, Maine |                                                                            |
|  | Group                | Group 1    | Scenario                           | Master Scenario                                                            |
|  | Drawn By             |            | Company                            | Haley & Aldrich, Inc.                                                      |
|  | Date                 | March 2022 | File Name                          | 2021-0330-HAI-Station 105_00 Longitudinal Global Stability-Seismic-D1.sldm |
|  | SLIDEINTERPRET 9.020 |            |                                    |                                                                            |

STATION 104+75  
TRANSVERSE  
STATIC



|                                                                                    |          |            |                                    |                                                                   |
|------------------------------------------------------------------------------------|----------|------------|------------------------------------|-------------------------------------------------------------------|
|  | Project  |            | Boombridge Brook, Greenbush, Maine |                                                                   |
|                                                                                    | Group    | Group 1    | Scenario                           | Master Scenario                                                   |
|                                                                                    | Drawn By |            | Company                            | Haley & Aldrich, Inc.                                             |
|                                                                                    | Date     | March 2022 | File Name                          | 2021-0331-HAI-Station 104_75 Transversel Global Stability-D1.slmd |

STATION 104+75  
TRANSVERSE  
SEISMIC



|                                                                                    |          |            |                                    |                                                                          |
|------------------------------------------------------------------------------------|----------|------------|------------------------------------|--------------------------------------------------------------------------|
|  | Project  |            | Boombridge Brook, Greenbush, Maine |                                                                          |
|                                                                                    | Group    | Group 1    | Scenario                           | Master Scenario                                                          |
|                                                                                    | Drawn By |            | Company                            | Haley & Aldrich, Inc.                                                    |
|                                                                                    | Date     | March 2022 | File Name                          | 2021-0331-HAI-Station 104_75 Transverse Global Stability-Seismic-D1.sldm |

## Settlement

|          |                                                            |
|----------|------------------------------------------------------------|
| Client:  | Maine Department of Transportation                         |
| Project: | US Route 2 Bridge over Boombridge Brook - Greenbush, Maine |
| Subject: | Bridge Abutment Settlement                                 |

**PROBLEM STATEMENT & OBJECTIVE**

Calculate the settlement for the proposed bridge abutments over Boombridge Brook.

**REFERENCES**

1. Settle3D version 4.0 by RocScience.

**AVAILABLE INFORMATION**

1. Current boring logs as noted below.
2. Plan set titled, "Boom Bridge - Boombridge Brook - Greenbush, Penobscot County - Cross Sections," by MaineDOT dated 19 May 2021.

**ASSUMPTIONS**

1. Borings used to determine soil profiles and groundwater depths vary and are noted below.
2. Fill height varies and is noted below.
3. New fill unit weight is assumed to be 130 pcf.
4. Existing soil unit weight is assumed to be 120 pcf in the existing embankment, 115 pcf in the Marine Deposit and 125 pcf in the Glacial Till.
5. Elastic soil moduli estimated after AASHTO 2004 with 2006 interims.
6. Consolidation properties based on laboratory testing performed on borings drilled in the vicinity of the proposed abutments, and on past experience with Marine Deposit clay properties.
7. Settlement was analyzed using the Boussinesq stress computation method.

**SOIL PROFILES AND PROPERTIES (not to scale)**

1. Abutment 1, Sta. 104+75

Based on boring BB-GBB-201

Assumed new fill height = 5 ft →  $\gamma = 0.625$  ksf  
 Groundwater table El. = 111.7 ft (assume water at ground surface based on BB-GBB-201)  
 Ground surface at proposed abutment = El. 120

| DEPTH (ft) |                                             | ELEVATION (ft) |                 |
|------------|---------------------------------------------|----------------|-----------------|
| 0          | <b>Existing Embankment</b>                  | 120            | G.S.<br>El. 120 |
| 8          | <b>Fill</b>                                 | 112            | G.W.<br>111.8   |
| 15.2       |                                             | 104.8          |                 |
|            | <b>Marine Deposit CLAY</b>                  |                |                 |
|            | $\gamma = 115$ pcf                          |                |                 |
|            | OCR = 6.9                                   |                |                 |
|            | $C_c = 0.23$                                |                |                 |
|            | $C_r = 0.04$                                |                |                 |
|            | $C_v = 3 \times 10^{-6}$ ft <sup>2</sup> /s |                |                 |
|            | $c_{\alpha E} = 0.004$                      |                |                 |
| 28.9       |                                             | 91.1           |                 |
|            | <b>Glacial Till</b>                         |                |                 |
|            | $\gamma = 125$ pcf                          |                |                 |
| 31.8       | <b>SAND</b>                                 | 88.2           |                 |
|            | E = 600 ksf                                 |                |                 |

Client: Maine Department of Transportation

Date: 1-Apr-2020

Project: US Route 2 Bridge over Boombridge Brook - Greenbush, Maine

Computed by: TPJ

Subject: Bridge Abutment Settlement

Checked by: JAD

### SOIL PROFILES AND PROPERTIES (not to scale), continued

#### 1. Abutment 2, Sta. 106+25

Based on boring BB-GBB-102

Assumed new fill height = 3 ft →  $\gamma = 0.375$  ksf

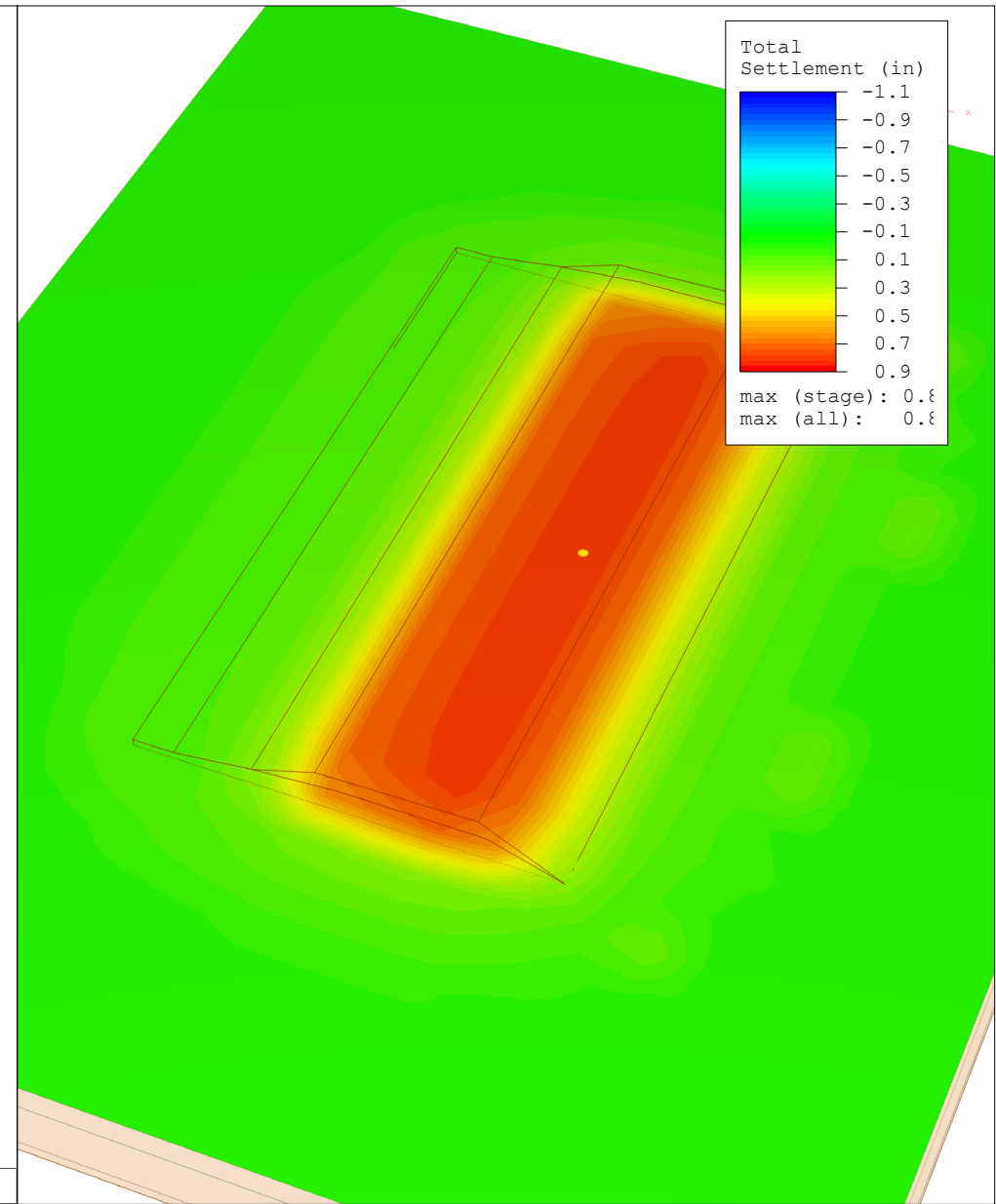
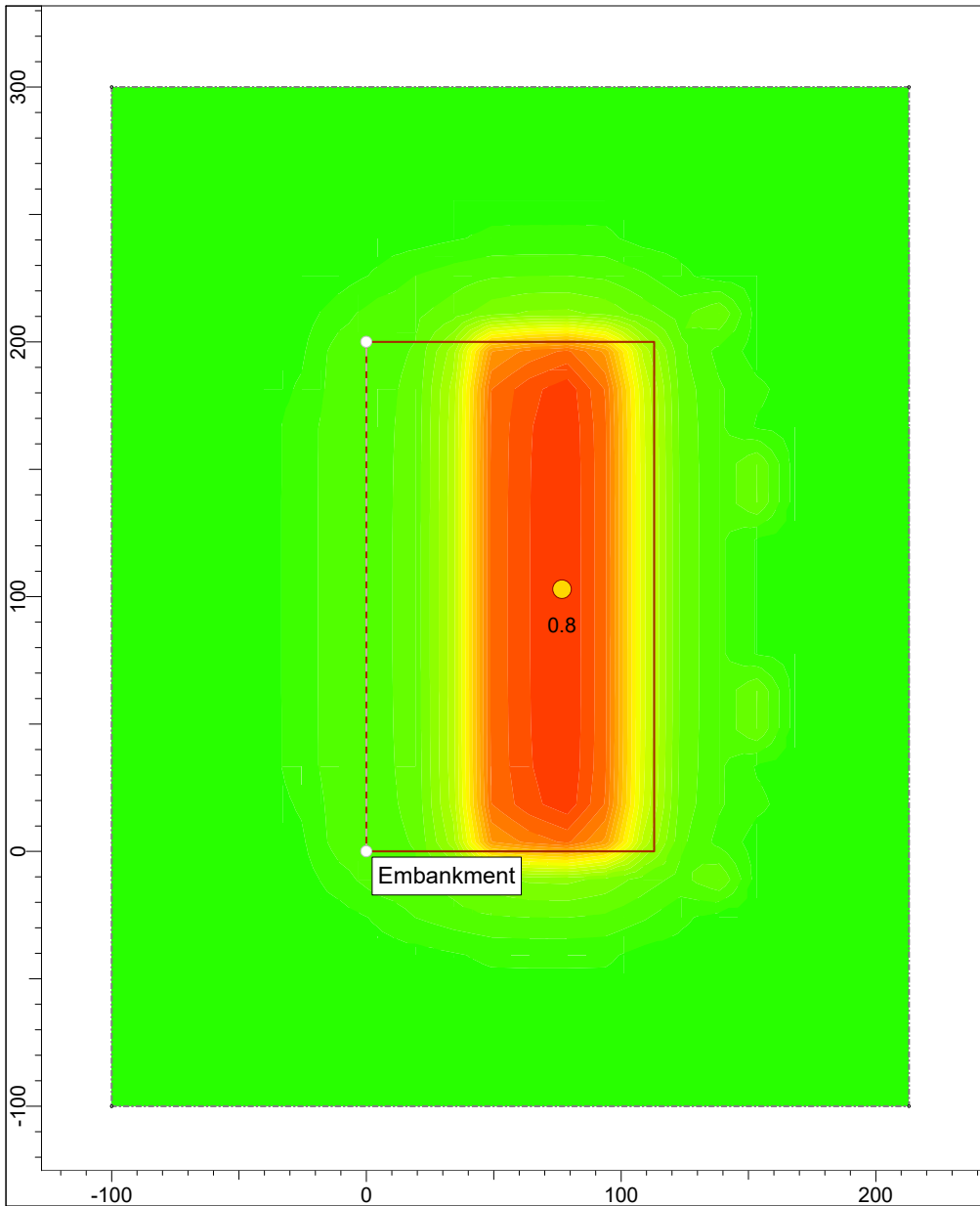
Groundwater table El. = 109.8 ft (assume water at ground surface based on BB-GBB-102)

