

**GEOTECHNICAL BASE LINE REPORT**  
**US 21 (Sea Island Parkway) Bridge over Harbor River**  
**Beaufort County, South Carolina**



**PREPARED FOR**

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**PREPARED BY**

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SCDOT Project ID: P026862  
F&ME Project #: G5396.00

**FEBRUARY 24, 2017**

February 24, 2017

Mr. Michael Darby, P.E.  
HDR, Inc.  
3955 Faber Place Drive, Suite 300  
North Charleston, South Carolina 29405

Re: Geotechnical Base Line Report  
US 21 (Sea Island Parkway) Bridge Replacement over Harbor River  
Beaufort County, South Carolina  
SCDOT Project ID P026862  
F&ME File No. G5396.00

Dear Mr. Darby:

Submitted herein is the geotechnical base line report for the above referenced bridge replacement project. Included is a summary of the subsurface investigation, a summary of the subsurface findings, a summary of the soil laboratory test results, and our preliminary conclusions and recommendations for the conceptual bridge foundation system and bridge/roadway embankments.

It has been a pleasure working with you on this project, and we appreciate the opportunity to be of service. Please notify us if there are any questions.

Sincerely,

F&ME CONSULTANTS



A handwritten signature in cursive script that reads "Bradley Fischer".

John F. Hamilton, P.E.  
Geotechnical Design Manager

Bradley M. Fischer, E.I.T.  
Geotechnical Staff Professional

Attachments

BMF:JFH/jfh:zwa

## EXECUTIVE SUMMARY

A geotechnical investigation was completed for the proposed US 21 (Sea Island Parkway) bridge replacement over Harbor River. The site is located near Harbor Island, South Carolina. The geotechnical investigation and subsequent geotechnical analysis were performed in general accordance with the Scope of Services and Schedule dated February 23, 2015. The objective of the geotechnical investigation is to collect subsurface information and generate subsurface data to be distributed to design-build teams for pursuit of the construction contract. The project is planned to be procured through the SCDOT Design-Build process. The following is a summary of the findings and our general interpretation of the subsurface conditions.

1. As provided to F&ME by HDR, the preferred alternative is the ALT1B alignment. The ALT1B alternative alignment is on a new alignment north of the existing US 21 roadway and bridge. The ALT1B alternative alignment is shown on the boring locations plans provided in the Appendix.
2. Seventeen (17) soil test borings (STB), eleven (11) cone penetrometer (CPT) soundings, and one (1) deep, seismic boring with geophysical testing were performed. Within two (2) of the CPT soundings, shear wave velocity measurements were collected to a depth of approximately 100 feet.
3. In general, three (3) major geologic units were identified: Surficial Holocene, Hawthorn Marl, and Cooper Group Limestone.
4. F&ME performed a Site Specific Seismic Response Analysis (SSSRA) for the site. For the bridge embankment design west of Harbor River, the SSSRA indicates peak ground acceleration (PGA) values of 0.14g for the Functional Evaluation Earthquake (FEE) event and 0.26g for the Safety Evaluation Earthquake (SEE) event. For the bridge embankment design east of Harbor River, the SSSRA indicates PGA values of 0.12g for the FEE event and 0.29g for the SEE event. For the bridge foundation driven piles and/or drilled shafts seismic design, the SSSRA indicates PGA values of 0.07g for the FEE event and 0.29g for the SEE event.
5. Screening for seismic soil shear strength loss (SSL) was performed in general accordance with the 2010 SCDOT Geotechnical Design Manual (GDM) v1.1. For both the FEE and SEE events, the surficial Holocene soils are susceptible to liquefaction based on the GDM screening criteria. Softening of the low shear strength, clay-like soils was also identified from the SSL screening. In addition, some of the clay-like soils are identified as highly-sensitive and will be subject to a larger reduction in shear strength due to seismic softening.
6. Based on the conceptual bridge and roadway plans, the embankment fill heights at the bridge ends are on the order of twenty (20) feet. Based on the results from the subsurface investigation and subsequent laboratory testing, the proposed bridge embankments within 150 feet of the bridge ends are not anticipated to meet the SCDOT Geotechnical Design Manual performance criteria for either the static or the seismic design events without ground improvement. The roadway embankments outside of the 150 foot bridge embankments may require localized ground improvements depending on the construction staging and schedule.

7. Limited ground improvement analyses were performed to quantify the extent of modifications that may be required at the site. Based on the encountered subsurface conditions, ground improvement that addresses long-term settlement, seismic induced settlement, static slope stability, and seismic slope stability is expected for the entire 150 foot bridge embankments. Certain types of ground improvement may be implemented to correct multiple failure modes. We anticipate ground improvement for the bridge embankments such as:
  - a. Vertical drains for collecting and conveying porewater upwards to the ground surface and soil reinforcement; or,
  - b. Deep foundation supported embankment.
8. Driven pile foundations are anticipated for support of the bridge end bents. We anticipate that larger than normal piles and/or multiple rows of piles will be required to resist the Extreme Event I loadings in accordance with Chapter 14 of the SCDOT Geotechnical Design Manual for the available backfill soils near the site. Based on the long-term settlement estimates, we anticipate that Strength limit state loadings with static downdrag forces will govern the geotechnical driven pile design. For either the Strength limit state or the Extreme Event I limit state, driven pile foundations will develop the required axial resistance through predominantly skin friction in the marl and limestone. Pile Dynamic Analysis (PDA) testing is recommended to monitor pile driving stresses during driving and to estimate mobilized pile resistance. An approximate seven (7) day wait period following initial drive is anticipated for development of pile freeze based on the encountered soil conditions. For the Service limit state, the estimated point-of-fixity for driven piles is on the order of twenty (20) feet below the proposed bottom of bent cap elevation at the end bents. For the Extreme Event I limit state, the estimated point-of-fixity for driven piles is located at the top of the limestone.
9. Drilled shaft foundations are anticipated for support of the bridge interior bents. The anticipated foundation elements for the interior bents range from 60 inch to 108 inch diameter drilled shafts. The Strength limit state axial loading conditions are expected to govern the geotechnical drilled shaft design. For the Strength limit state, drilled shaft foundations will develop the required axial resistance through skin resistance and/or end resistance in the marl and limestone. A drilled shaft axial load test is recommended in proximity to the production shafts to estimate the mobilized shaft resistance and end resistance within select geologic formations. For the Service and Extreme Event I limit state, the estimated point-of-fixity for drilled shafts is located at the top of the limestone.

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## 1. PROJECT DESCRIPTION

The bridge replacement project is located on US 21 (Sea Island Parkway) over Harbor River in Beaufort County, South Carolina. A site location plan is presented in the Section 1 of the Appendix.

It is our understanding that the project will extend approximately 9,000 feet. Based on the conceptual bridge and roadway plans, the maximum new roadway embankment fill height required to meet the planned grade elevation is on the order of twenty (20) feet. The conceptual replacement bridge length is approximately 3,600 feet.

We anticipate that the proposed bridge substructure will consist of driven pile foundations at the end bents and drilled shaft foundations at the interior bents. For the end bents, we anticipate larger than normal piles and/or multiple rows of piles will be required in order to resist the Extreme Event I loadings in accordance with Chapter 14 of the SCDOT Geotechnical Design Manual (GDM) v1.1 for the available backfill soils near the site. The anticipated foundation elements for the interior bents range from 60 inch to 108 inch diameter drilled shafts. Furthermore, we anticipate that ground improvement(s) will likely be required within the entire 150 foot bridge embankments to address both static and seismic settlement and static and seismic slope stability. The roadway embankments outside of the 150 foot bridge embankments may require localized ground improvements depending on the construction staging and schedule.

The geotechnical field investigations were performed in accordance with the 2010 SCDOT Geotechnical Design Manual (GDM) version 1.1. Preliminary foundation and embankment analyses were performed in accordance with the 2012 AASHTO LRFD Bridge Design Specifications, 6<sup>th</sup> Ed. with the 2013 interim revisions and the 2010 GDM.

## 2. SUBSURFACE INVESTIGATION

### 2.1. Phase 1

From August 25 to September 3, 2014, two (2) soil test borings (designated as B-1 and B-2), one (1) cone penetrometer sounding (designated as CPT-1), and one (1) seismic cone penetrometer sounding (designated as SCPT-2) were performed along the existing US 21 roadway. This investigation was conducted to aid in the development of the project's scope.

The soil test borings were advanced utilizing a CME 550 drill rig. Rotary wash drilling techniques were used to maintain a stable borehole. Standard Penetration Tests (SPT) tests were continuously obtained in the top twenty (20) feet of each test boring. Following the continuous sampling, SPT samples were obtained at regular, five (5) foot intervals throughout the remaining depths of the borings. SPT samples were performed in general accordance with ASTM D-1586 to determine the relative densities and consistencies of the subsurface soils and to collect subsurface soil samples. An automatic hammer was used to perform the SPTs. The measured energy ratio for the CME 550 hammer was 82%. The borings were advanced to a depth of 125 feet below the existing ground surface.

The CPT soundings were advanced using a 25-ton truck rig. CPT measurements were generally performed on five (5) centimeter intervals. CPT-1 extended to a target depth of approximately 125 feet below the ground surface. SCPT-2 extended to a depth of refusal where the maximum reaction force from the rig was applied. SCPT-2 refusal was encountered at an approximate depth of approximately (90) feet below the existing ground surface.

## 2.2. Phase 2

From September 15 to September 18, 2015, four (4) SPT borings (designated as B-3 through B-6) were performed off the existing US 21 alignment. Borings B-3 and B-4 were performed west of the existing bridge, and boring B-5 and B-6 were performed east of the existing bridge. A Diedrich D-25 drill rig mounted on a marsh buggy carrier was used to advance the borings. Rotary wash drilling techniques were utilized to maintain a stable borehole. Borings were advanced to a depth of eighty (80) feet below existing ground surface. SPT tests were continuously obtained in the top ten (10) feet of each test boring. Following continuous sampling, SPT samples were obtained at regular, five (5) foot intervals throughout the remaining depths of the soil test borings in general accordance with ASTM D1586 to determine the relative densities and consistencies of the subsurface soils and to collect subsurface soil samples. An automatic hammer was used to perform the SPTs. The measured energy ratio of the hammer was 80%.

From November 16 to November 17, 2015, one (1) soil test boring (designated as TS-1) was performed. The boring was performed at the Butches Road boat landing. A CME 550X ATV mounted drill rig was used to advance the boring. Rotary wash drilling techniques were utilized to maintain a stable borehole. The soil boring was advanced to 150 feet below existing ground surface. Standard split-spoon samples were continuously obtained at two (2) foot intervals throughout the entire depth of the boring. An automatic hammer was used to perform the SPTs. The measured energy ratio of the hammer was 74%.

From September 22 to September 24, 2015, eight (8) CPT soundings (designated as CPT-3 through CPT-10) were advanced off the existing US 21 alignment. On November 18, 2015, one (1) seismic CPT (designated as SCPT-11) was advanced. CPT-3 through CPT-6 were performed west of the existing bridge, CPT-7 through CPT-10 were performed east of the existing bridge, and SCPT-11 was performed at the Butches Road boat landing west of Harbor River. The CPT soundings were advanced utilizing a Diedrich D-25 drill rig mounted on a marsh buggy carrier. SCPT-11 was advanced utilizing a truck mounted rig. The CPT soundings were advanced to refusal where the maximum reaction force of the marsh buggy rig was applied. SCPT-11 was advanced to a target depth of approximately 100 feet below the existing ground surface. SCPT-11 was performed as a seismic CPT sounding with shear wave velocity measurements taken at regular three (3) foot intervals throughout the entire depth of the sounding.

## 2.3. Phase 3

From June 13 to August 3, 2016, ten (10) SPT borings (designated as B-7 through B-16) were performed off the existing US 21 alignment. Borings B-7 through B-9 were performed west of the existing bridge, borings B-10 through B-14 were performed within Harbor River, and borings B-15 and B-16 were performed east of the existing bridge. A CME 45B drill rig mounted on a marsh buggy carrier was used to advance borings B-7 through B-9, B-15, and B-16. The same CME 45B drill rig mounted on a barge platform was used to advance borings B-10 through B-14

which are located in Harbor River. Rotary wash drilling techniques were utilized to maintain a stable borehole. The marsh borings were advanced to a depth of 150 feet below existing ground surface. The barge borings were advanced to a target depth of approximately 190 feet below the mean water surface elevation. SPT tests were continuously obtained in the top ten (10) feet of each test boring. Following continuous sampling, SPT samples were obtained at regular, five (5) foot intervals throughout the remaining depths of the soil test borings in general accordance with ASTM D1586. An automatic hammer was used to perform the SPTs. The measured energy ratio of the hammer was 83%.