Ground surface at proposed abutment = El. 119.8

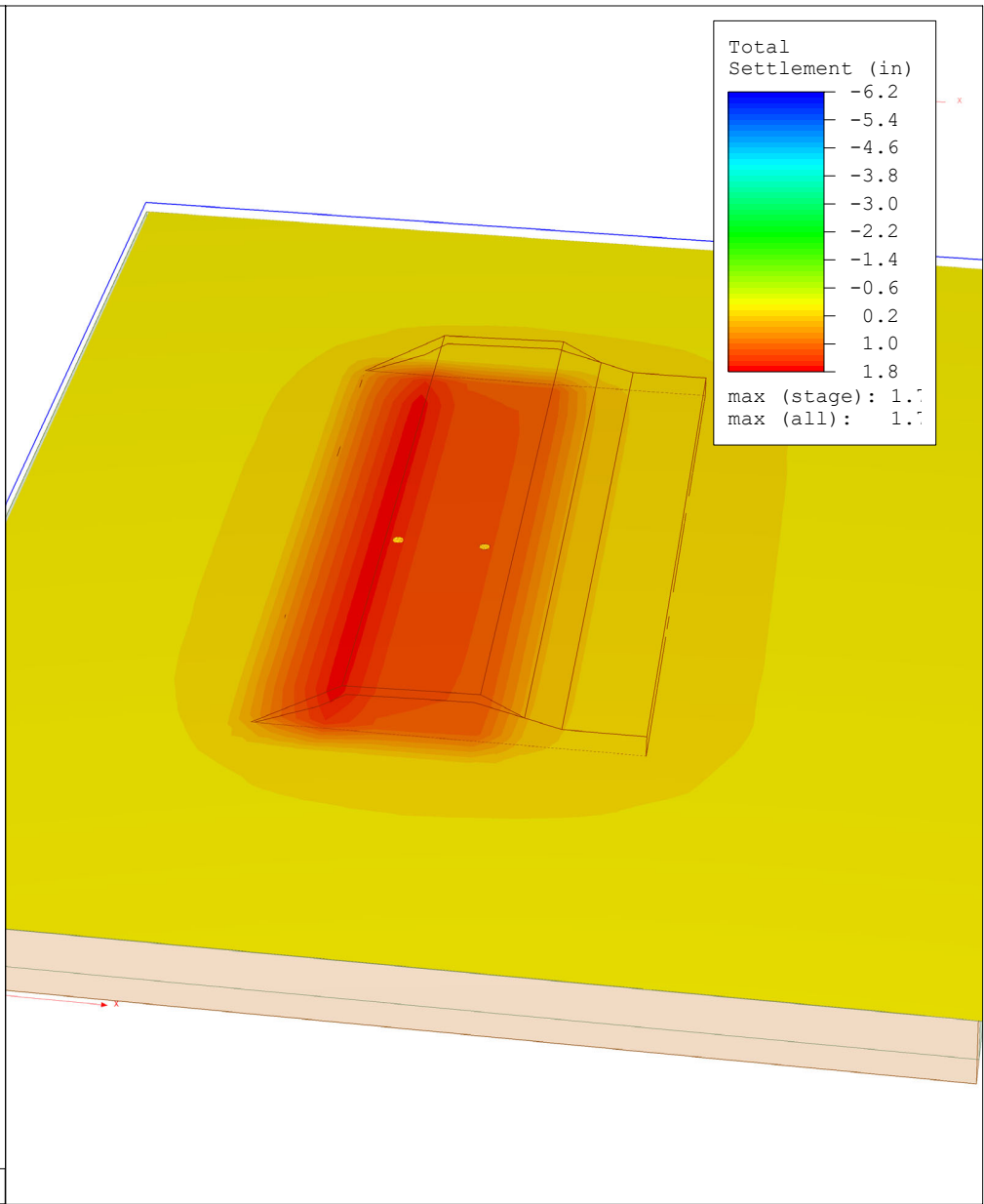
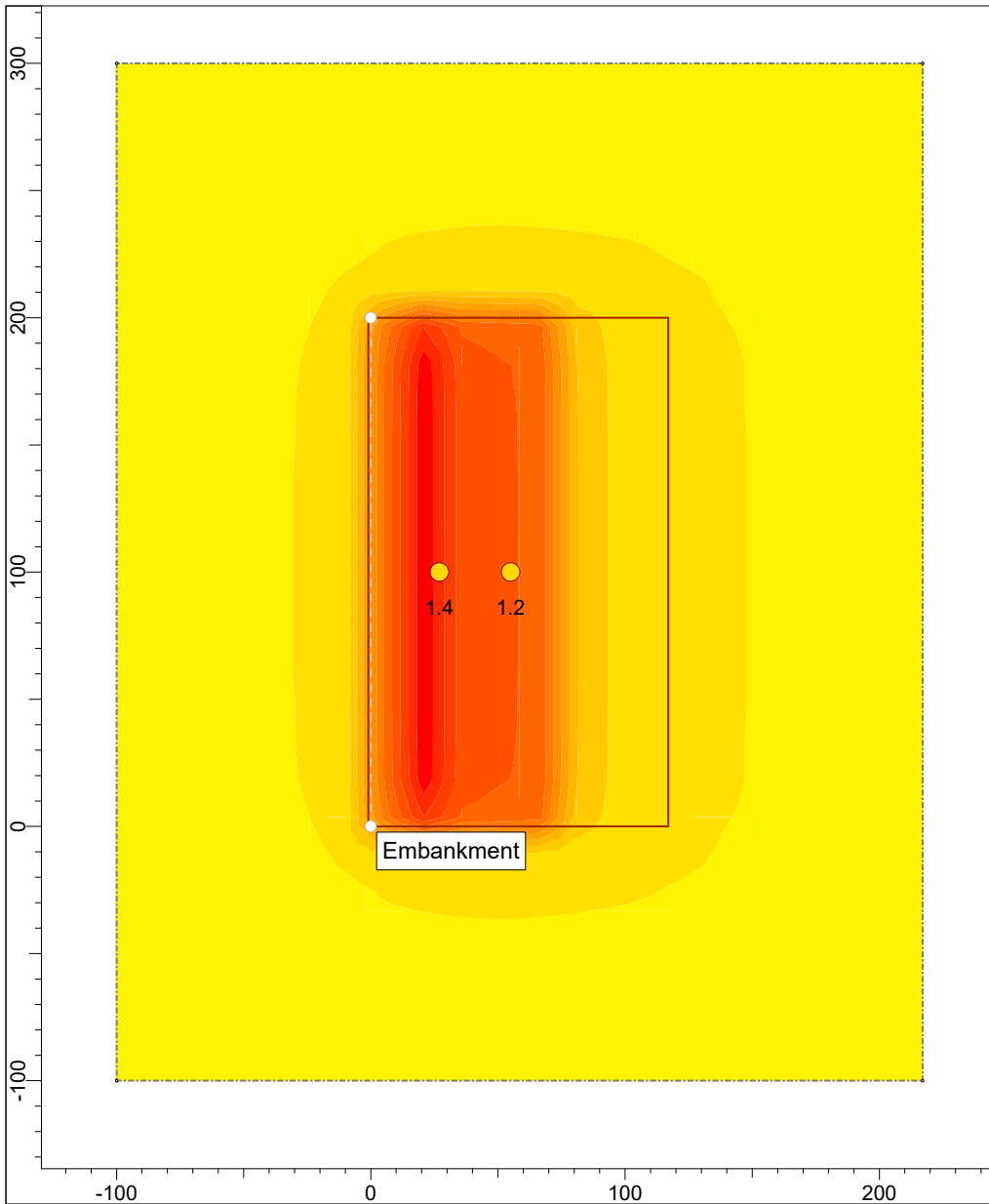
| DEPTH (ft) |                                                                                                                                                                          | ELEVATION (ft) |         |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------|
| 0          | Existing Embankment<br>$\gamma = 120$ pcf                                                                                                                                | 119.8          | G.S.    |
| 113.8      |                                                                                                                                                                          | 106            | El. 120 |
|            | Marine Deposit<br>CLAY<br>$\gamma = 115$ pcf<br>OCR = 2.6<br>$C_c = 0.13$<br>$C_r = 0.02$<br>$C_v = 1 \times 10^{-6}$ ft <sup>2</sup> /s<br>$c_{\alpha\epsilon} = 0.006$ |                | G.W.    |
| 27.3       |                                                                                                                                                                          | 92.5           | 109.8   |
| 35.9       | Glacial Till<br>SAND<br>$\gamma = 125$ pcf<br>E = 600 ksf                                                                                                                | 83.9           |         |

### SUMMARY OF RESULTS

| Structure  | Station | Elastic Settlement (in.) | Primary Consolidation Settlement (in.) | Secondary Consolidation Settlement (in.) | Total Settlement (in.) |
|------------|---------|--------------------------|----------------------------------------|------------------------------------------|------------------------|
| Abutment 1 | 104+75  | 0.3                      | 0.4                                    | 0.1                                      | 0.8                    |
| Abutment 2 | 273+50  | 0.1                      | 1.2                                    | 0.1                                      | 1.4                    |



|                                                                                    |                      |  |            |                                                     |                                                    |
|------------------------------------------------------------------------------------|----------------------|--|------------|-----------------------------------------------------|----------------------------------------------------|
|  | Project              |  |            | Boom Bridge over Boombridge Brook, Greenbush, Maine |                                                    |
|                                                                                    | Analysis Description |  |            | Abutment 1 Settlement                               |                                                    |
|                                                                                    | Drawn By             |  |            | Company                                             | Haley & Aldrich, Inc.                              |
|                                                                                    | Date                 |  |            | File Name                                           | 2021-1203-HAI-Greenbush-Settle3D-Abutment 1-D2.s3z |
| SETTLE3 5.013                                                                      |                      |  | April 2022 |                                                     |                                                    |



|                                                                                    |                      |           |                                                                |
|------------------------------------------------------------------------------------|----------------------|-----------|----------------------------------------------------------------|
|  | Project              |           | Boom Bridge over Boombridge Brook, Greenbush, Maine            |
|                                                                                    | Analysis Description |           | Abutment 2 Settlement                                          |
|                                                                                    | Drawn By             | Company   | Haley & Aldrich                                                |
|                                                                                    | Date                 | File Name | 2021-1203-HAI-Greenbush-Settle3D-Abutment 2-D2.s3z (Recovered) |

## **Pile Structural Resistance**

**PROBLEM STATEMENT AND OBJECTIVE**

Calculate the pile geotechnical resistance in axial compression (structural resistance) for Abutments 1 and 2.

**REFERENCES**

- 1. AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020.

**ASSUMPTIONS**

- 1. Steel H-pile HP14X89 and HP14x117 were considered for the structural evaluations.
- 2. A pile yield stress of 50 ksi was considered for the structural resistance evaluations.
- 3. The pile axial structural resistance was evaluated assuming a full steel H pile section (no corrosion).
- 4. The pile effective length is 0 ft for the structural axial resistance calculations. The calculated resistance presented only addresses axial resistance. If the piles are subjected to lateral loads then the structural resistance under combined axial load and flexure should also be evaluated by others.

PILE GEOTECHNICAL RESISTANCE IN AXIAL COMPRESSION (STRUCTURAL RESISTANCE) - AASHTO LRFD

10.7.3.2 - Point Bearing Piles on Rock  
10.7.3.2.3 - Piles Driven to Hard Rock  
The nominal resistance of piles driven to point bearing on hard rock where pile penetrtrion into the rock formation is minimal is controlled by the structural limit state. The nominal resistance shall not exceed the values obtained from Section 6.9.4.1 with the resistance factors specified in Section 6.5.4.2 and 6.15 for severe driving conditions.

10.7.3.13 - Pile Structural Resistance  
10.7.3.13.1 - Steel Piles  
The nominal axial compression resistance in the structural limit state for piles loaded in compression shall be as specified in Section 6.9.4.1 for non composite piles and Section 6.9.5.1 for composite piles.  
If the pile is fully embedded,  $\lambda$  in Equation 6.9.5.1-1 shall be taken as zero.  
The nominal axial resistance of horizontally unsupported noncomposite piles that extend above the ground surface in air or water shall be determined from Equations 6.9.4.1.1-1 or 6.9.4.1.1-2.  
The nominal axial resistance of horizontally unsupported composite piles that extend above the ground surface in air or water shall be determined from Equations 6.9.5.1-1 or 6.9.5.1-2.  
The effective length of laterally unsupported piles should be determined based on the provisions in Section 10.7.3.13.4.  
The resistance factors for the compression limit state are specified in Section 6.5.4.2.

6.9.4 - Noncomposite Members  
6.9.4.1 - Nominal Compressive Resistance      If  $\frac{P_0}{P_e} \leq 2.25$ , then  $P_n = P_0 * (0.658^{\frac{P_0}{P_e}})$       6.9.4.1.1-1      otherwise  $P_n = 0.877P_e$       6.9.4.1.1-2

where  
 $A_g$  = gross cross-sectional area of the member  
 $F_y$  = specified minimum yield strength  
 $P_e$  = elastic critical buckling resistance determined as specified in Article 6.9.4.1.2 for flexural buckling, and as specified in Article 6.9.4.1.3 for torsional buckling or flexural-torisonal buckling as applicable  
 $P_0$  = nominal yield resistance =  $F_y A_g$

6.9.4.1.2 - Elastic Flexural Buckling Resistance  
The elastic critical buckling resistance,  $P_e$ , based on flexural buckling shall be taken as       $P_e = \frac{\pi^2 E}{(\frac{Kl}{r_s})^2} A_g$       6.9.4.1.2-1

where  
 $A_g$  = gross cross-sectional area of the member  
 $K$  = effective length factor in the plane of buckling determined as specified in Article 4.6.2.5  
 $l$  = unbraced length in the plane of buckling  
 $r_s$  = radius of gyration about the axis normal to the plane of buckling

STRUCTURAL AXIAL RESISTANCE CALCULATIONS (STRENGTH LIMIT STATE)

| Pile Section | Gross Section Area<br><br>$A_g$<br>(in <sup>2</sup> ) | Corrosion Allowance<br><br>(in) | Effective Gross Area<br><br>$A_{eff}$<br>(in <sup>2</sup> ) | Effective Length Factor<br><br>$K$ | Unbraced Length<br><br>$l$<br>(ft) | Yield Stress<br><br>$f_y$<br>(ksi) | Elastic Modulus<br><br>$E$<br>(ksi) | Pile Radius of Gyration<br><br>$r_{y-y}$<br>(in) | Pile Radius of Gyration<br><br>$r_{x-x}$<br>(in) | $P_0$<br><br>(kips) | $P_e$<br><br>(kips) | $P_0/P_e$ | $P_n$<br><br>(kips) | $\phi$<br>(Strength Limit State) | $\phi P_n$<br><br>(kips) |
|--------------|-------------------------------------------------------|---------------------------------|-------------------------------------------------------------|------------------------------------|------------------------------------|------------------------------------|-------------------------------------|--------------------------------------------------|--------------------------------------------------|---------------------|---------------------|-----------|---------------------|----------------------------------|--------------------------|
| HP 14x89     | 26.1                                                  | 0                               | 26.1                                                        | 1.0                                | 0                                  | 50                                 | 29000                               | 3.53                                             | 5.88                                             | 1305                | 6.5E+15             | 2.0E-13   | 1305                | 0.5                              | 652                      |
| HP 14x117    | 34.4                                                  | 0                               | 34.4                                                        | 1.0                                | 0                                  | 50                                 | 29000                               | 3.59                                             | 5.96                                             | 1720                | 8.8E+15             | 2.0E-13   | 1720                | 0.5                              | 860                      |

Note: This calculation only addresses axial resistance, if the piles are subjected to lateral loads, the structural resistance under combined axial load and flexure should also be evaluated by others.  
Note: The effective length was assumed to be zero.

SUMMARY

| Steel H-pile<br>Section | Nominal Pile<br>Geotechnical Resistance<br>in Axial Compression<br>(kips) | Factored Pile Geotechnical Resistance<br>in Axial Compression (kips) |                                           |                                          |
|-------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------|------------------------------------------|
|                         |                                                                           | Service<br>Limit State<br>( $\phi=1.0$ )                             | Strength<br>Limit State<br>( $\phi=0.5$ ) | Extreme<br>Limit State<br>( $\phi=1.0$ ) |
| HP 14x89                | 1,305                                                                     | 1,305                                                                | 652                                       | 1,305                                    |
| HP 14x117               | 1,720                                                                     | 1,720                                                                | 860                                       | 1,720                                    |

NOTES:

1. Piles are driven to hard rock therefore the piles are governed by the structural resistance (geotechnical resistance in axial compression) based on Section 10.7.3.2.3.
2. The structural resistance was calculated from Section 6.9.4.1 for noncomposite piles as referenced from Section 10.7.3.13.
3. The calculated resistance presented above only addresses axial resistance. If the piles are subjected to lateral loads then the structural resistance under combined axial load and flexure should also be evaluated by others.
4. The effective length used in the evaluation was assumed to be zero.
5. A resistance factor of 0.5 was selected for the Strength Limit State from Section 6.5.4.2 for Hpiles subjected to severe driving conditions where the use of a pile tip is necessary.

**Downdrag**

|          |                                                     |
|----------|-----------------------------------------------------|
| Client:  | Fuss & O'Neill                                      |
| Project: | Boom Bridge over Boombridge Brook, Greenbush, Maine |
| Subject: | Downdrag                                            |

**PROBLEM STATEMENT AND OBJECTIVE**

Evaluate the downdrag load for steel HP14x89 and HP14x117 piles at Abutments 1 and 2.

**AVAILABLE INFORMATION**

1. 50% progress plan set titled, "Greenbush Penobscot County, Boom Bridge over Boombridge Brook, US Route 2, Project No. 21727.00, Project Length 0.152 mi., Bridge No. 3587."
2. Haley & Aldrich boring logs BB-GBB-101 and BB-GBB-102 dated March 2017 and BB-GBB-201 and BB-GBB-202 dated June 2021. Borings BB-GBB-101 and BB-GBB-201 are at Abutment 1 and borings BB-GBB-102 and BB-GBB-202 are at Abutment 2.

**ASSUMPTIONS**

1. Piles will be driven to the top of bedrock. No pile movement.
2. Piles will be driven from approximate El. 110 for Abutment 1 and El. 109 for Abutment 2.
3. Nominal unit side for each layer were determined in a separate calculation using the Beta method (static method).
4. Soil settlements range from 0.8 to 1.4 in. The downdrag zone is from the bottom of the pile cap to the bottom of the marine clay.
5. Box perimeter of HP14x89 and HP14x117 were considered.
6. Stratum changes are interpreted as the middle between borings BB-GBB-101 and BB-GBB-201 for Abutment 1 and BB-GBB-102 and BB-GBB-202 for Abutment 2.

**REFERENCES**

1. 9th Edition of AASHTO LRFD Bridge Design Specifications, 2020.
2. American Institute of Steel Construction (AISC) Manual, 13th Edition, 2005.

**CALCULATIONS**

Abutment 1 - HP14x89

| Material      | Top Elevation | Bottom Elevation | Nominal Unit Side Resistance (psf) | Pile Perimeter (ft) | Unfactored Drag Load (kips) | Load Factor | Factored Drag Load (kips) |
|---------------|---------------|------------------|------------------------------------|---------------------|-----------------------------|-------------|---------------------------|
| Existing Fill | 110           | 103              | 76                                 | 4.75                | 3                           | 1.05        | 3                         |
| Marine Clay   | 103           | 91               | 290                                | 4.75                | 17                          | 1.4         | 23                        |

total 25.8 kips

Abutment 2 - HP14x89

| Material      | Top Elevation | Bottom Elevation | Nominal Unit Side Resistance (psf) | Pile Perimeter (ft) | Unfactored Drag Load (kips) | Load Factor | Factored Drag Load (kips) |
|---------------|---------------|------------------|------------------------------------|---------------------|-----------------------------|-------------|---------------------------|
| Existing Fill | 109           | 103.5            | 59                                 | 4.75                | 2                           | 1.05        | 2                         |
| Marine Clay   | 103.5         | 91               | 260                                | 4.75                | 15                          | 1.4         | 22                        |

total 23.3 kips

# CALCULATIONS

File No.: 127991-003

Sheet: 2 of 2

Client: Fuss & O'Neill

Date: 1-Apr-2022

Project: Boom Bridge over Boombridge Brook, Greenbush, Maine

Computed by: MMB

Subject: Downdrag

Checked by: EAF

## CALCULATIONS

### Abutment 1 - HP14x117

| Material      | Top Elevation | Bottom Elevation | Nominal Unit Side Resistance (psf) | Pile Perimeter (ft) | Unfactored Drag Load (kips) | Load Factor | Factored Drag Load (kips) |
|---------------|---------------|------------------|------------------------------------|---------------------|-----------------------------|-------------|---------------------------|
| Existing Fill | 110           | 103              | 76                                 | 4.85                | 3                           | 1.05        | 3                         |
| Marine Clay   | 103           | 91               | 290                                | 4.85                | 17                          | 1.4         | 24                        |

total 26.3 kips

### Abutment 2 - HP14x117

| Material      | Top Elevation | Bottom Elevation | Nominal Unit Side Resistance (psf) | Pile Perimeter (ft) | Unfactored Drag Load (kips) | Load Factor | Factored Drag Load (kips) |
|---------------|---------------|------------------|------------------------------------|---------------------|-----------------------------|-------------|---------------------------|
| Existing Fill | 109           | 103.5            | 59                                 | 4.85                | 2                           | 1.05        | 2                         |
| Marine Clay   | 103.5         | 91               | 260                                | 4.85                | 16                          | 1.4         | 22                        |

total 23.8 kips

## CONCLUSIONS

| Location   | Factored Downdrag Load (kips) |          |
|------------|-------------------------------|----------|
|            | HP14x89                       | HP14x117 |
| Abutment 1 | 26                            | 26       |
| Abutment 2 | 23                            | 24       |