From September 27 to August 4, 2016 five (5) auger probe borings (designated as AP-1 through AP-5) were advanced within the marsh areas. Borings AP-1 through AP-3 were performed west of the existing bridge. Borings AP-4 and AP-5 were performed east of the existing bridge. A CME 45B drill rig mounted on a marsh buggy carrier was used to advance the auger probes. Rotary wash drilling techniques were utilized to maintain a stable borehole. Boring AP-1 and AP-2 were advanced to a depth of twenty (20) feet while boring AP-3 was advanced to a depth of twenty-nine (29) feet below existing ground surface. Borings AP-4 and AP-5 were advanced to a depth of seventy-four (74) and thirty-two (32) feet below existing ground surface, respectively. Undisturbed samples were collected from the auger probe borings. Undisturbed samples were collected in general accordance with ASTM D1587.

On July 19, 2016, four (4) bulk soil samples (designated as BS-1 through BS-4) were collected from the existing roadway embankments. BS-1 and BS-2 were collected from the embankments west of the existing bridge. BS-3 and BS-4 were collected from the embankments east of the existing bridge. The bulk samples extended to a maximum depth of five (5) feet below the top of the existing embankment. The primary purpose of collecting the bulk samples was to determine the shear strength parameters of the existing embankment fill soils.

#### **2.4. Deep Seismic Boring**

From July 6 to July 14, 2016, a deep, soil test boring (designated as SB-1) was performed at the Butches Road boat landing. SB-1 was performed for the primary purpose of collecting samples for laboratory testing and to collect in situ shear wave velocity measurements for seismic site response analysis. A Failing 1500 truck mounted drill rig was utilized to advance the soil test boring. Rotary wash drilling techniques were utilized to maintain a stable borehole. The boring was advanced to a depth of 520 feet below the existing ground surface. SPT tests were continuously obtained in the top eighty (80) feet of the boring. Following continuous sampling, SPT tests were performed at five (5) foot intervals to a depth of 150 feet below existing ground surface. SPT tests were then performed at ten (10) foot intervals to a depth of 250 feet below existing ground surface. Below a depth of 250 feet, coring techniques were utilized to advance the boring. An NQ, double barrel, wireline coring system was used. An additional twenty (20) feet was drilled below 500 feet to facilitate the geophysical testing to a 500 foot depth. Within boring SB-1, F&ME collected nine (9) undisturbed samples at various depths throughout the boring using a pitcher sampler. Undisturbed samples were collected in general accordance with ASTM D1587. Standard penetration testing was performed in the top 250 feet. An automatic hammer was used to perform the SPTs. The measured energy ratio of the hammer was 75%.



## 2.5. Field Investigation Summary

The locations, elevations and depths of the borings and soundings performed during the subsurface investigation(s) are provided in the following table.

| Test Boring Location Schedule |                           |                 |                     |                           |                 |           |            |
|-------------------------------|---------------------------|-----------------|---------------------|---------------------------|-----------------|-----------|------------|
| Boring I.D.                   | Test Hole Locale          | Station (US 21) | Offset from CL (ft) | Boring Elevation (ft-MSL) | Test Depth (ft) | Latitude  | Longitude  |
| B-1                           | Existing Embankment, West | 45+50           | 7.4-LT              | 10.9                      | 125.0           | 32.408695 | -80.465492 |
| B-2                           | Existing Roadway, East    | 109+84          | 28.4-RT             | 8.6                       | 125.0           | 32.401896 | -80.446292 |
| B-3                           | Marsh, West               | 39+79           | 81.5-LT             | 2.5                       | 80.0            | 32.409483 | -80.467111 |
| B-4                           | Marsh, West               | 53+45           | 92.6-LT             | 2.4                       | 80.0            | 32.408077 | -80.463008 |
| B-5                           | Marsh, East               | 116+48          | 81.7-LT             | 2.7                       | 80.0            | 32.400844 | -80.444475 |
| B-6                           | Marsh, East               | 119+93          | 41.7-LT             | 2.3                       | 80.0            | 32.39997  | -80.443953 |
| B-7                           | Marsh, West               | 57+99           | 45.9-LT             | 2.7                       | 150.0           | 32.407501 | -80.461704 |
| B-8                           | Marsh, West               | 65+00           | 0.1-RT              | 3.0                       | 150.0           | 32.406749 | -80.459611 |
| B-9                           | Marsh, West               | 67+04           | 9.3-LT              | 2.6                       | 150.0           | 32.406583 | -80.458978 |
| B-10                          | Harbor River              | 78+24           | 21.4-RT             | 0.0                       | 193.0           | 32.405352 | -80.455652 |
| B-11                          | Harbor River              | 82+65           | 4.4-LT              | 0.0                       | 192.0           | 32.404954 | -80.454298 |
| B-12                          | Harbor River              | 87+88           | 79.3-LT             | 0.0                       | 192.0           | 32.404595 | -80.45264  |
| B-13                          | Harbor River              | 92+79           | 16.2-RT             | 0.0                       | 190.5           | 32.403837 | -80.451288 |
| B-14                          | Harbor River              | 97+18           | 5.6-LT              | 0.0                       | 190.0           | 32.403431 | -80.449948 |
| B-15                          | Marsh, East               | 100+78          | 9.6-RT              | 1.6                       | 150.0           | 32.403014 | -80.448888 |
| B-16                          | Marsh, East               | 105+97          | 25.2-LT             | 2.4                       | 150.0           | 32.402552 | -80.447291 |
| TS-1                          | Butches Road Boat Landing | 40+78           | 305.9-RT            | 6.4                       | 150.0           | 32.408395 | -80.467293 |
| AP-1                          | Marsh, West               | 65+07           | 7.2-LT              | 2.5                       | 20.0            | 32.406761 | -80.459581 |
| AP-2                          | Marsh, West               | 67+03           | 15.9-LT             | 2.6                       | 20.0            | 32.406601 | -80.458973 |
| AP-3                          | Marsh, West               | 69+09           | 39.8-LT             | 2.0                       | 29.0            | 32.406462 | -80.458322 |
| AP-4                          | Marsh, East               | 100+73          | 8.7-RT              | 1.6                       | 74.0            | 32.403021 | -80.448901 |
| AP-5                          | Marsh, East               | 106+03          | 26.3-LT             | 2.3                       | 32.0            | 32.402547 | -80.44727  |
| SB-1                          | Butches Road Boat Landing | 40+85           | 293.6-RT            | 6.8                       | 520.0           | 32.408419 | -80.467258 |
| BS-1                          | Existing Embankment, West | 60+00           | 12.5-RT             | 8.1                       | 5.0             | 32.407225 | -80.46113  |
| BS-2                          | Existing Embankment, West | 68+00           | 34.2-RT             | 8.9                       | 5.0             | 32.406379 | -80.458736 |
| BS-3                          | Existing Embankment, East | 107+01          | 35.5-RT             | 7.0                       | 5.0             | 32.402276 | -80.447076 |
| BS-4                          | Existing Embankment, East | 114+06          | 12.4-LT             | 6.9                       | 5.0             | 32.401234 | -80.445171 |
| CPT-1                         | Existing Embankment, West | 13+72           | 7.0-LT              | 8.5                       | 127.5           | 32.412031 | -80.475011 |
| SCPT-2                        | Existing Embankment, West | 62+99           | 27.1-RT             | 10.7                      | 88.9            | 32.406856 | -80.460253 |
| CPT-3                         | Marsh, West               | 42+42           | 96.4-LT             | 2.4                       | 70.5            | 32.409245 | -80.466306 |
| CPT-4                         | Marsh, West               | 49+36           | 76.2-LT             | 1.6                       | 75.5            | 32.408465 | -80.464251 |
| CPT-5                         | Marsh, West               | 60+88           | 78.7-LT             | 2.5                       | 75.0            | 32.407317 | -80.46079  |
| CPT-6                         | Marsh, West               | 69+12           | 41.6-LT             | 2.0                       | 82.0            | 32.406463 | -80.458308 |
| CPT-7                         | Marsh, East               | 100+84          | 1.9-LT              | 1.7                       | 79.9            | 32.403037 | -80.448855 |
| CPT-8                         | Marsh, East               | 103+87          | 15.3-RT             | 2.2                       | 66.6            | 32.402675 | -80.447969 |
| CPT-9                         | Marsh, East               | 116+53          | 42.4-LT             | 2.4                       | 79.6            | 32.400768 | -80.444567 |
| CPT-10                        | Marsh, East               | 120+07          | 49.3-LT             | 2.4                       | 80.2            | 32.399945 | -80.443909 |
| SCPT-11                       | Butches Road Boat Landing | 40+89           | 292.5-RT            | 6.4                       | 101.1           | 32.408417 | -80.467244 |

All of the soil samples collected during the subsurface investigation were examined and logged in the field by F&ME personnel, sealed in plastic bags, and transported to our laboratory for further examination and analyses. The soils were visually classified in the field based upon the Unified Soil Classification System.

Cores collected from the deep seismic boring were also transported to our laboratory for visual inspection and for selecting specimens for laboratory testing. Photos of the recovered core specimens are provided in Section 6 of the Appendix.

We have provided Soil Testing Location Plans in Section 2 of the Appendix. The soil testing location plans display the locations of the borings and soundings performed during the subsurface investigation(s). Individual boring logs and CPT logs are provided in Section 4 of the Appendix.

### 3. LABORATORY TESTING PROGRAM

Select soil samples from the borings were tested in our laboratory to determine physical and engineering soil properties. The laboratory test program included moisture content, Atterberg limits, grain size distribution, CU triaxial, consolidation, unconfined compression, electro-chemical, and resonant column tests. These tests were used to identify the strength and behavioral characteristics of the soils as well as to verify the field classifications by the AASHTO classification system and the Unified Soil Classification System (USCS). The quantity of laboratory testing is summarized in the following table.

| Laboratory Testing Table  |          |
|---------------------------|----------|
| Test Type                 | Quantity |
| Moisture Content          | 138      |
| Grain Size w/ Wash #200   | 133      |
| Atterberg Limits          | 133      |
| CU Triaxial               | 10       |
| Direct Shear              | 6        |
| Consolidation             | 7        |
| Unconfined Compression    | 5        |
| Standard Proctor          | 4        |
| Calcium Carbonate Content | 15       |
| Electro-Chemical Series   | 10       |
| Resonant Column           | 4        |

All soil testing was conducted in general accordance with applicable ASTM/AASHTO standards. Data sheets presenting the results of the laboratory test program are provided in Section 7 of the Appendix.

## 4. SUBSURFACE CONDITIONS

### 4.1. General Site Geology

The project site is located within the Lower Coastal Plain physiographic unit of South Carolina. The Lower Coastal Plain is a gently seaward dipping surface containing seven terraces, which represent sedimentary sequences believed to have been formed during periods of eustatic sea level rise/fall or tectonic uplift/subsidence over geologic time.

The site is situated on the Princess Anne terrace. The near surface geology underlying the Princess Anne terrace was mapped in Beaufort County near the site by the United States Geological Survey (McCartan and others, 1984 and Colquhoun and others, 1987). The general discussion of the shallow geology underlying the site is taken in large part from the aforementioned maps and text. The sediments in the area consist of fluvial, beach, backbarrier, estuarine and undifferentiated sandy carbonate deposits (McCartan and others, 1984).

The upper most mapped geologic features were deposited during the Holocene age (~11,700 yrs to the present) and consist of predominantly silty or clayey, fine sands. Below the muddy sands, is the Princess Anne Formation of Holocene age (~10,000 yrs). The Holocene age deposits consist of unconsolidated beach and shelf sediments. The sand constituent in the Holocene sediments are composed of clean, fine to medium, quartz sand and transition to coarse sand with some shell debris. The typical thickness of the Holocene deposits may range from 50-70 feet (McCartan and others, 1984 and Colquhoun and others, 1987).

The upper tertiary deposits consist of a relatively thin layer of Hawthorn Marl of Miocene age (~23 MYA). The marl thickness at this site varies from 10-30 feet.

The lower tertiary deposits consist of calcareous, sandy limestone. The upper limestone is considered part of the Cooper Group, and consists of Oligocene (~36 MYA) and late Eocene (~40-50 MYA) age deposits. Based on the maps, the Oligocene age limestone is unnamed, and the Eocene age limestone is termed the Ocala Limestone. Below the Cooper Group limestones, the Orangeburg Group limestones exist. The upper Orangeburg Group consists of the Santee Limestone of early Eocene age (50-60 MYA), and the lower Orangeburg Group consists of the Williamsburg Formation limestone of early Eocene age.

The Garner-Edisto fault is an east-to-west trending, normal fault traversing Beaufort and Jasper Counties in South Carolina and is depicted as crossing near the bridge site on a map entitled, Structural Features of South Carolina, produced by the South Carolina Department of Natural Resources, Geologic Survey. A map entitled Geologic Hazards of South Carolina Coastal Plain, also produced by the South Carolina Department of Natural Resources, Geologic Survey and the Emergency Management Division, Off of the Adjutant General shows that this area has a high potential for liquefaction during substantial seismic events.

## 4.2. Soil Stratigraphy

The soil borings and CPT soundings indicate five (5) main strata. The following table summarizes the encountered soils at the site.

| Soil Stratification Table         |                                                 |                                         |                                   |                        |                                  |                                                                                        |
|-----------------------------------|-------------------------------------------------|-----------------------------------------|-----------------------------------|------------------------|----------------------------------|----------------------------------------------------------------------------------------|
| Geologic Formation                | <sup>3</sup> Elevation of Top of Layer (ft-MSL) | <sup>2</sup> Depth to Top of Layer (ft) | USCS Soil Type                    | Avg. SPT N-Value (bpf) | Average CPT Tip Resistance (tsf) | Comments                                                                               |
| Fill                              | +10                                             | 0                                       | SP & SP-SM                        | 13                     | 100                              | Existing Embankment                                                                    |
| Engineered Fill <sup>1</sup>      | 0                                               | 10                                      | SP, SP-SM, SM                     | 5                      | 70                               | Backfill material under existing embankment following mucking from 1940's construction |
| Holocene <sup>1</sup>             | 0                                               | 10                                      | SP, SP-SM, SM, SC, ML, MH, CL, CH | 5                      | 50                               | Original ground surface                                                                |
| Tertiary (Hawthorn Marl)          | -50                                             | 60                                      | SM, SC, ML, MH                    | 8                      | 40                               |                                                                                        |
| Tertiary (Cooper Group Limestone) | -70                                             | 80                                      | SM, ML, MH, CL, CH                | 13                     | 85                               |                                                                                        |

<sup>1</sup> Engineered Fill was encountered under the existing embankment. Below the Engineered Fill, Holocene soils were encountered. Outside the existing embankment footprint, Holocene soils were encountered at the existing ground surface.

<sup>2</sup> Depths are generalized and are referenced from top of existing roadway embankment

<sup>3</sup> Elevations are generalized from the totality of subsurface information collected

## 4.3. Groundwater Conditions

Groundwater table measurements were recorded immediately following completion of the boring/sounding and 24-hours following completion of the boring/sounding. Groundwater was encountered from approximately 0 ft-MSL to 3 ft-MSL in the borings and soundings. Groundwater elevations at this site will fluctuate with tidal movement. In general, the tidal fluctuation varies from -2 ft-MSL to 9 ft-MSL. We would anticipate that ground water table elevation would approximate the Harbor River stage elevation. For the preliminary geotechnical analyses, we have selected a groundwater table elevation of 0 ft-MSL.

The following table presents the water depths measured from the borings performed within Harbor River. This table excludes the water depths at boring B-10 and B-14 which are located in a tidal marsh and not in the river channel.

| Harbor River Water Depths |                  |
|---------------------------|------------------|
| Boring ID                 | Water Depth (ft) |
| B-11                      | 22               |
| B-12                      | 33               |
| B-13                      | 28               |

## CONCLUSIONS AND RECOMMENDATIONS

### 5.1. Geotechnical Design Soil Profiles and Sections

The design soil profiles and sections used for our preliminary geotechnical calculations and analyses were developed from the following:

- Profile and cross-sections provided by HDR for the proposed US 21 roadway alignment ALT1B;
- F&ME's subsurface investigation;
- SCDOT GDM soil strength parameter correlations, CPT soil strength parameter correlations, and laboratory derived soil parameters;
- SCDOT GDM residual soil strength parameters based on the soil shear loss calculations in accordance with Idriss and Boulanger (2008).

This report includes F&ME's findings from the subsurface investigations in accordance with the Scope of Services and Schedule.

### 5.2. Site Preparation

Based on the subsurface conditions encountered during the field investigations, the soil subgrade below the planned 150 foot bridge approach embankment areas will likely require improvement or modification to meet the GDM performance criteria. For the roadway embankments, localized mucking and/or other ground modifications may be required for acceptable performance for normal, static conditions. Depending on the construction sequencing, undercutting, soil reinforcement, temporary shoring, or some combination of these activities may be required for a stable working platform, equipment access, equipment mobility, maintenance of existing traffic, and/or safety.

### 5.3. Seismic Site Response Analyses

F&ME performed a Site Specific Seismic Response Analysis (SSSRA) for the site. ADRS curves were developed at the ground surface for soil conditions west of Harbor River, at the ground surface for soil conditions east of Harbor River, and at the top of limestone for bridge foundation analysis. The results from the SSSRA are provided in the SSSRA report. Please refer to this report for a more thorough discussion of the procedure and results from the SSSRA.

Based on the SSSRA, the recommended design spectra for bridge embankment and bridge foundation design is as follows.

| <b>Acceleration Design Response Spectra at Ground Surface<br/>For Beginning of Bridge Embankment</b> |      |                 |                 |
|------------------------------------------------------------------------------------------------------|------|-----------------|-----------------|
|                                                                                                      | PGA  | S <sub>DS</sub> | S <sub>D1</sub> |
| FEE                                                                                                  | 0.14 | 0.38            | 0.14            |
| SEE                                                                                                  | 0.26 | 0.74            | 0.74            |

| <b>Acceleration Design Response Spectra at Ground Surface<br/>For End of Bridge Embankment</b> |      |                 |                 |
|------------------------------------------------------------------------------------------------|------|-----------------|-----------------|
|                                                                                                | PGA  | S <sub>DS</sub> | S <sub>D1</sub> |
| FEE                                                                                            | 0.12 | 0.26            | 0.17            |
| SEE                                                                                            | 0.29 | 0.58            | 0.58            |

| <b>Acceleration Design Response Spectra at Top of Limestone<br/>For Bridge Foundations</b> |      |                 |                 |
|--------------------------------------------------------------------------------------------|------|-----------------|-----------------|
|                                                                                            | PGA  | S <sub>DS</sub> | S <sub>D1</sub> |
| FEE                                                                                        | 0.07 | 0.17            | 0.08            |
| SEE                                                                                        | 0.29 | 0.77            | 0.42            |

### 5.4. Geotechnical Seismic Hazard Potential

Geotechnical seismic hazards consist of a loss in a soil’s shear strength through cyclic ground motions induced by earthquakes. In sand-like soils, this phenomenon is typically referred to as soil liquefaction. Cyclic-softening is the typical terminology for fine grained soils. Liquefaction of sand-like soils and softening of highly sensitive clay-like soils are considered the most devastating seismically induced geotechnical hazards.

Liquefaction is the loss of a soil’s shear strength due to a rapid increase in pore water pressure resulting from soil particle contraction induced by seismic vibrations. Soils most susceptible to liquefaction generally consist of saturated, loose, “clean” (i.e., Plasticity Indexes less than 7), fine (10% particle size ranging from 0.07 millimeters to 0.25 millimeters) sands. Soil softening occurs in moderate to high plasticity silts and clays.

Based on our review of the collected subsurface information as outlined in our soil test boring/sounding logs and as-built roadway drawings, the upper Holocene soils above marl will be susceptible to liquefaction and softening. At some locations, highly sensitive silts and clays were encountered. Based on the GDM, the shear strength loss from seismic softening of these highly sensitive soils could be on the order of 50% to 60%. Ground improvement will likely be required for acceptable seismic bridge approach embankment performance (i.e. within 150 feet of bridge ends).

### 5.5. Static Settlement

The proposed bridge and roadway embankment subgrade soils consist of very loose sandy material with interbedded layers of very soft silty/clay of varying thickness. Any fill placement at this site will result in deformation of the subgrade soils. We anticipate that the near surface, clay-like soils, where present, would be removed and replaced prior to fill placement, since these soils would be difficult to stabilize for filling and would be subject to long-term consolidation settlements. After removal and replacement, the majority of the deformation would occur in the predominant sandy, cohesionless soils and would take place rapidly with new fill placement. At some locations, relatively thick layers of sensitive, very soft clays were encountered that would experience long-term consolidation settlements.

Based on the settlement parameters determined from the performed laboratory consolidation testing, the predicted magnitudes of consolidation settlement vary from five (5) inches to fifty (50) inches, and the time required to complete the consolidation settlements in accordance with the GDM vary from 400 days to over 1,000 days. These estimates do not account for ground improvement.

Settlement analyses were also provided to account for wick drain and/or temporary surcharging. Based on these analyses, we anticipate that wick drains and a temporary soil surcharge will be required for the bridge approach embankments. By implementing wick drains and a surcharge, the estimated time to complete consolidation settlement in accordance with the GDM performance criteria can potentially be reduced to under a year.

We acknowledge that the theoretical settlement calculations often tend to over-predict magnitudes of settlement and under-predict time rates of settlement. Both the presented magnitude and time rates of settlement can differ from that presented above. As such, we recommend that a settlement monitoring program be required to verify that the as constructed embankment performance conforms to the performance criteria.

### 5.6. Seismic Settlement

Where calculations indicate that Soil Shear Loss (SSL) is triggered, a subsequent deformation analysis was performed to calculate the vertical settlement from the sand-like soil. In addition, the lateral displacement was also calculated from lateral spreading of the liquefied soils. The liquefaction induced settlement and the lateral displacements were calculated in accordance with the Idriss & Boulanger (2008) methodology.

The calculated liquefaction-induced vertical settlements vary from two (2) inches to fourteen (14) inches for the FEE event and three (3) inches to twenty (20) inches for the SEE event. In general, higher seismic induced settlements were observed nearest to the river. We also note that the liquefaction-induced settlements will likely induce downdrag loads on the foundations.

Based on the seismic ground deformation analysis, ground improvement is anticipated to meet the GDM EV-03 and EV-05 performance limits. The ground improvement is anticipated to extend the full length of the 150 foot bridge approach embankments at each end of the bridge.

### **5.7. Embankment Slope Stability**

F&ME performed limited bridge and roadway embankment slope stability analyses based on the conceptual embankment geometry for the preferred ALT1B alignment. The subsurface soil stratigraphy, groundwater conditions, and soil strength parameters utilized in these analyses were based on generalized conditions as indicated by the test borings and soundings performed at each respective bridge approach embankment location. Both static and seismic slope stability analyses were performed. The seismic ground accelerations were determined from the site response analyses. The residual soil strength parameters calculated per the GDM were utilized with the seismic slope stability analyses.

Based on the results from the limited slope stability analyses, bridge embankments are not anticipated to meet the GDM requirements for either the Strength or Extreme Event I limit states, and ground improvement is expected for the full length of the 150 foot bridge approach embankments. For roadway embankments located outside the 150 foot bridge embankments, localized areas of ground improvement may be required.

### **5.8. Ground Improvement**

Limited geotechnical ground improvement analyses were performed to investigate the types and extent of ground improvement required to meet the GDM design criteria and performance limits. Based on our evaluation of the site, ground improvement is required to meet static settlement, seismic settlement, static slope stability, and seismic slope stability performance criteria. We anticipate that ground improvement will be required to achieve acceptable performance in accordance with the GDM. Ground improvements such as:

- Vertical drains for collecting and conveying porewater upwards to the ground surface and soil reinforcement; or,
- Deep foundation supported embankment

are anticipated for the bridge approach embankments.



## 5.9. Foundation Corrosion and Deterioration

Per AASHTO, the following soil or site conditions are considered indicative of a potential for steel corrosion and/or concrete deterioration.

- Resistivity less than 2,000 ohm-cm;
- pH less than 5.5;
- pH between 5.5 and 8.5 in soils with high organic content;
- Sulfate concentrations greater than 1,000 ppm;
- Landfills and cinder fills;
- Soils subject to mine or industrial discharge; and,
- Areas with a mixture of high resistivity soils and low resistivity high alkaline soils.

Per AASHTO, the following water conditions are considered indicative of a potential for steel corrosion and/or concrete deterioration.

- Chloride content greater than 500 ppm;
- Sulfate concentration greater than 500 ppm;
- Mine or industrial runoff;
- High organic content;
- pH less than 5.5;
- Marine borers; and,
- Piles exposed to wet/dry cycles.

Electrochemical testing was performed on soils collected within marsh areas and within Harbor River. In addition, electro-chemical testing was performed on two (2) water samples collected from the river. Electrochemical testing results are provided in Section 7 of the Appendix. Based on the electro-chemical test results, steel corrosion is probable at the site, and steel corrosion mitigation will likely be required. Furthermore, concrete deterioration is also probable. We recommend that all concrete used for the bridge construction include sulfate resistant additives to mitigate concrete deterioration of the bridge elements.