## **Pile Driveability**

|              |             |
|--------------|-------------|
| File No.:    | 127991-003  |
| Sheet:       | 1 of 3      |
| Date:        | 31-Mar-2022 |
| Computed by: | MMB         |
| Checked by:  | JGD         |

Client: Fuss & O'Neill  
 Project: Boom Bridge over Boombridge Brook, Greenbush, Maine  
 Subject: Pile Driveability for Abutments 1 and 2

**PROBLEM STATEMENT AND OBJECTIVE**

Evaluate the driveability for steel HP14x89 and HP14x117 at Abutments 1 and 2 driven to the top of bedrock.

**AVAILABLE INFORMATION**

1. 50% progress plan set titled, "Greenbush Penobscot County, Boom Bridge over Boombridge Brook, US Route 2, Project No. 21727.00, Project Length 0.152 mi., Bridge No. 3587."
2. Haley & Aldrich boring logs BB-GBB-101 and BB-GBB-102 dated March 2017 and BB-GBB-201 and BB-GBB-202 dated June 2021. Borings BB-GBB-101 and BB-GBB-201 are at Abutment 1 and borings BB-GBB-102 and BB-GBB-202 are at Abutment 2.

**ASSUMPTIONS**

1. Pile steel yield stress is 50 ksi. Maximum driving stress is  $0.9F_y = 45$  ksi.
2. Piles will be driven to the top of bedrock.
3. Piles will be driven from approximate El. 110 for Abutment 1 and El. 109 for Abutment 2.
4. Nominal unit side and end-bearing resistances for each layer were determined in a separate calculation for geotechnical axial resistance using the Beta method (static method).
5. A driveability evaluation for each abutment was performed using the software GRL WEAP 14.
6. The soil profile was determined using borings BB-GBB-101 and BB-GBB-201 for Abutment 1 and borings BB-GBB-102 and BB-GBB-202 for Abutment 2.

**REFERENCES**

1. 9th Edition of AASHTO LRFD Bridge Design Specifications, 2020.
2. GRL WEAP 14
3. American Institute of Steel Construction (AISC) Manual, 13th Edition, 2005.

GENERALIZED SOIL PROFILE AND PROPERTIES - ABUTMENT 1

| Layer No. | Material Name     | Top Elevation | Bottom Elevation | Top Depth | Bottom Depth | Thickness | Nominal Unit Side Resistance | Nominal Unit Side Resistance | Nominal Unit Tip Resistance | Skin Quake | Toe Quake    | Skin Damping | Toe Damping  |
|-----------|-------------------|---------------|------------------|-----------|--------------|-----------|------------------------------|------------------------------|-----------------------------|------------|--------------|--------------|--------------|
|           |                   |               |                  | (ft)      | (ft)         | (ft)      | (psf)                        | (ksf)                        | (ksf)                       | (in.)      | (in.)        | (s/ft)       | (s/ft)       |
| 1         | Existing Fill     | 110           | 103              | 0         | 7            | 7.0       | 0<br>151                     | 0.00<br>0.15                 | 0<br>4                      | 0.1<br>0.1 | 0.23<br>0.23 | 0.1<br>0.1   | 0.15<br>0.15 |
| 2         | Marine Clay       | 103           | 91               | 7         | 19           | 12.0      | 163<br>417                   | 0.16<br>0.42                 | 14<br>14                    | 0.1<br>0.1 | 0.23<br>0.23 | 0.2<br>0.2   | 0.15<br>0.15 |
| 3         | Glacial Till      | 91            | 88               | 19        | 22           | 3.0       | 724<br>866                   | 0.72<br>0.87                 | 55<br>65                    | 0.1<br>0.1 | 0.12<br>0.12 | 0.05<br>0.05 | 0.15<br>0.15 |
| 4         | Weathered Bedrock | 88            | 87               | 22        | 23           | 1.0       | 906<br>963                   | 0.91<br>0.96                 | 100<br>107                  | 0.1<br>0.1 | 0.12<br>0.12 | 0.05<br>0.05 | 0.15<br>0.15 |
| 5         | Bedrock           | 87            | 86.9             | 23        | 23.1         | 0.1       | 0<br>0                       | 0.00<br>0.00                 | 5540<br>5540                | 0.1<br>0.1 | 0.04<br>0.04 | 0.05<br>0.05 | 0.15<br>0.15 |

GENERALIZED SOIL PROFILE AND PROPERTIES - ABUTMENT 2

| Layer No. | Material Name     | Top Elevation | Bottom Elevation | Top Depth | Bottom Depth | Thickness | Nominal Unit Side Resistance | Nominal Unit Side Resistance | Nominal Unit Tip Resistance | Skin Quake | Toe Quake    | Skin Damping | Toe Damping  |
|-----------|-------------------|---------------|------------------|-----------|--------------|-----------|------------------------------|------------------------------|-----------------------------|------------|--------------|--------------|--------------|
|           |                   |               |                  | (ft)      | (ft)         | (ft)      | (psf)                        | (ksf)                        | (ksf)                       | (in.)      | (in.)        | (s/ft)       | (s/ft)       |
| 1         | Existing Fill     | 109           | 103.5            | 0         | 5.5          | 5.5       | 0<br>119                     | 0.00<br>0.12                 | 0<br>3                      | 0.1<br>0.1 | 0.23<br>0.23 | 0.1<br>0.1   | 0.15<br>0.15 |
| 2         | Marine Clay/Silt  | 103.5         | 91               | 5.5       | 18           | 12.5      | 128<br>393                   | 0.13<br>0.39                 | 11<br>11                    | 0.1<br>0.1 | 0.23<br>0.23 | 0.2<br>0.2   | 0.15<br>0.15 |
| 3         | Glacial Till      | 91            | 85               | 18        | 24           | 6.0       | 682<br>966                   | 0.68<br>0.97                 | 51<br>73                    | 0.1<br>0.1 | 0.12<br>0.12 | 0.05<br>0.05 | 0.15<br>0.15 |
| 4         | Weathered Bedrock | 85            | 82               | 24        | 27           | 3.0       | 1011<br>1181                 | 1.01<br>1.18                 | 112<br>131                  | 0.1<br>0.1 | 0.12<br>0.12 | 0.05<br>0.05 | 0.15<br>0.15 |
| 5         | Bedrock           | 82            | 81.9             | 27        | 27.1         | 0.1       | 0<br>0                       | 0.00<br>0.00                 | 5540<br>5540                | 0.1<br>0.1 | 0.04<br>0.04 | 0.05<br>0.05 | 0.15<br>0.15 |

GRL WEAP INPUTS

Hammer Information

|                    |            |
|--------------------|------------|
| Hammer Name        | Delmag D15 |
| Type               | OED        |
| Ram Weight         | 3.3 kips   |
| Rated Energy/Power | 27 kip-ft  |
| Efficiency         | 0.8        |
| Rated Stroke       | 8.2 ft     |

Hammer Cushion Information

|                 |                     |
|-----------------|---------------------|
| Area            | 227 in <sup>2</sup> |
| Elastic Modulus | 530 ksi             |
| Thickness       | 2 in.               |
| C.O.R.          | 0.8                 |
| Stiffness       | 60155.55            |
| Helmet Weight   | 1.9 kips            |

Hammer cushion modeled is manufacturer recommendation provided in GRL WEAP

Pile Information

| Input                             | Pile Size |          |
|-----------------------------------|-----------|----------|
|                                   | HP14x89   | HP14x117 |
| Section Area (in <sup>2</sup> )   | 26.1      | 34.4     |
| Elastic Modulus (ksi)             | 29,000    | 29,000   |
| Spec Weight (lb/ft <sup>3</sup> ) | 492       | 492      |
| Toe Area (in <sup>2</sup> )       | 26.1      | 34.4     |
| Perimeter (ft)                    | 4.75      | 4.85     |
| Pile Size (in.)                   | 14        | 14       |

Client: 

Fuss & O'Neill

Computed by: 

MMB

Checked by: 

JGD

Sheet: 

2 of 3

HALEYALDRICH

File No.: 

127991-003

Date: 

31-Mar-2022

Project: 

Boom Bridge over Boombridge Brook, Greenbush, Maine

Subject: 

Pile Driveability for Abutments 1 and 2

SUMMARY AND CONCLUSIONS

| Substructure<br>Location | Pile<br>Type | Pile<br>Embedment<br>Depth | Pile Tip<br>Elevation | Hammer<br>Type | Nominal<br>End<br>Bearing<br>Resistance | Rated<br>Hammer<br>Energy | Penetration<br>Resistance |
|--------------------------|--------------|----------------------------|-----------------------|----------------|-----------------------------------------|---------------------------|---------------------------|
|                          |              | (ft)                       |                       |                | (kips)                                  | (kip-ft)                  | (blows/in)                |
| Abutment 1               | HP14x89      | 23                         | 87                    | Delmag D15 OED | 1004                                    | 27                        | refusal                   |
| Abutment 2               | HP14x89      | 27                         | 82                    | Delmag D15 OED | 1004                                    | 27                        | refusal                   |
| Abutment 1               | HP14x117     | 23                         | 87                    | Delmag D15 OED | 1323                                    | 27                        | refusal                   |
| Abutment 2               | HP14x117     | 27                         | 82                    | Delmag D15 OED | 1323                                    | 27                        | refusal                   |