## 5.10. Driven Pile Foundations

Driven piles are anticipated for support of the bridge end bents. We anticipate that larger than normal piles or multiples rows of pile will be required at the end bents to provide increased stiffness for lateral performance. Pre-stressed concrete (PSC) piles may be desired at the interior bents in the marsh near the bridge ends. Specific driven pile design issues are discussed in the following sections.

### 5.10.1. Axial Resistance

The Strength limit state axial loading conditions with static downdrag forces are likely to govern the geotechnical driven pile design at both bridge ends.

Driven piles are expected to develop the required driving resistance through predominantly skin friction in the marl and limestone. Although a hard cap was encountered at most locations on top of the limestone ( $N_{meas}=100+$ ), this cap is relatively thin or may not be present at all. We expect that large pile hammers will be required to effectively mobilize the required driving resistance, and these larger pile hammers would advance piles through this hard cap. Relying on this hard cap to provide the required driving resistance is considered a very risky option and should be approached with caution.

Pile Dynamic Analyses (PDA) testing with CAPWAP measurements is recommended to monitor pile driving stresses during driving and to verify the in-place, driven pile resistance. Based on experience, we anticipate a minimum seven (7) day wait period may be required for development of pile freeze following initial drive. Continuous PDA testing is recommended during both the initial drive and the re-strikes, as necessary. The number of required PDA tests shall be in accordance with the GDM.

### 5.10.2. Lateral Resistance

For the Strength limit state, the driven piles will develop the required lateral stability in the embankment fill and the upper Holocene soils. For the Extreme Event I limit state, the driven piles will develop the required lateral stability from mostly the marl and the limestone. At the end bents, the seismic bridge abutment backwall passive pressure shall be calculated in accordance with Chapter 14 of the GDM for the selected embankment fill material. The remaining lateral resistance, following use of the bridge abutment backwall resistance, will be carried by the driven end bent piles. Given the size of the proposed bridge structure and the anticipated large seismic demand, we anticipate that the end bents will be responsible for absorbing a significant amount of load. Based on this assumption, we anticipate that large piles and/or multiple rows of piles will be required at the end bents to accommodate the bridge structural design while satisfying the GDM performance limits for bridge foundations.

### 5.10.3. Drivability

Driven piles will likely use a diesel pile hammer. We anticipate that non-displacement piles (ie. steel H-piles or steel open-ended pipe piles) will be utilized at the end bents. The anticipated pile length for non-displacements piles is 100+ feet. Pre-stressed concrete (PSC) piles may be desired at the interior bents in the marsh near the bridge ends. The anticipated PSC pile length is 100+ feet.

Based on the anticipated pile lengths and the assumed construction logistics, we expect that both steel piles and concrete piles will be driven in at least two (2) sequences to allow for pile splices. Drivable pile splices would be required for both steel and concrete piles. For the assumed pile lengths, we anticipate that a relatively large pile hammer will be required to effectively mobilize the required driving force. Based on the soils conditions encountered, we anticipate that the initial pile driving will occur without much noticeable resistance. Once

penetration in the marl and limestone has occurred, pile freeze is expected following any discontinuities in the pile driving operations. Caution should be exercised when temporarily terminating pile driving in this material if further pile advancement is required.

For a properly selected driving system, we do not anticipate unusual pile driving issues for successful installation of the driven piles. The selected driving system shall address driving compressive and tensile stresses to conform to the SCDOT criteria.

## **5.11. Drilled Shaft Foundations**

Drilled shafts are anticipated for support of the bridge interior bents. We anticipate that drilled shaft sizes could range from 60 inch to 108 inch diameter shafts. Specific drilled shaft design issues are discussed in the following sections.

### **5.11.1. Axial Resistance**

The Strength limit state axial loading conditions are expected to govern the geotechnical design of drilled shafts.

Depending on the approach taken by the Design-Build team, the drilled shafts will develop the required axial resistance through skin friction in the marl and the limestone and/or through end bearing in the limestone. Since drilled shafts mobilize shaft resistance and end resistance at different displacements, it is difficult to predict the load transfer from skin resistance to end resistance without implementing an instrumented load test. Therefore, we recommend that an axial load test be performed on either a production or a non-production drilled shaft. The test shaft should be located within fifty (50) feet of the proposed alignment between the existing western bridge end (ie. proximity to boring B-9) and the eastern edge of the river (ie. proximity to boring B-14). Since the subsurface conditions outside these limits might provide a higher resistance than compared to within the limits, we do not recommend that the load test be performed on a non-production drilled shaft outside the recommended limits.

Construction casing will be required to facilitate drilled shaft construction. It is anticipated that the drilled shaft excavation can be advanced through the upper Holocene soils, marl, and limestone. In general, the marl and limestone are predominantly loose to medium dense, sands/silts with fines contents varying from 40% to 60%. We expect drilled shaft lengths will approach 150 feet.

### **5.11.2. Lateral Resistance**

For the Strength limit state and Extreme Event I limit state, the drilled shafts will develop the required lateral stability in the marl and the limestone. Given the long unsupported drilled shaft lengths which are influenced by scour and seismic loading, we anticipate that the drilled shafts will be large diameter or multiple shafts in a footing to accommodate the structural bridge design while conforming to the GDM performance limits for bridge foundations.

## 6. LIMITATIONS OF REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to the referenced bridge project. The conclusions and recommendations contained herein are based upon the provided test borings and testing result data, contained within, and applicable standards in this geographic area at the time this report was prepared. No other warranty, expressed or implied, is made.

F&ME would like to note that Hurricane Matthew did impact the South Carolina coastal region, including Beaufort and the site location for the US 21 bridge replacement over Harbor River. The hurricane passed through the southeast coastal region of South Carolina from Friday, October 7 through Saturday, October 8, approximately two (2) months after the completion of our subsurface investigation. F&ME does not know to what extent the hurricane may have affected the subsurface conditions along the banks of Harbor River, within the channel of Harbor River, or within the surrounding marsh areas at the site. Our report includes subsurface data and conditions associated with the site prior to Hurricane Matthew at the time our subsurface investigation was performed.

## 7. REFERENCES

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US 21 (SEA ISLAND PKWY.) BRIDGE REPLACEMENT OVER  
HARBOR RIVER  
GEOTECHNICAL BASE LINE REPORT

# APPENDIX

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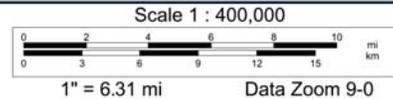
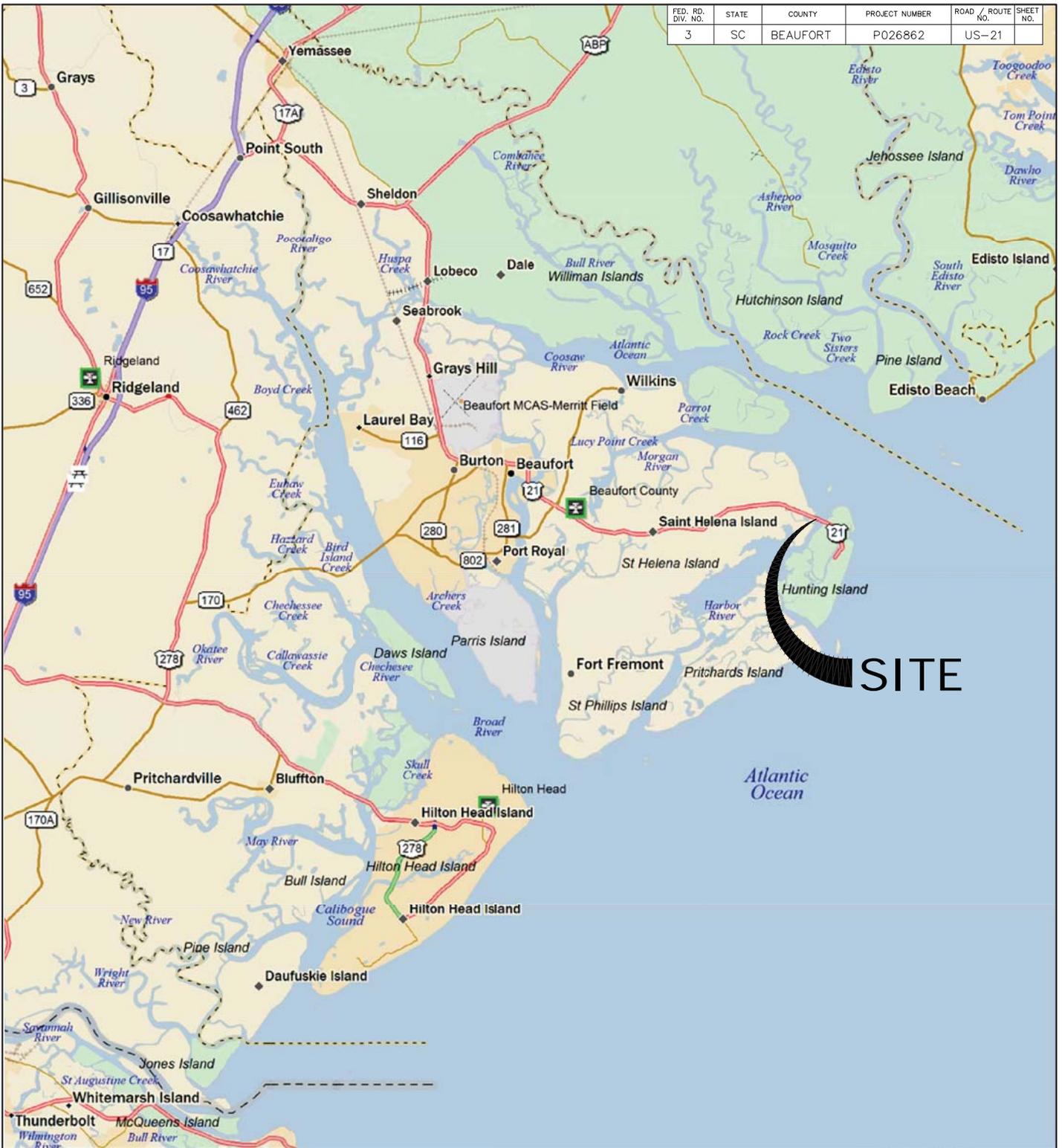
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GEOTECHNICAL BASE LINE REPORT

**APPENDIX**

SECTION 1

SITE LOCATION PLAN

|                   |       |          |                |                  |           |
|-------------------|-------|----------|----------------|------------------|-----------|
| FED. RD. DIV. NO. | STATE | COUNTY   | PROJECT NUMBER | ROAD / ROUTE NO. | SHEET NO. |
| 3                 | SC    | BEAUFORT | P026862        | US-21            |           |



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US-21 (SEA ISLAND PKWY)  
BRIDGE REPLACEMENT OVER HARBOR RIVER

SITE LOCATION PLAN

SCALE = NTS

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US 21 (SEA ISLAND PKWY.) BRIDGE REPLACEMENT OVER  
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SECTION 2

SOIL TESTING LOCATION PLANS



|                   |       |          |            |                  |           |
|-------------------|-------|----------|------------|------------------|-----------|
| FED. RD. DIV. NO. | STATE | COUNTY   | PROJECT ID | ROAD / ROUTE NO. | SHEET NO. |
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LEGEND:

 CONE PENETRATION TEST LOCATION



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TESTING LOCATION PLAN

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|  | SOIL TEST BORING LOCATION      |
|  | BULK SAMPLE LOCATION           |
|  | CONE PENETRATION TEST LOCATION |



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TESTING LOCATION PLAN

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**LEGEND:**

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|  | SOIL TEST BORING LOCATION      |
|  | BULK SAMPLE LOCATION           |
|  | CONE PENETRATION TEST LOCATION |