Client: Fuss & O'Neill

Computed by: MMB

Checked by: JGD

Sheet: 3 of 3

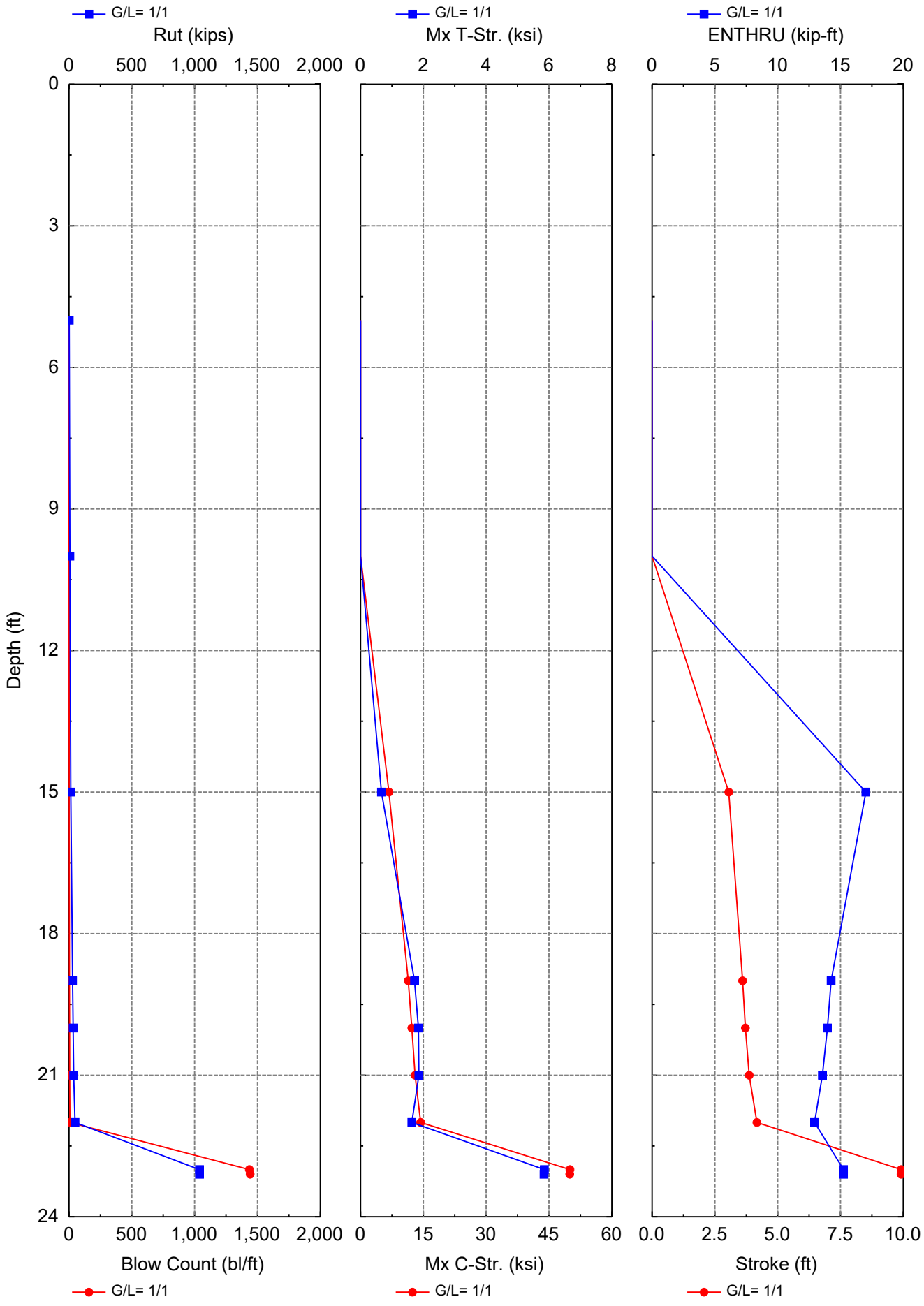
HALEYALDRICH

File No.: 127991-003

Date: 31-Mar-2022

Project: Boom Bridge over Boombridge Brook, Greenbush, Maine

Subject: Pile Driveability for Abutments 1 and 2



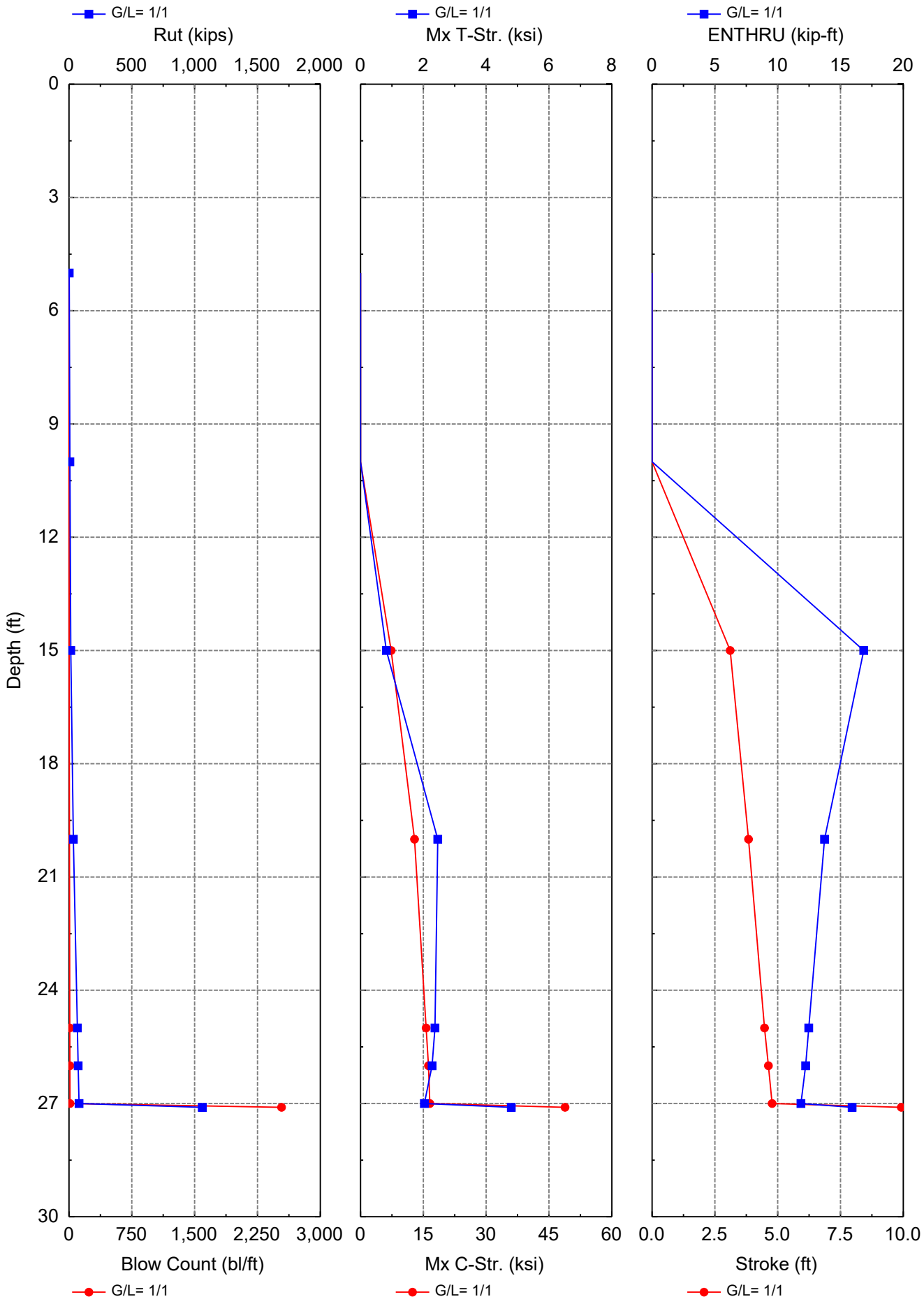
Gain/Loss Factor at Shaft/Toe = 1.000/1.000

| Depth<br>ft | Rut<br>kips | Rshaft<br>kips | Rtoe<br>kips | Blow CtMx<br>bl/ft | C-StrMx<br>ksi | T-Str.<br>ksi | Stroke<br>ft | ENTHRU<br>kip-ft | Hammer<br>- |
|-------------|-------------|----------------|--------------|--------------------|----------------|---------------|--------------|------------------|-------------|
| 5.0         | 1.8         | 1.3            | 0.5          | 0.3                | 0.000          | 0.000         | 8.21         | 0.0              | D 15        |
| 10.0        | 7.5         | 5.2            | 2.4          | 0.0                | 0.000          | 0.000         | 0.00         | 0.0              | D 15        |
| 15.0        | 14.1        | 11.7           | 2.4          | 1.7                | 6.790          | 0.667         | 3.05         | 17.0             | D 15        |
| 19.0        | 28.8        | 18.8           | 10.0         | 3.9                | 11.403         | 1.719         | 3.60         | 14.3             | D 15        |
| 20.0        | 32.9        | 22.3           | 10.6         | 4.5                | 12.240         | 1.844         | 3.71         | 14.0             | D 15        |
| 21.0        | 37.2        | 26.1           | 11.2         | 5.3                | 13.038         | 1.857         | 3.86         | 13.6             | D 15        |
| 22.0        | 48.2        | 30.0           | 18.1         | 7.2                | 14.366         | 1.633         | 4.17         | 12.9             | D 15        |
| 23.0        | 1038.4      | 34.4           | 1003.9       | 1435.4             | 49.997         | 5.851         | 9.91         | 15.2             | D 15        |
| 23.1        | 1038.4      | 34.4           | 1003.9       | 1442.1             | 49.961         | 5.841         | 9.91         | 15.2             | D 15        |

Total driving time: 20 minutes; Total Number of Blows: 896 (starting at penetration 5.0 ft)

nominal end  
bearing  
resistance

refusal will be  
encountered on  
top of bedrock



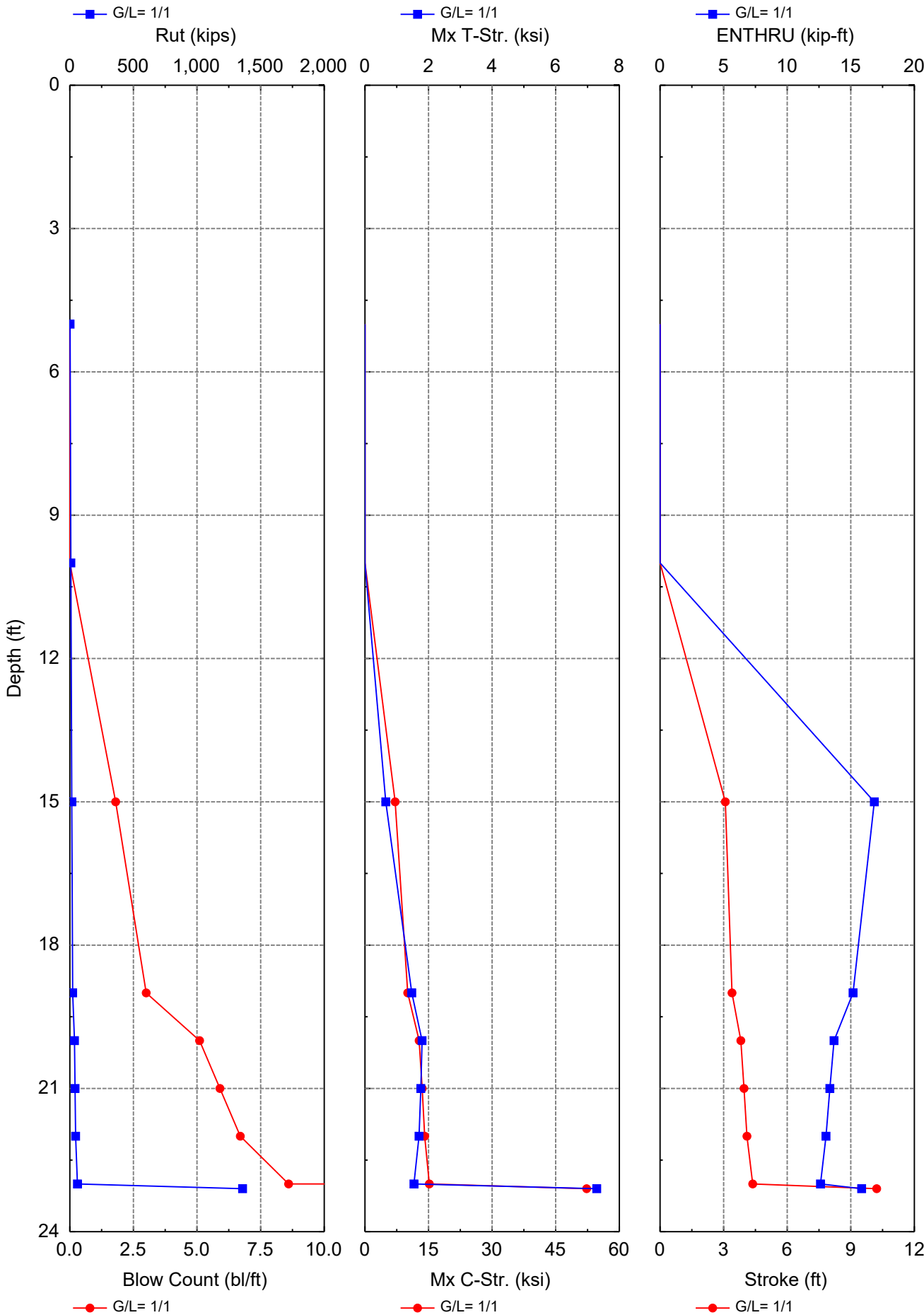
Gain/Loss Factor at Shaft/Toe = 1.000/1.000

| Depth<br>ft | Rut<br>kips | Rshaft<br>kips | Rtoe<br>kips | Blow CtMx<br>bl/ft | C-StrMx<br>ksi | T-Str.<br>ksi | Stroke<br>ft | ENTHRU<br>kip-ft | Hammer<br>- |
|-------------|-------------|----------------|--------------|--------------------|----------------|---------------|--------------|------------------|-------------|
| 5.0         | 1.8         | 1.3            | 0.5          | 0.3                | 0.000          | 0.000         | 8.21         | 0.0              | D 15        |
| 10.0        | 7.3         | 5.3            | 2.0          | 0.0                | 0.000          | 0.000         | 0.00         | 0.0              | D 15        |
| 15.0        | 13.9        | 11.9           | 2.0          | 1.7                | 7.314          | 0.822         | 3.11         | 16.8             | D 15        |
| 20.0        | 34.5        | 23.9           | 10.6         | 4.8                | 12.902         | 2.457         | 3.84         | 13.7             | D 15        |
| 25.0        | 66.9        | 45.4           | 21.4         | 9.1                | 15.659         | 2.371         | 4.48         | 12.5             | D 15        |
| 26.0        | 73.2        | 50.7           | 22.6         | 10.4               | 16.220         | 2.277         | 4.63         | 12.2             | D 15        |
| 27.0        | 79.9        | 56.1           | 23.7         | 11.7               | 16.549         | 2.032         | 4.78         | 11.9             | D 15        |
| 27.1        | 1060.2      | 56.1           | 1004.1       | 2537.1             | 48.825         | 4.799         | 9.92         | 15.9             | D 15        |

Total driving time: 4 minutes; Total Number of Blows: 204 (starting at penetration 5.0 ft)

nominal end  
bearing  
resistance

refusal will be  
encountered on  
top of bedrock



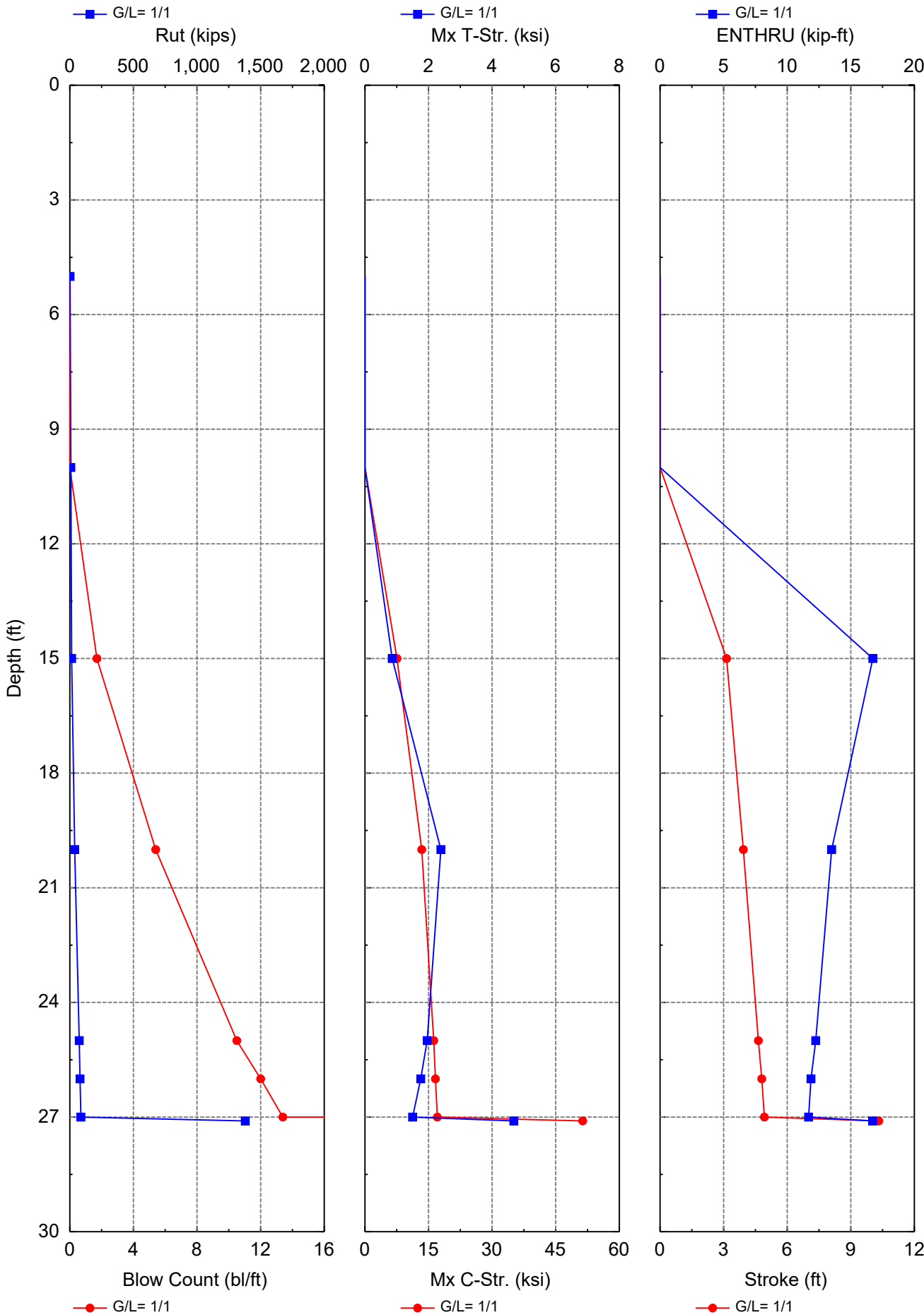
Gain/Loss Factor at Shaft/Toe = 1.000/1.000

| Depth<br>ft | Rut<br>kips | Rshaft<br>kips | Rtoe<br>kips | Blow CtMx<br>bl/ft | C-StrMx<br>ksi | T-Str.<br>ksi | Stroke<br>ft | ENTHRU<br>kip-ft | Hammer<br>- |
|-------------|-------------|----------------|--------------|--------------------|----------------|---------------|--------------|------------------|-------------|
| 5.0         | 1.9         | 1.3            | 0.7          | 0.3                | 0.000          | 0.000         | 8.21         | 0.0              | D 15        |
| 10.0        | 8.3         | 5.2            | 3.1          | 0.0                | 0.000          | 0.000         | 0.00         | 0.0              | D 15        |
| 15.0        | 14.8        | 11.7           | 3.1          | 1.8                | 7.123          | 0.654         | 3.08         | 16.8             | D 15        |
| 19.0        | 21.9        | 18.8           | 3.1          | 3.0                | 10.092         | 1.474         | 3.40         | 15.2             | D 15        |
| 20.0        | 36.3        | 22.3           | 13.9         | 5.1                | 12.790         | 1.796         | 3.81         | 13.7             | D 15        |
| 21.0        | 40.8        | 26.1           | 14.7         | 5.9                | 13.512         | 1.757         | 3.96         | 13.4             | D 15        |
| 22.0        | 45.6        | 30.0           | 15.5         | 6.7                | 14.083         | 1.701         | 4.10         | 13.1             | D 15        |
| 23.0        | 60.0        | 34.4           | 25.6         | 8.6                | 15.181         | 1.542         | 4.37         | 12.6             | D 15        |
| 23.1        | 1357.6      | 34.4           | 1323.2       | 9999.0             | 52.287         | 7.290         | 10.22        | 15.9             | D 15        |

Refusal occurred; no driving time output possible.

nominal end  
bearing  
resistance

refusal will be  
encountered on  
top of bedrock



| Gain/Loss Factor at Shaft/Toe = 1.000/1.000 |        |        |        |         |          |           |        |        |        |
|---------------------------------------------|--------|--------|--------|---------|----------|-----------|--------|--------|--------|
| Depth                                       | Rut    | Rshaft | Rtoe   | Blow Ct | Mx C-Str | Mx T-Str. | Stroke | ENTHRU | Hammer |
| ft                                          | kips   | kips   | kips   | bl/ft   | ksi      | ksi       | ft     | kip-ft | -      |
| 5.0                                         | 1.9    | 1.3    | 0.7    | 0.3     | 0.000    | 0.000     | 8.21   | 0.0    | D 15   |
| 10.0                                        | 8.0    | 5.3    | 2.6    | 0.0     | 0.000    | 0.000     | 0.00   | 0.0    | D 15   |
| 15.0                                        | 14.5   | 11.9   | 2.6    | 1.7     | 7.552    | 0.857     | 3.14   | 16.7   | D 15   |
| 20.0                                        | 37.9   | 23.9   | 13.9   | 5.4     | 13.392   | 2.388     | 3.93   | 13.5   | D 15   |
| 25.0                                        | 73.7   | 45.4   | 28.3   | 10.5    | 16.226   | 1.957     | 4.64   | 12.2   | D 15   |
| 26.0                                        | 80.4   | 50.7   | 29.8   | 12.0    | 16.616   | 1.755     | 4.80   | 11.9   | D 15   |
| 27.0                                        | 87.4   | 56.1   | 31.3   | 13.4    | 17.070   | 1.499     | 4.92   | 11.7   | D 15   |
| 27.1                                        | 1379.6 | 56.1   | 1323.4 | 9999.0  | 51.357   | 4.683     | 10.32  | 16.7   | D 15   |