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TESTING LOCATION PLAN

SCALE = NTS

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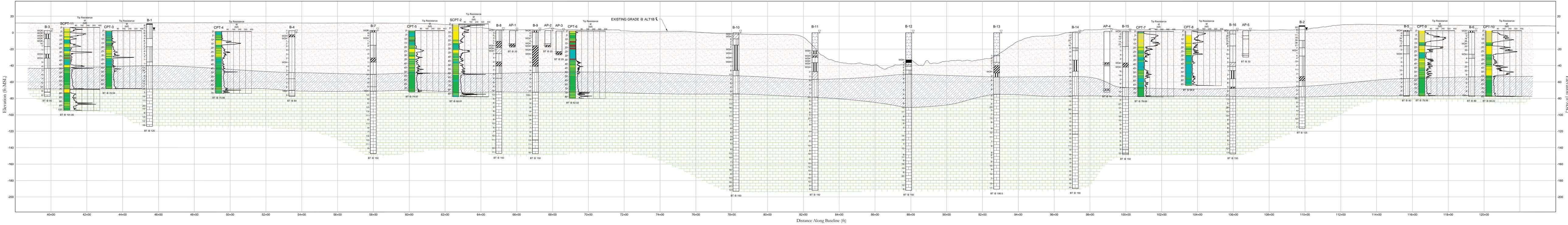
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US 21 (SEA ISLAND PKWY.) BRIDGE REPLACEMENT OVER  
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GEOTECHNICAL BASE LINE REPORT

**APPENDIX**

SECTION 3

GENERALIZED SUBSURFACE PROFILE

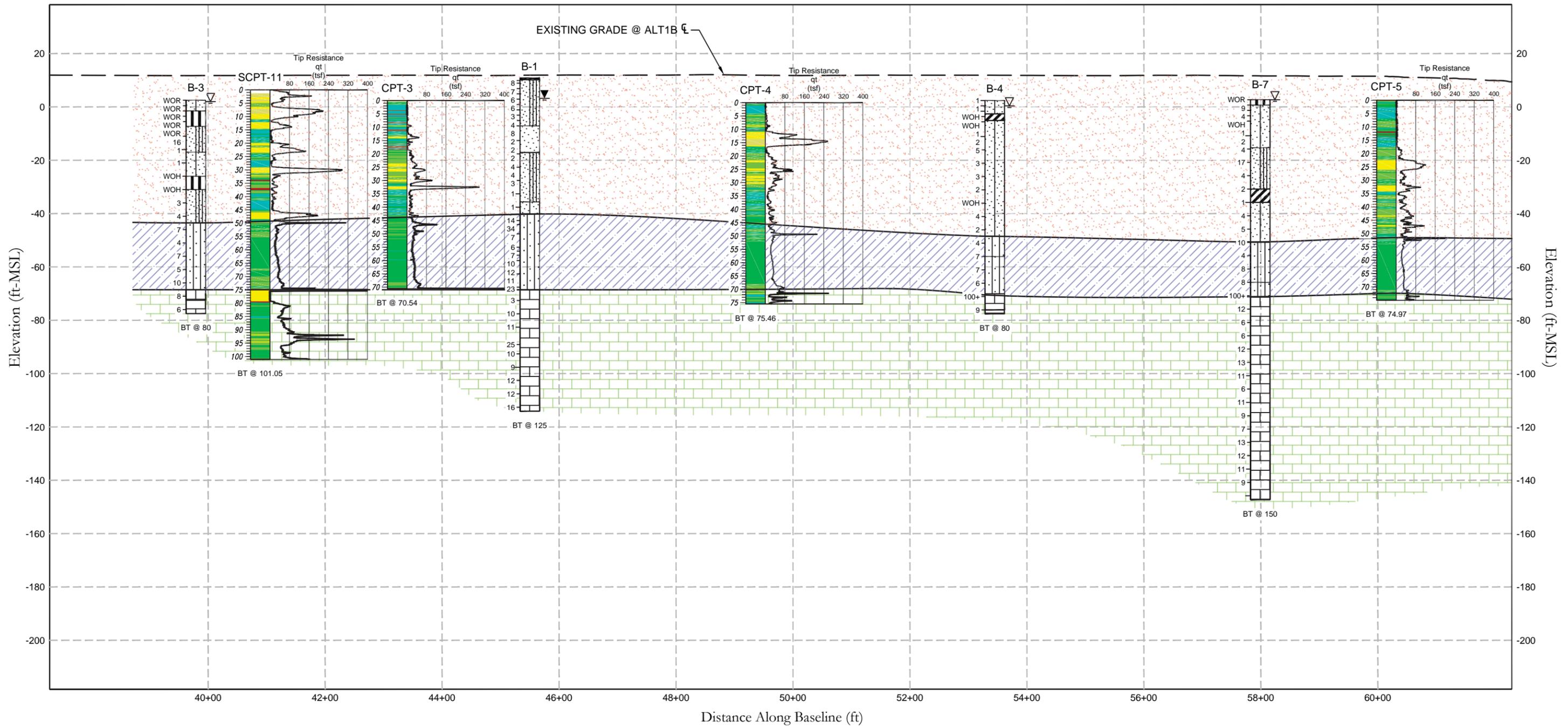


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BRIDGE REPLACEMENT OVER HARBOR RIVER  
GENERALIZED SUBSURFACE PROFILE

SCALE = NTS



**LEGEND:**

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|  | RECENT HOLOCENE SANDS AND CLAYS  |
|  | MIOCENE HAWTHORN MARL            |
|  | OLIGOCENE COOPER GROUP LIMESTONE |

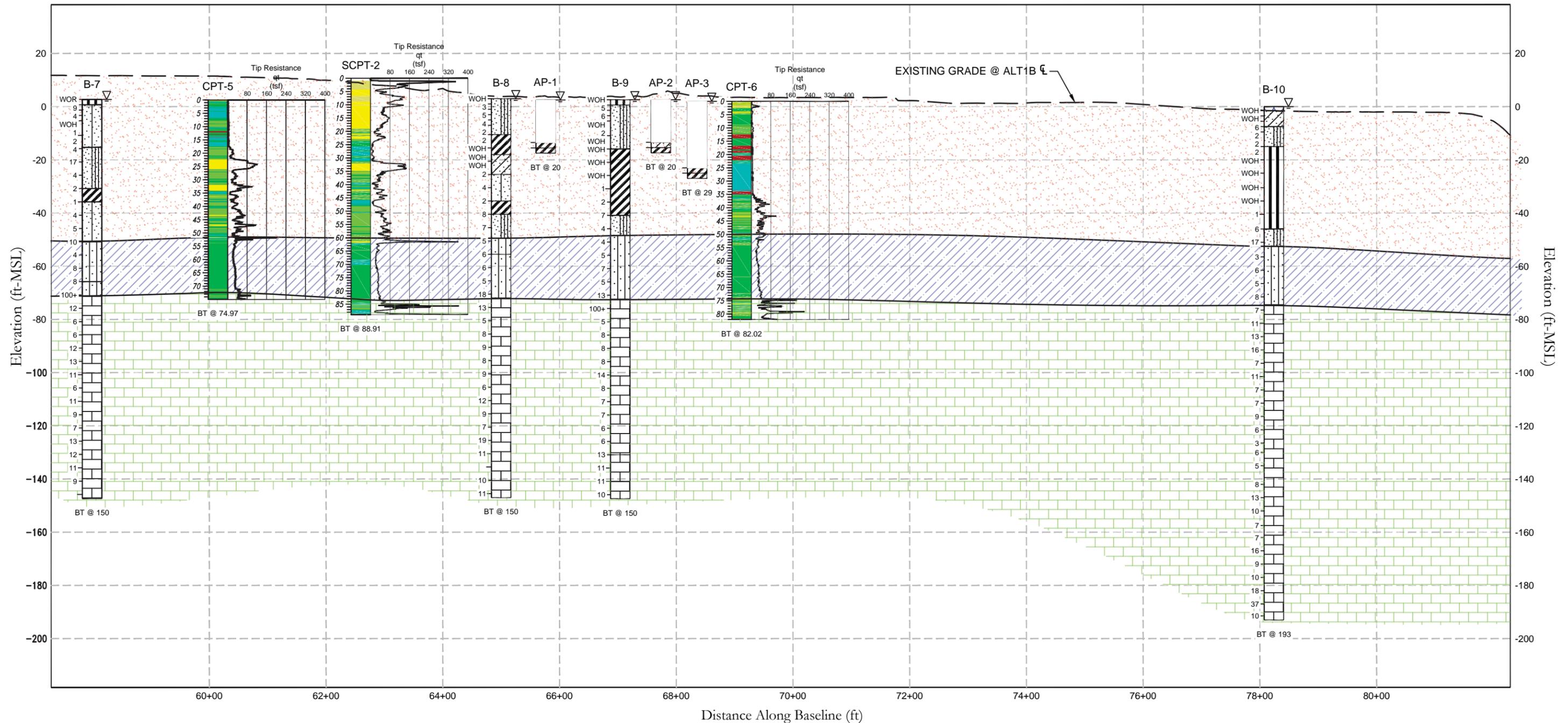
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US-21 (SEA ISLAND PKWY)  
BRIDGE REPLACEMENT OVER HARBOR RIVER  
GENERALIZED SUBSURFACE PROFILE

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|-------------------|-------|----------|------------|------------------|-----------|
| FED. RD. DIV. NO. | STATE | COUNTY   | PROJECT ID | ROAD / ROUTE NO. | SHEET NO. |
| 3                 | SC    | BEAUFORT | P026862    | US-21            | 1         |



**LEGEND:**

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|  | RECENT HOLOCENE SANDS AND CLAYS  |
|  | MIOCENE HAWTHORN MARL            |
|  | OLIGOCENE COOPER GROUP LIMESTONE |

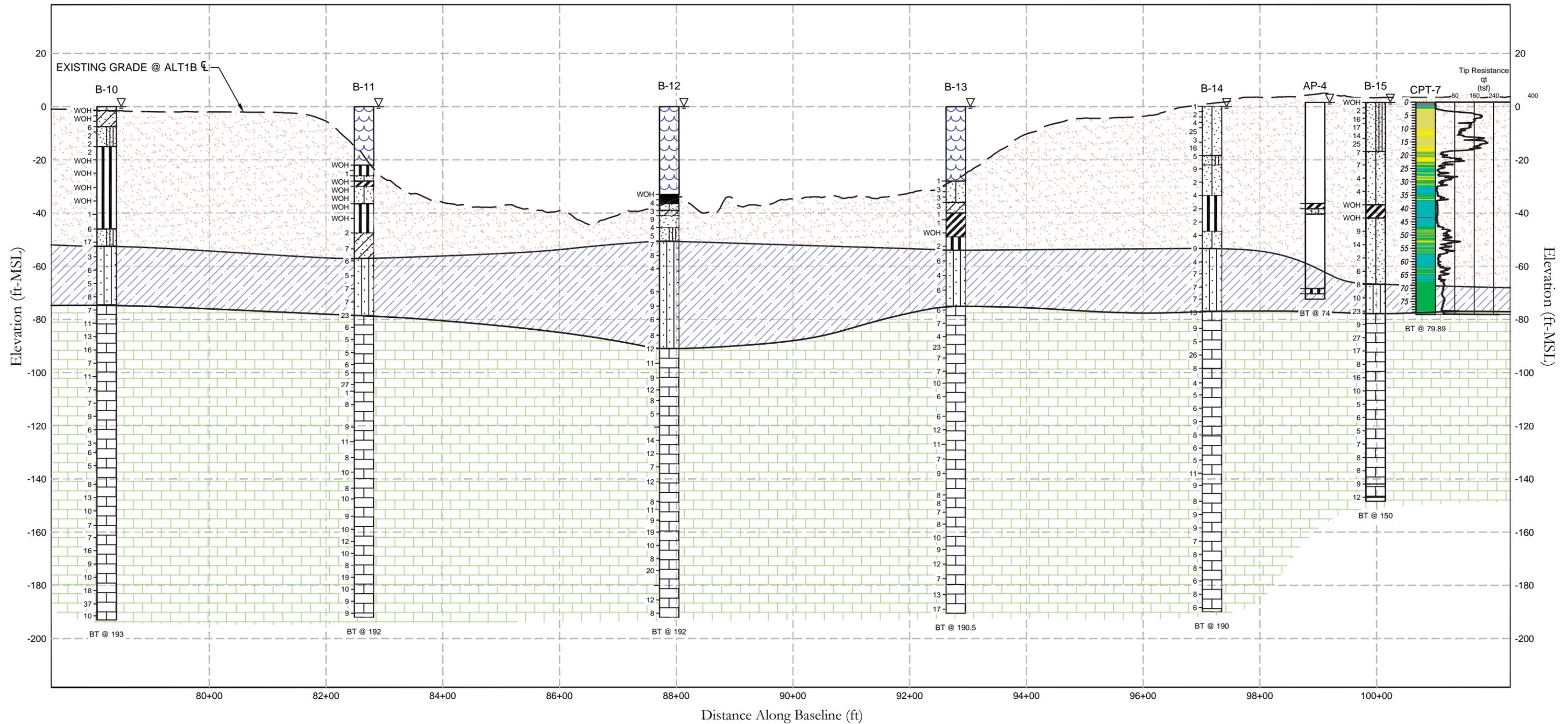
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CONSULTANTS  
GEOTECHNICAL – ENVIRONMENTAL – MATERIALS  
COLUMBIA, SOUTH CAROLINA

US-21 (SEA ISLAND PKWY)  
BRIDGE REPLACEMENT OVER HARBOR RIVER  
GENERALIZED SUBSURFACE PROFILE

SCALE = NTS

|          |                |       |                         |
|----------|----------------|-------|-------------------------|
| REV. NO. | BY             | DATE  | DESCRIPTION OF REVISION |
| 4        |                |       |                         |
| 3        |                |       |                         |
| 2        |                |       |                         |
| 1        |                |       |                         |
| TOPO.    | DATE           |       |                         |
| DWG. CTC | DATE 11/4/2016 | GROUP |                         |
| R/W      | DATE           |       |                         |

|                   |       |          |            |                  |           |
|-------------------|-------|----------|------------|------------------|-----------|
| FED. RD. DIV. NO. | STATE | COUNTY   | PROJECT ID | ROAD / ROUTE NO. | SHEET NO. |
| 3                 | SC    | BEAUFORT | P026862    | US-21            | 1         |



**LEGEND:**

|  |                                  |
|--|----------------------------------|
|  | RECENT HOLOCENE SANDS AND CLAYS  |
|  | MIOCENE HAWTHORN MARL            |
|  | OLIGOCENE COOPER GROUP LIMESTONE |

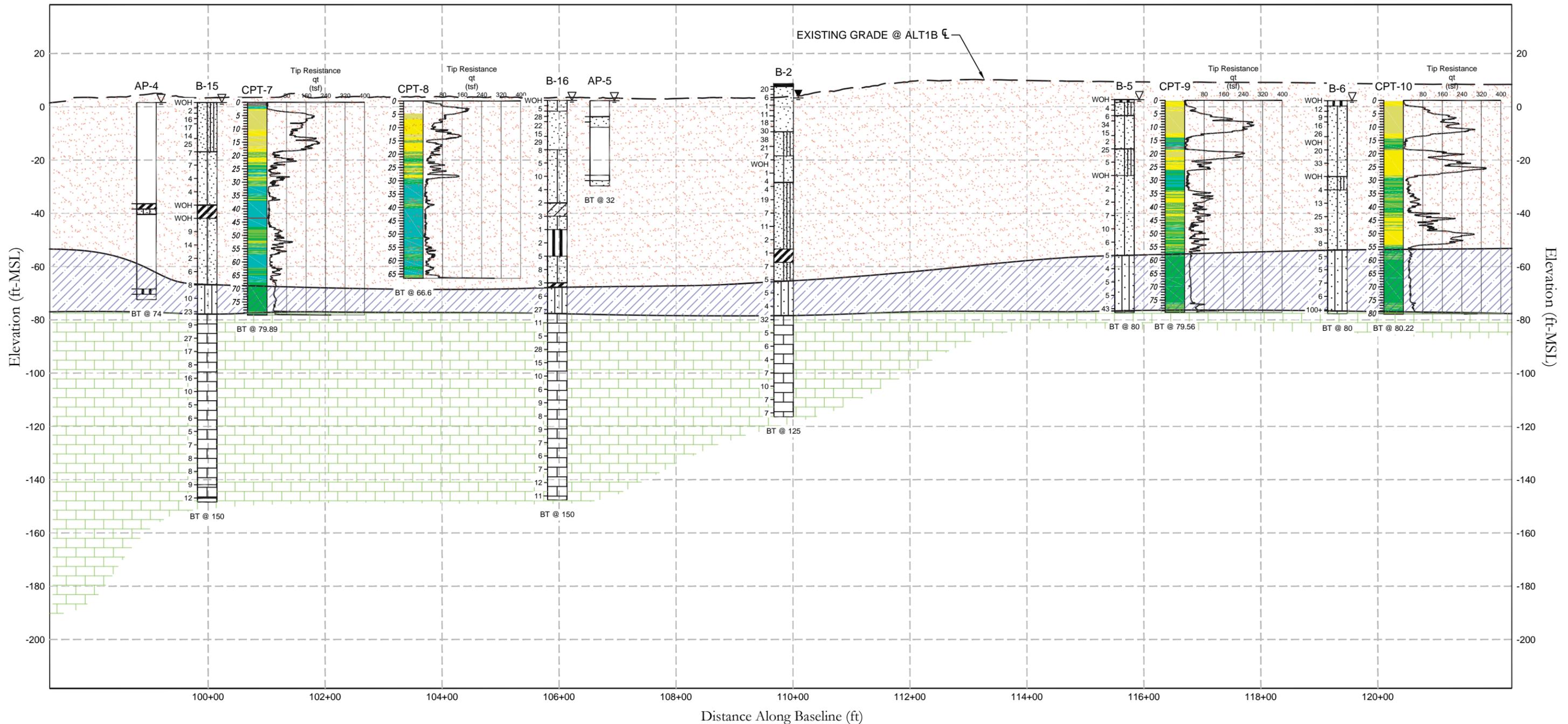
**F&ME**  
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US-21 (SEA ISLAND PKWY)  
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|----------|----------------|-------|-------------------------|
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| 4        |                |       |                         |
| 3        |                |       |                         |
| 2        |                |       |                         |
| 1        |                |       |                         |
| TOPO.    | DATE           |       |                         |
| DWG. CTC | DATE 11/4/2016 | GROUP |                         |
| R/W      | DATE           |       |                         |





**LEGEND:**

|  |                                  |
|--|----------------------------------|
|  | RECENT HOLOCENE SANDS AND CLAYS  |
|  | MIOCENE HAWTHORN MARL            |
|  | OLIGOCENE COOPER GROUP LIMESTONE |

**F&ME**  
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COLUMBIA, SOUTH CAROLINA

US-21 (SEA ISLAND PKWY)  
BRIDGE REPLACEMENT OVER HARBOR RIVER  
GENERALIZED SUBSURFACE PROFILE

SCALE = NTS

|          |                |       |                         |
|----------|----------------|-------|-------------------------|
| REV. NO. | BY             | DATE  | DESCRIPTION OF REVISION |
| 4        |                |       |                         |
| 3        |                |       |                         |
| 2        |                |       |                         |
| 1        |                |       |                         |
| TOPO.    | DATE           |       |                         |
| DWG. CTC | DATE 11/4/2016 | GROUP |                         |
| R/W      | DATE           |       |                         |

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US 21 (SEA ISLAND PKWY.) BRIDGE REPLACEMENT OVER  
HARBOR RIVER  
GEOTECHNICAL BASE LINE REPORT

**APPENDIX**

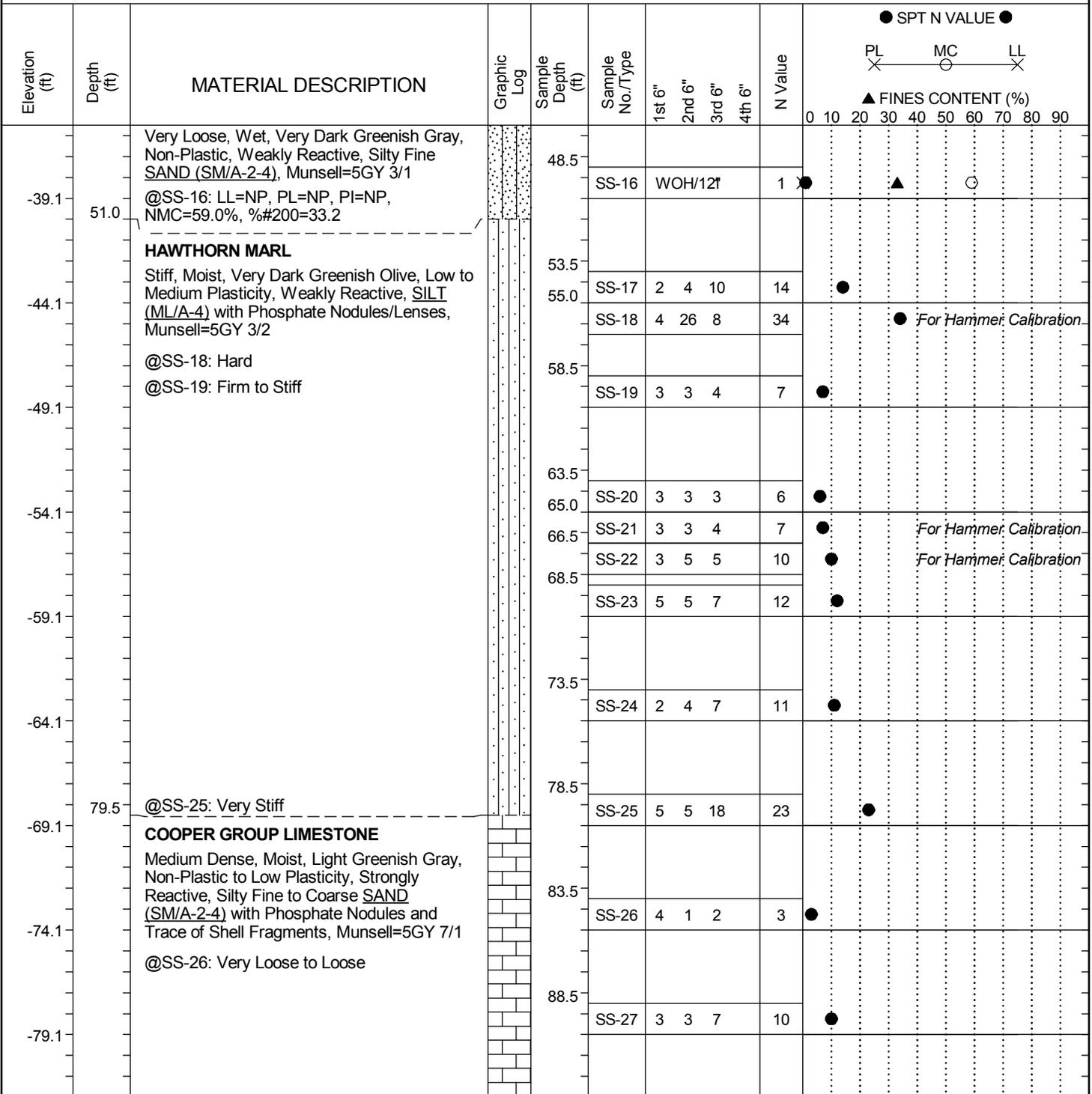
SECTION 4

BORING LOGS & CPT LOGS



# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-1        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 45+50 | <b>Offset:</b> 7.4'-LT        |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 10.9 ft                                               | <b>Latitude:</b> 32.408695    | <b>Longitude:</b> -80.465492  |
| <b>Date Started:</b> 8/26/2014                                      |                               |                               |
| <b>Total Depth:</b> 125 ft                                          | <b>Soil Depth:</b> 125 ft     | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 8/28/2014                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 6                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 550X                                      | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 82%                                            |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> Independence  | <b>Groundwater:</b> TOB NR    |
| <b>24HR:</b> 8.3 ft                                                 |                               |                               |