Refusal occurred; no driving time output possible.

nominal end  
bearing  
resistance

refusal will be  
encountered on  
top of bedrock

## **Lateral Soil Resistance**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                 | <b>CALCULATIONS</b> |              | File No.:         | 127991-003                       |                            |                              |      |              |                   |                                  |                            |                              |   |          |              |     |   |     |    |    |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |       |          |      |              |                   |                                  |                            |                              |   |             |              |     |   |     |    |     |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |
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---|------|------|------|---|---|---|-------|----------|------|--------------|-------------------|----------------------------------|----------------------------|------------------------------|---|-------------|--------------|-----|---|-----|----|-----|---|------|--------------|-----|---|-----|----|----|---|-------------|----------|-------|------|-----|------|---|---|--------------|--------------|------|------|-----|----|-----|---|------|------|------|------|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                 |                     |              | Sheet:            | 1 of 2                           |                            |                              |      |              |                   |                                  |                            |                              |   |          |              |     |   |     |    |    |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |       |          |      |              |                   |                                  |                            |                              |   |             |              |     |   |     |    |     |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |
| Client:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Fuss & O'Neill                                  |                     |              | Date:             | 25AUG2021                        |                            |                              |      |              |                   |                                  |                            |                              |   |          |              |     |   |     |    |    |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |       |          |      |              |                   |                                  |                            |                              |   |             |              |     |   |     |    |     |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |
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                                                                                                                                                                                                                                                                                                                                                                                                                               | Boom Bridge, Greenbush, Penobscot County, Maine |                     |              | Computed by:      | JLL                              |                            |                              |      |              |                   |                                  |                            |                              |   |          |              |     |   |     |    |    |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |       |          |      |              |                   |                                  |                            |                              |   |             |              |     |   |     |    |     |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |
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                                                                                                                                                                                                                                                                                                                                                                                                                               | LPile Soil Parameters, Lateral Soil Springs     |                     |              | Checked by:       | MMB                              |                            |                              |      |              |                   |                                  |                            |                              |   |          |              |     |   |     |    |    |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |       |          |      |              |                   |                                  |                            |                              |   |             |              |     |   |     |    |     |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |
| <p><b>PROBLEM STATEMENT &amp; OBJECTIVE</b></p> <p>Estimate soil parameters for use in LPile evaluations, calculate the lateral soil springs for the proposed pile foundations and the abutment walls.</p> <p><b>REFERENCES</b></p> <ol style="list-style-type: none"> <li>1. AASHTO LRFD Bridge Design Specifications, 2020.</li> <li>2. LPile Software Manual by Ensoft.</li> <li>3. Performance and Use of the Standard Penetration Test in Geotech. Engineering Practice, McGregor J.A. and Duncan J.M., 1998.</li> <li>4. Effects of Soil Slope on Lateral Pile Capacity of Piles in Cohesive and Cohesionless Soils, report by Nontapat Nimityongskul, Paul Barker, and Scott A. Ashford dated March 2012.</li> <li>5. FB-MultiPier Software Manual by Bridge Software Institute (BSI).</li> </ol> <p><b>AVAILABLE INFORMATION</b></p> <ol style="list-style-type: none"> <li>1. Logs for borings BB-GBB-101/101A, -102, -201, and 202.</li> <li>2. Greenbush Boom Bridge Plan and Profile pages from drawings by Fuss &amp; O'Neill, dated May 2021 (Plan Drawing).</li> <li>3. Info from Fuss &amp; O'Neill indicating proposed pile section (HP14x89 and HP14x117).</li> </ol> <p><b>ASSUMPTIONS</b></p> <ol style="list-style-type: none"> <li>1. Elevation Datum: NAVD88.</li> <li>2. Water at Q100, El. 107.3 ft based on Hydrologic Data on Plan Drawing .</li> <li>3. For loading towards the retained side, model ground surface at El. 123.</li> <li>4. For loading towards the stream side, model ground surface at El. 114.</li> <li>5. If piles are closer than 5 times the pile dimension, consider lateral group effects (see AASHTO LRFD for factors).</li> <li>6. For loading towards the stream, consider the impact of the slope in front of the wall on lateral resistance using a P-multiplier of 0.5 on the soil springs (reference 4).</li> <li>7. Bottom of abutment wall/top of pile at El. 109 to 110. Tip of pile is approximately at top of rock.</li> </ol> <p><b>LPile Soil Model Parameters</b></p> <p><b>Retained Side Lateral Soil Parameters</b></p> <table border="1"> <thead> <tr> <th>Layer</th> <th>Material</th> <th>Type</th> <th>Top El. (ft)</th> <th>Depth to Top (ft)</th> <th>Total Unit Wt., <math>\gamma_t</math> (pcf)</th> <th><math>S_u</math> or <math>\phi</math> (psf, deg)</th> <th>k or <math>\epsilon_{50}</math> (pci,%)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>New Fill</td> <td>Cohesionless</td> <td>123</td> <td>0</td> <td>125</td> <td>32</td> <td>50</td> </tr> <tr> <td>2</td> <td>Fill</td> <td>Cohesionless</td> <td>120</td> <td>3</td> <td>120</td> <td>28</td> <td>25</td> </tr> <tr> <td>3</td> <td>Marine Clay</td> <td>Cohesive</td> <td>103.5</td> <td>19.5</td> <td>115</td> <td>1000</td> <td>1</td> </tr> <tr> <td>4</td> <td>Glacial Till</td> <td>Cohesionless</td> <td>91.5</td> <td>31.5</td> <td>130</td> <td>36</td> <td>125</td> </tr> <tr> <td>5</td> <td>Rock</td> <td>Rock</td> <td>85.5</td> <td>37.5</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p><b>Stream Side Lateral Soil Parameters</b></p> <table border="1"> <thead> <tr> <th>Layer</th> <th>Material</th> <th>Type</th> <th>Top El. (ft)</th> <th>Depth to Top (ft)</th> <th>Total Unit Wt., <math>\gamma_t</math> (pcf)</th> <th><math>S_u</math> or <math>\phi</math> (psf, deg)</th> <th>k or <math>\epsilon_{50}</math> (pci,%)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>New Rip Rap</td> <td>Cohesionless</td> <td>114</td> <td>0</td> <td>140</td> <td>45</td> <td>125</td> </tr> <tr> <td>2</td> <td>Fill</td> <td>Cohesionless</td> <td>111</td> <td>3</td> <td>120</td> <td>28</td> <td>25</td> </tr> <tr> <td>3</td> <td>Marine Clay</td> <td>Cohesive</td> <td>103.5</td> <td>10.5</td> <td>115</td> <td>1000</td> <td>1</td> </tr> <tr> <td>4</td> <td>Glacial Till</td> <td>Cohesionless</td> <td>91.5</td> <td>22.5</td> <td>130</td> <td>36</td> <td>125</td> </tr> <tr> <td>5</td> <td>Rock</td> <td>Rock</td> <td>85.5</td> <td>28.5</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>Notes:</p> <ol style="list-style-type: none"> <li>1. <math>S_u</math> = undrained shear strength, <math>\phi</math> = soil internal friction angle, k = lateral subgrade modulus, <math>\epsilon_{50}</math> = percent strain at 50% of shear strength</li> <li>2. <math>\phi</math> and k apply to Cohesionless type materials, <math>S_u</math> and <math>\epsilon_{50}</math> apply to Cohesive type materials.</li> <li>3. Use buoyant unit weight below water.</li> </ol> |                                                 |                     |              |                   |                                  | Layer                      | Material                     | Type | Top El. (ft) | Depth to Top (ft) | Total Unit Wt., $\gamma_t$ (pcf) | $S_u$ or $\phi$ (psf, deg) | k or $\epsilon_{50}$ (pci,%) | 1 | New Fill | Cohesionless | 123 | 0 | 125 | 32 | 50 | 2 | Fill | Cohesionless | 120 | 3 | 120 | 28 | 25 | 3 | Marine Clay | Cohesive | 103.5 | 19.5 | 115 | 1000 | 1 | 4 | Glacial Till | Cohesionless | 91.5 | 31.5 | 130 | 36 | 125 | 5 | Rock | Rock | 85.5 | 37.5 | - | - | - | Layer | Material | Type | Top El. (ft) | Depth to Top (ft) | Total Unit Wt., $\gamma_t$ (pcf) | $S_u$ or $\phi$ (psf, deg) | k or $\epsilon_{50}$ (pci,%) | 1 | New Rip Rap | Cohesionless | 114 | 0 | 140 | 45 | 125 | 2 | Fill | Cohesionless | 111 | 3 | 120 | 28 | 25 | 3 | Marine Clay | Cohesive | 103.5 | 10.5 | 115 | 1000 | 1 | 4 | Glacial Till | Cohesionless | 91.5 | 22.5 | 130 | 36 | 125 | 5 | Rock | Rock | 85.5 | 28.5 | - | - | - |
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     |      |      |   |   |   |       |          |      |              |                   |                                  |                            |                              |   |             |              |     |   |     |    |     |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |
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     |      |      |   |   |   |       |          |      |              |                   |                                  |                            |                              |   |             |              |     |   |     |    |     |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |
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     |      |      |   |   |   |       |          |      |              |                   |                                  |                            |                              |   |             |              |     |   |     |    |     |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |
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(ft) | Depth to Top (ft) | Total Unit Wt., $\gamma_t$ (pcf) | $S_u$ or $\phi$ (psf, deg) | k or $\epsilon_{50}$ (pci,%) |      |              |                   |                                  |                            |                              |   |          |              |     |   |     |    |    |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |       |          |      |              |                   |                                  |                            |                              |   |             |              |     |   |     |    |     |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |
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     |      |      |   |   |   |       |          |      |              |                   |                                  |                            |                              |   |             |              |     |   |     |    |     |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Rock                                            | Rock                | 85.5         | 28.5              | -                                | -                          | -                            |      |              |                   |                                  |                            |                              |   |          |              |     |   |     |    |    |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |       |          |      |              |                   |                                  |                            |                              |   |             |              |     |   |     |    |     |   |      |              |     |   |     |    |    |   |             |          |       |      |     |      |   |   |              |              |      |      |     |    |     |   |      |      |      |      |   |   |   |

|                                                                                   |  |                     |  |                                     |
|-----------------------------------------------------------------------------------|--|---------------------|--|-------------------------------------|
|  |  | <b>CALCULATIONS</b> |  | File No.: 127991-003                |
| Client: Fuss & O'Neill                                                            |  |                     |  | Sheet: 2 of 2                       |
| Project: Boom Bridge, Greenbush, Penobscot County, Maine                          |  |                     |  | Date: 25AUG2021                     |
| Subject: LPILE Soil Parameters, Lateral Soil Springs                              |  |                     |  | Computed by: JLL<br>Checked by: MMB |

**RESULTS**

**PILE**  
**Retained Side P-y Springs for HP14**

| Layer | Material     | k<br>(pci) | Limit<br>(psi) |                                     |
|-------|--------------|------------|----------------|-------------------------------------|
| 1     | New Fill     | -          | -              | (pile not in contact with New Fill) |
| 2     | Fill         | 350        | 260            |                                     |
| 3     | Marine Clay  | 60         | 60             |                                     |
| 4     | Glacial Till | 1380       | 720            |                                     |
| 5     | Rock         | -          | -              | (pile not penetrating into Rock)    |

**Stream Side P-y Springs for HP14**

| Layer | Material     | k<br>(pci) | Limit<br>(psi) |                                        |
|-------|--------------|------------|----------------|----------------------------------------|
| 1     | New Rip Rap  | -          | -              | (pile not in contact with New Rip Rap) |
| 2     | Fill         | 150        | 110            |                                        |
| 3     | Marine Clay  | 60         | 60             |                                        |
| 4     | Glacial Till | 870        | 460            |                                        |
| 5     | Rock         | -          | -              | (pile not penetrating into Rock)       |

Notes:

1. Soil springs are compression only and applicable only to HP14 piles (i.e., function of pile width).
2. Values should be multiplied by the pile width and vertical node spacing to obtain the soil reaction force per unit deflection at a node.
3. Pile lateral group effects are not included (i.e., group effects not considered).
4. Slope effects for the stream side are not included (i.e., soil resistance reduction due to slope proximity not included).
5. Top of pile is located approximately 14 ft below ground surface on the retained side.
6. Top of pile is located approximately 4 ft below ground surface on the stream side.