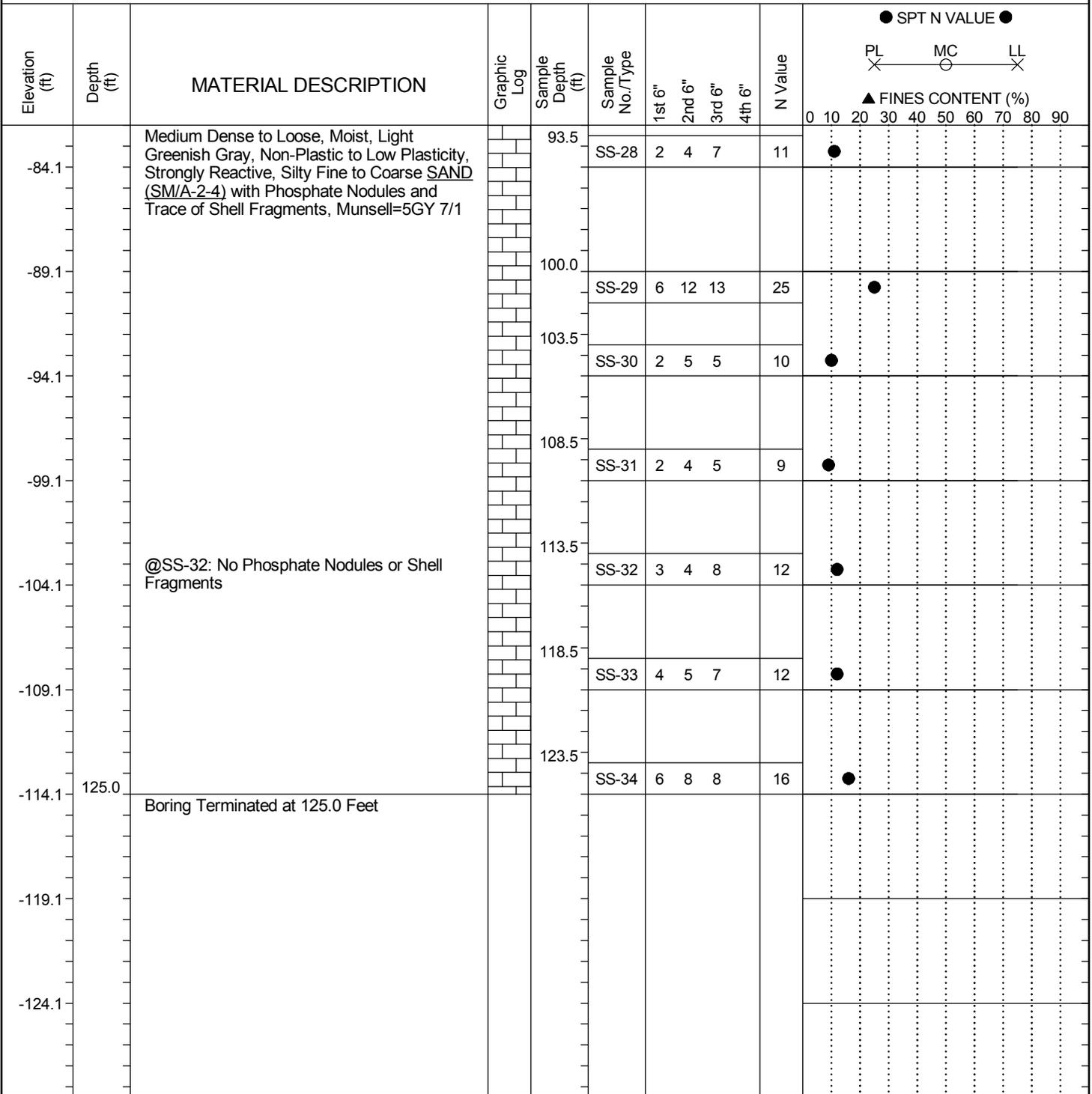
## LEGEND

Continued Next Page

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                                |                              |
|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-1       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River |                                | <b>Route:</b> US 21          |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 45+50  | <b>Offset:</b> 7.4'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 8/26/2014 |                              |
| <b>Elev.:</b> 10.9 ft                                               | <b>Latitude:</b> 32.408695     | <b>Longitude:</b> -80.465492 |
| <b>Total Depth:</b> 125 ft                                          | <b>Soil Depth:</b> 125 ft      | <b>Core Depth:</b> N/A ft    |
| <b>Date Completed:</b> 8/28/2014                                    |                                |                              |
| <b>Bore Hole Diameter (in):</b> 6                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 550X | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 82%       |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> Independence   | <b>Groundwater:</b> TOB NR   |
| <b>24HR:</b> 8.3 ft                                                 |                                |                              |



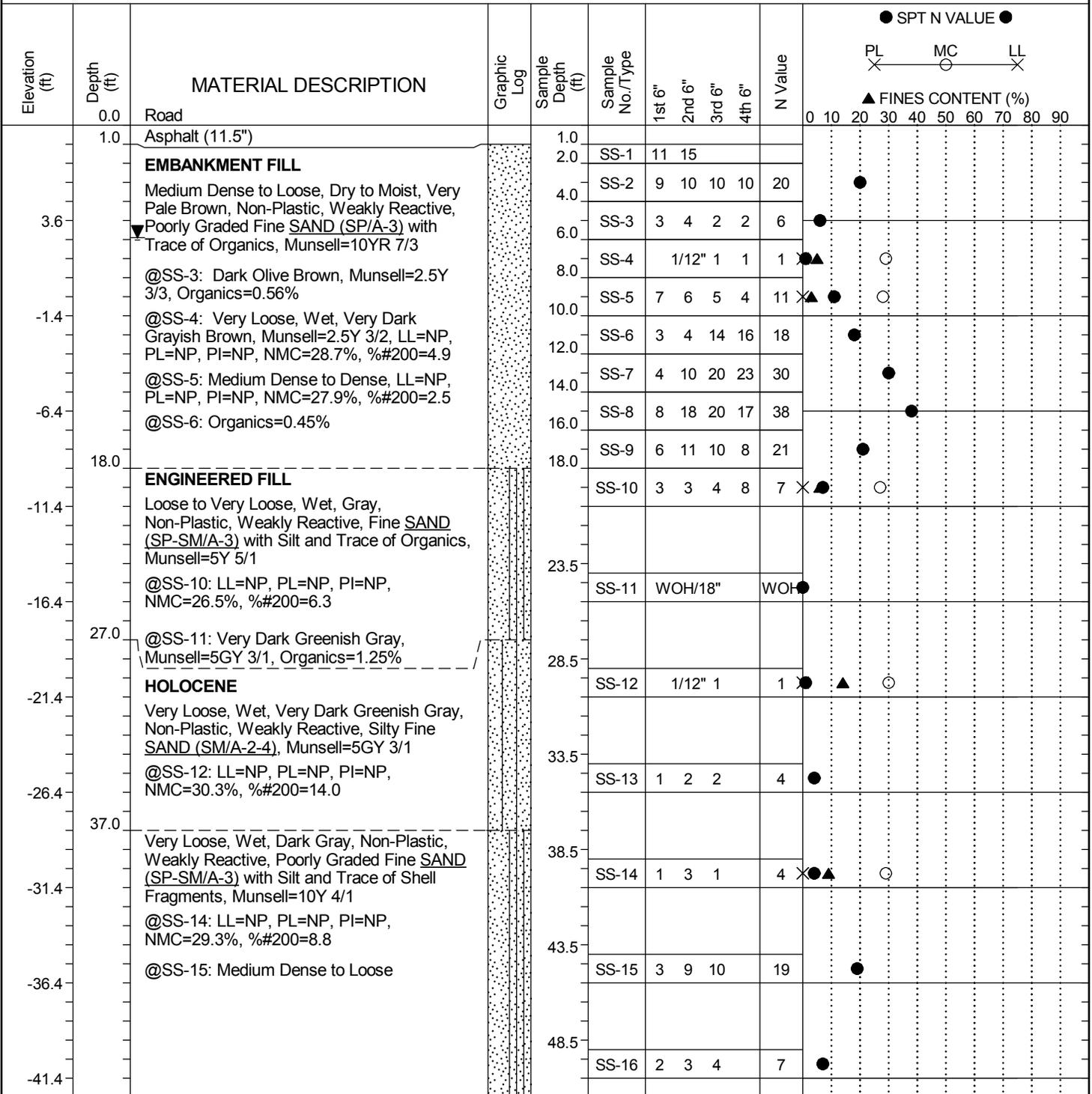
### LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

SC\_DOT\_G5396 - HARBOR RIVER SPT AND CPT.GPJ\_FME2017.GDT\_2/14/17

# SCDOT Soil Test Log

|                                                                     |                                   |                               |
|---------------------------------------------------------------------|-----------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort           | <b>Boring No.:</b> B-2        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21               |                               |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 109+84    | <b>Offset:</b> 28.4'-RT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 8.6 ft              | <b>Latitude:</b> 32.401896    |
| <b>Longitude:</b> -80.446292                                        | <b>Date Started:</b> 9/2/2014     |                               |
| <b>Total Depth:</b> 125 ft                                          | <b>Soil Depth:</b> 125 ft         | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 9/3/2014                                     | <b>Bore Hole Diameter (in):</b> 6 | <b>Sampler Configuration:</b> |
| <b>Liner Required:</b> Y (N)                                        | <b>Liner Used:</b> Y (N)          |                               |
| <b>Drill Machine:</b> CME 550X                                      | <b>Drill Method:</b> RW           | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 82%                                            | <b>Core Size:</b> N/A             | <b>Driller:</b> Independence  |
| <b>Groundwater:</b> TOB NR                                          | <b>24HR:</b> 5.9 ft               |                               |



## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

Continued Next Page



# SCDOT Soil Test Log

|                                                                     |                                |                               |
|---------------------------------------------------------------------|--------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-2        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                               |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 109+84 | <b>Offset:</b> 28.4'-RT       |
| <b>Alignment:</b> ALT 1B                                            |                                |                               |
| <b>Elev.:</b> 8.6 ft                                                | <b>Latitude:</b> 32.401896     | <b>Longitude:</b> -80.446292  |
| <b>Date Started:</b> 9/2/2014                                       |                                |                               |
| <b>Total Depth:</b> 125 ft                                          | <b>Soil Depth:</b> 125 ft      | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 9/3/2014                                     |                                |                               |
| <b>Bore Hole Diameter (in):</b> 6                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                                |                               |
| <b>Drill Machine:</b> CME 550X                                      | <b>Drill Method:</b> RW        | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 82%                                            |                                |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> Independence   | <b>Groundwater:</b> TOB NR    |
| <b>24HR:</b> 5.9 ft                                                 |                                |                               |

| Elevation (ft) | Depth (ft) | MATERIAL DESCRIPTION                                                                                                                                  | Graphic Log | Sample Depth (ft)               | Sample No./Type | SPT N VALUE |        |        |        | N Value | FINES CONTENT (%) |    |    |   |    |    |    |    |    |    |    |    |    |
|----------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------|-----------------|-------------|--------|--------|--------|---------|-------------------|----|----|---|----|----|----|----|----|----|----|----|----|
|                |            |                                                                                                                                                       |             |                                 |                 | 1st 6"      | 2nd 6" | 3rd 6" | 4th 6" |         | PL                | MC | LL | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| -96.4          |            | Very Loose to Loose, Moist, Olive, Non-Plastic, Strongly Reactive, Silty Fine to Coarse SAND (SM/A-2-4) with Phosphate Nodules/Lenses, Munsell=5Y 4/3 |             | 103.5                           | SS-27           | 1           | 2      | 2      |        | 4       | ●                 |    |    |   |    |    |    |    |    |    |    |    |    |
| -101.4         |            |                                                                                                                                                       |             | 108.5                           | SS-28           | 1           | 2      | 5      |        | 7       | ●                 |    |    |   |    |    |    |    |    |    |    |    |    |
| -106.4         |            |                                                                                                                                                       |             | 113.5                           | SS-29           | 1           | 4      | 6      |        | 10      | ●                 |    |    |   |    |    |    |    |    |    |    |    |    |
| -111.4         |            |                                                                                                                                                       |             | 118.5                           | SS-30           | 2           | 2      | 5      |        | 7       | ●                 |    |    |   |    |    |    |    |    |    |    |    |    |
| -116.4         | 125.0      |                                                                                                                                                       |             | Boring Terminated at 125.0 Feet |                 | 123.5       | SS-31  | 2      | 3      | 4       |                   | 7  | ●  |   |    |    |    |    |    |    |    |    |    |
| -121.4         |            |                                                                                                                                                       |             |                                 |                 |             |        |        |        |         |                   |    |    |   |    |    |    |    |    |    |    |    |    |
| -126.4         |            |                                                                                                                                                       |             |                                 |                 |             |        |        |        |         |                   |    |    |   |    |    |    |    |    |    |    |    |    |
| -131.4         |            |                                                                                                                                                       |             |                                 |                 |             |        |        |        |         |                   |    |    |   |    |    |    |    |    |    |    |    |    |
| -136.4         |            |                                                                                                                                                       |             |                                 |                 |             |        |        |        |         |                   |    |    |   |    |    |    |    |    |    |    |    |    |
| -141.4         |            |                                                                                                                                                       |             |                                 |                 |             |        |        |        |         |                   |    |    |   |    |    |    |    |    |    |    |    |    |