**ABUTMENT WALL**  
**Retained Side P-y Springs for Abutment Wall**

| Layer | Material | k<br>(pci) | Limit<br>(psi) |
|-------|----------|------------|----------------|
| 1     | New Fill | 10         | 10             |
| 2     | Fill     | 30         | 70             |

**Stream Side P-y Springs for Abutment Wall**

| Layer | Material    | k<br>(pci) | Limit<br>(psi) |
|-------|-------------|------------|----------------|
| 1     | New Rip Rap | 20         | 30             |
| 2     | Fill        | 20         | 30             |

Notes:

1. Soil springs are compression only and applicable only to the Abutment Wall.
2. Values should be multiplied by a tributary wall area to obtain the soil reaction force per unit deflection for that tributary area.
3. Slope effects for the stream side are not included (i.e., soil resistance reduction due to slope proximity not included).

**Frost Depth**

Client: Fuss & O'Neill, Inc.

Date: 9-Mar-22

Project: US Route 2 Bridge over Boombridge Brook, Greenbush, Maine - MaineDOT WIN 21727.00

Computed by: TPJ

Subject: Frost Susceptibility and Maximum Depth of Frost Penetration

Checked by: MMB

**OBJECTIVE:**

Evaluate maximum depth of frost penetration based on soil and groundwater conditions, as well as geographic site location.

**REFERENCES:**

1. MaineDOT Bridge Design Guide, 2003 with interim revisions through 2018.
2. Boring logs dated 03/16/2017 through 03/17/2017 and 06/14/2021 through 06/16/2021 drilled by New England Boring Contractors, Inc. (monitored by Haley & Aldrich, Inc.).
3. Draft plan set prepared by MaineDOT dated November 2021.

**EVALUATION:**

1. Gather relevant information from test borings performed near proposed bridge abutment locations:

| STRUCTURE             | STRUCTURE BEARING ELEVATION | TEST BORING NO./GS EL. | GROUND WATER                                | SAMPLE No. AND ELEVATION | AASHTO/USCS | FINES CONTENT | MOISTURE CONDITION |
|-----------------------|-----------------------------|------------------------|---------------------------------------------|--------------------------|-------------|---------------|--------------------|
| <b>ABUTMENT NO. 2</b> | El. 109 approximate         | BB-GBB-102 / 119.8     | El. 109.8 at time of drilling               | 5D<br>El. 109.8 - 107.8  | A-2-4(0)/SM | 32.6          | Wet                |
|                       |                             | BB-GBB-202 / 119.5     | El. 106.1 at time of drilling               | 5D<br>El. 109.5 - 107.5  | A-2-4(0)/SM | 28.0          | Wet                |
| <b>ABUTMENT NO. 1</b> | El. 110 approximate         | BB-GBB-101 / 119.5     | Not observed, assume El. 111.7 <sup>9</sup> | 4D<br>El. 111.5 - 109.5  | A-4(0)/SM   | 38.4          | Moist              |
|                       |                             | BB-GBB-201 / 120.0     | El. 111.7 at time of drilling               | 5DA<br>El. 110.0 - 108.0 | A-4(0)/SM   | 36.4          | Wet                |

Note:

1. Elevations are in feet and reference NAVD 88.
2. Sample No. and elevation selected based on proposed structure bearing elevation.
3. Ground water elevations summarized above were determined in the field and may have been influenced by the drilling process. Ground water elevations may vary throughout the year due to seasonal variations and precipitation events.
4. The abutments will be supported by H-piles which will bear on bedrock. Assume the embankment fill consists of granular material.
5. From MaineDOT Bridge Design Guide Figure 5-1 presented on page 2, the design freezing index for the site is approximately 1800 °F - days
6. Estimate range in frost penetration using MaineDOT Bridge Design Guide Table 5-1 and the design freezing index above.
7. For coarse grained soil at the abutments, from Table 5-1, frost penetration depths vary between approximately 5.3 ft (64.0 in) (w=30%) to 7.5 ft (90.1 in) (w=10%).
8. For fine grained soil at the abutments, from Table 5-1, frost penetration depths vary between approximately 4.2 ft (49.8 in) (w=30%) to 5.3 ft (64.0 in) (w=10%).
9. Assume groundwater elevation in BB-GBB-101 equal to groundwater elevation in BB-GBB-201.

**Recommend 6.0 ft at the abutments.**

Client: Fuss &amp; O'Neill, Inc.

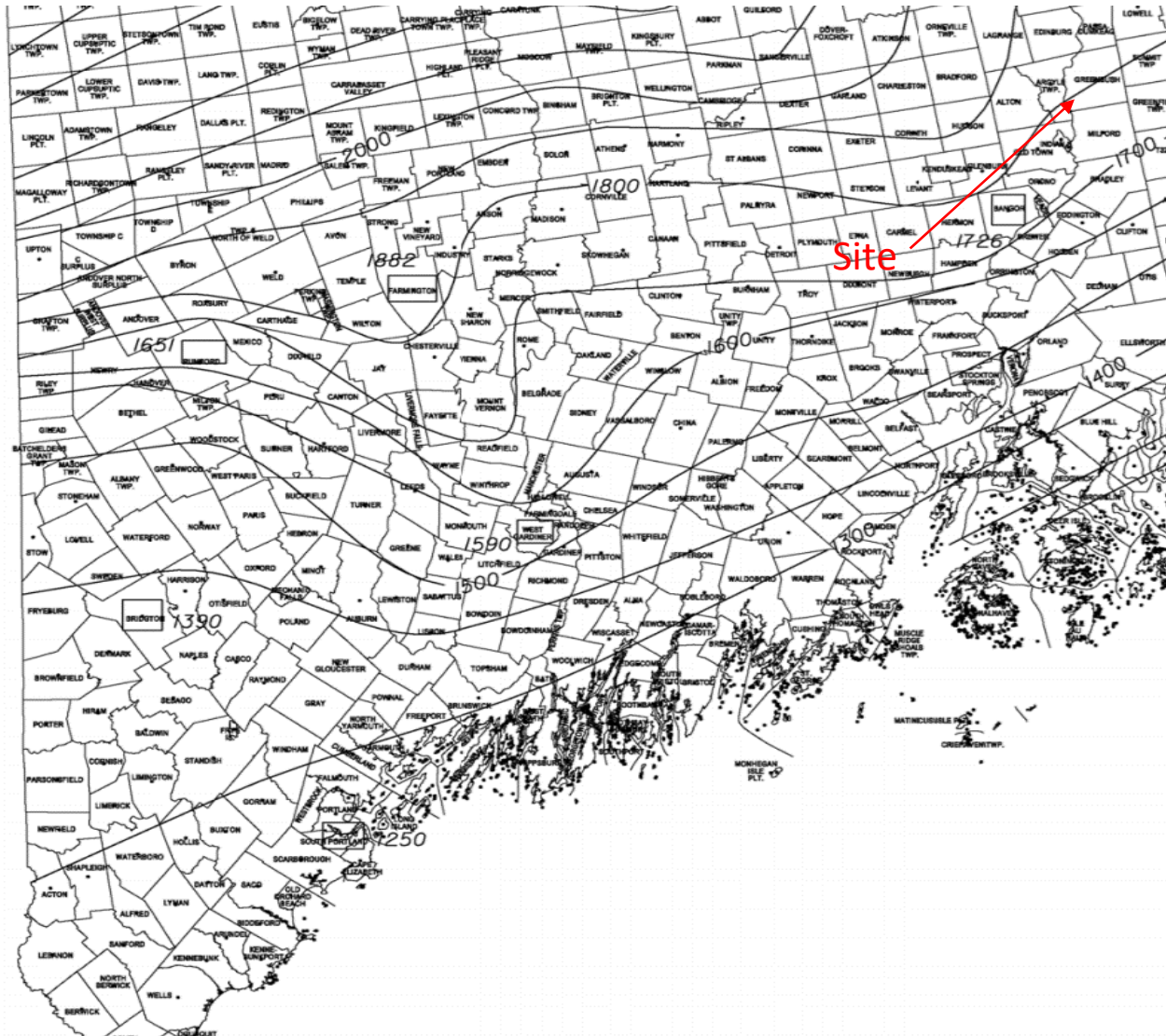
Date: 9-Mar-22

Project: US Route 2 Bridge over Boombridge Brook, Greenbush, Maine - MaineDOT WIN 21727.00

Computed by: TPJ

Subject: Frost Susceptibility and Maximum Depth of Frost Penetration

Checked by: MMB

**Figure 5-1 Maine Design Freezing Index Map**

**Table 5-1 Depth of Frost Penetration**

| Design Freezing Index | Frost Penetration (in) |       |       |              |       |       |
|-----------------------|------------------------|-------|-------|--------------|-------|-------|
|                       | Coarse Grained         |       |       | Fine Grained |       |       |
|                       | w=10%                  | w=20% | w=30% | w=10%        | w=20% | w=30% |
| 1000                  | 66.3                   | 55.0  | 47.5  | 47.1         | 40.7  | 36.9  |
| 1100                  | 69.8                   | 57.8  | 49.8  | 49.6         | 42.7  | 38.7  |
| 1200                  | 73.1                   | 60.4  | 52.0  | 51.9         | 44.7  | 40.5  |
| 1300                  | 76.3                   | 63.0  | 54.3  | 54.2         | 46.6  | 42.2  |
| 1400                  | 79.2                   | 65.5  | 56.4  | 56.3         | 48.5  | 43.9  |
| 1500                  | 82.1                   | 67.9  | 58.4  | 58.3         | 50.2  | 45.4  |
| 1600                  | 84.8                   | 70.2  | 60.3  | 60.2         | 51.9  | 46.9  |
| 1700                  | 87.5                   | 72.4  | 62.2  | 62.2         | 53.5  | 48.4  |
| 1800                  | 90.1                   | 74.5  | 64.0  | 64.0         | 55.1  | 49.8  |
| 1900                  | 92.6                   | 76.6  | 65.7  | 65.8         | 56.7  | 51.1  |