## LEGEND

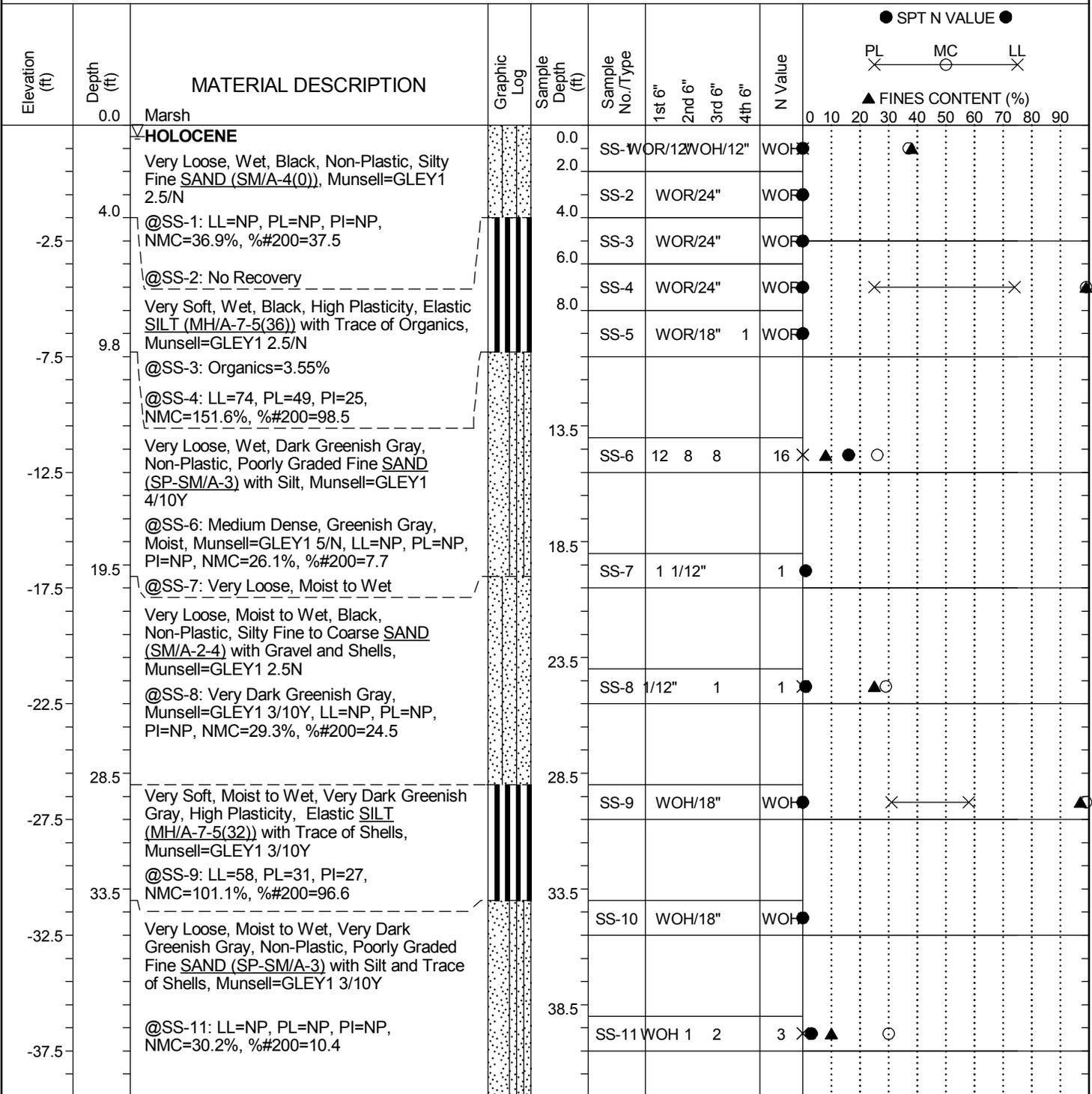
| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

SC\_DOT\_G5396 - HARBOR RIVER SPT AND CPT.GPJ FME2017.GDT 2/14/17



# SCDOT Soil Test Log

|                                                                     |                                |                                |
|---------------------------------------------------------------------|--------------------------------|--------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-3         |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                                |
| <b>Eng./Geo.:</b> J. Stewart                                        | <b>Boring Location:</b> 39+79  | <b>Offset:</b> 81.5'-LT        |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 9/15/2015 |                                |
| <b>Elev.:</b> 2.5 ft                                                | <b>Latitude:</b> 32.409483     | <b>Longitude:</b> -80.467111   |
| <b>Total Depth:</b> 80 ft                                           | <b>Soil Depth:</b> 80 ft       | <b>Core Depth:</b> N/A ft      |
| <b>Date Completed:</b> 9/15/2015                                    |                                |                                |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N)   |
| <b>Liner Used:</b> Y (N)                                            |                                |                                |
| <b>Drill Machine:</b> Deidrich D-25                                 | <b>Drill Method:</b> RW        | <b>Hammer Type:</b> Automatic  |
| <b>Energy Ratio:</b> 80%                                            |                                |                                |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0.5 ft |
| <b>24HR:</b> TIDAL                                                  |                                |                                |



## LEGEND

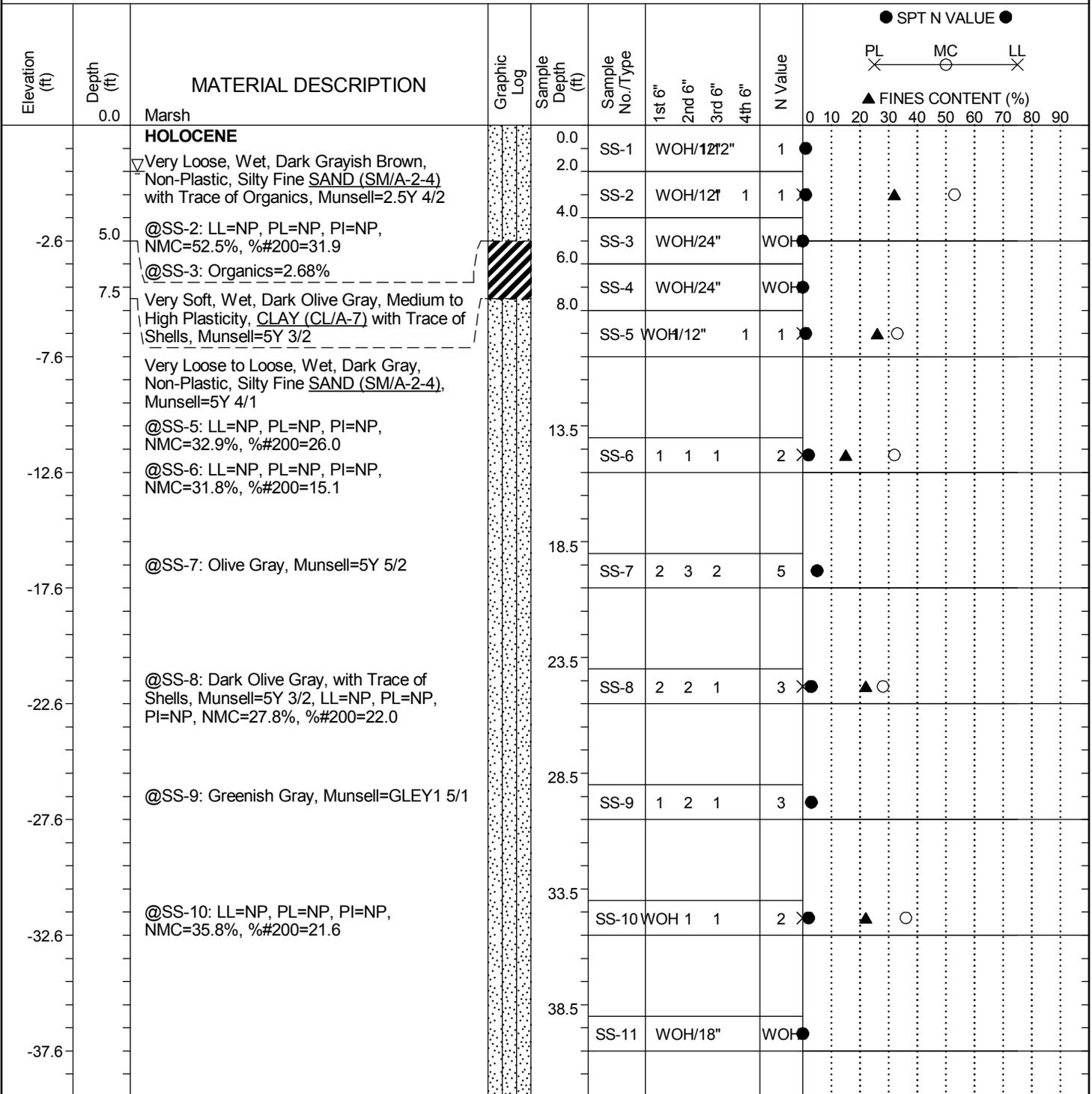
| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

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# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-4        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 53+45 | <b>Offset:</b> 92.6'-LT       |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 2.4 ft                                                | <b>Latitude:</b> 32.408077    | <b>Longitude:</b> -80.463008  |
| <b>Date Started:</b> 9/16/2015                                      |                               |                               |
| <b>Total Depth:</b> 80 ft                                           | <b>Soil Depth:</b> 80 ft      | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 9/16/2015                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> Deidrich D-25                                 | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 80%                                            |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 2 ft  |
|                                                                     |                               | <b>24HR:</b> TIDAL            |



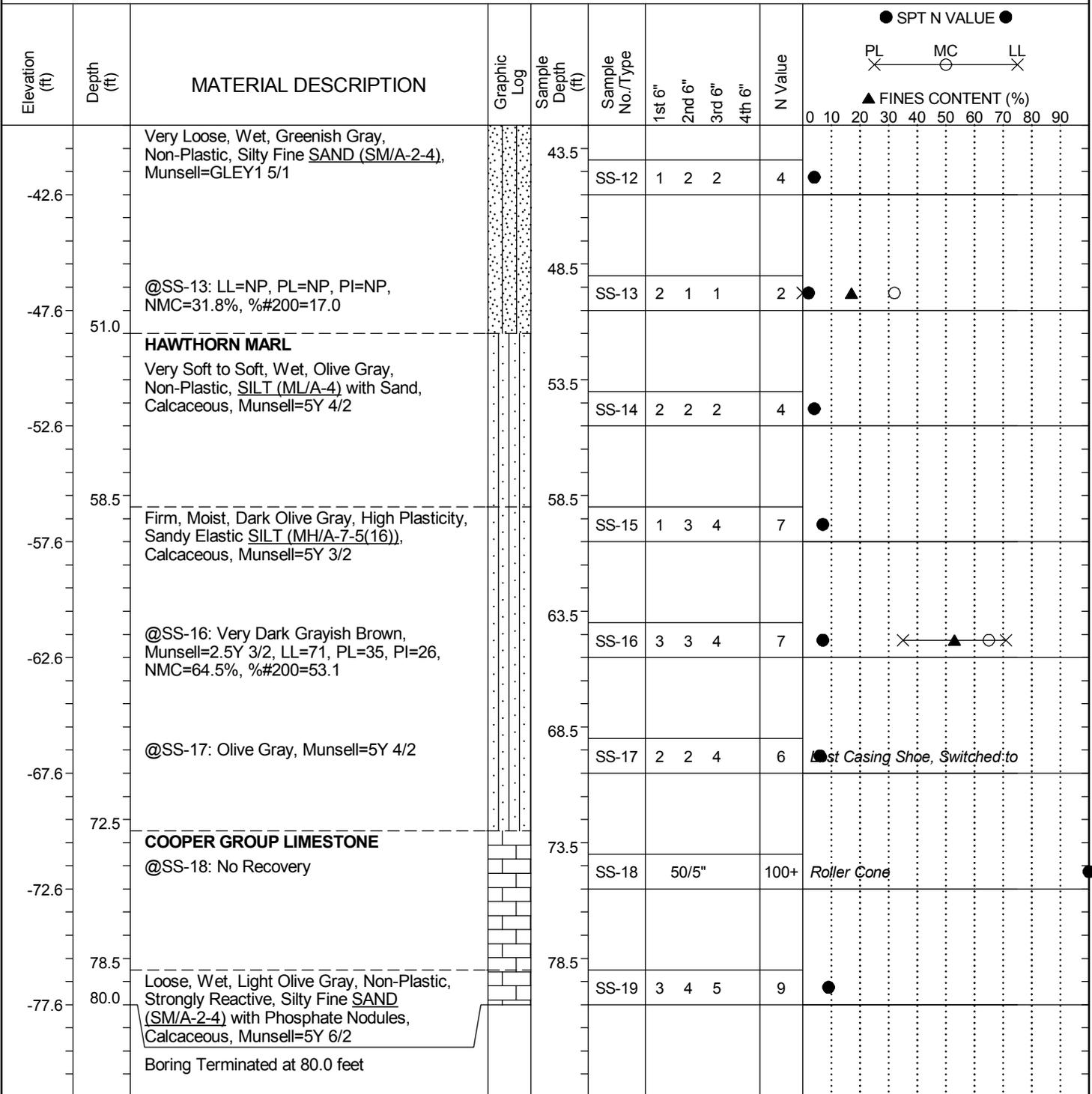
## LEGEND

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| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                                   |                               |
|---------------------------------------------------------------------|-----------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort           | <b>Boring No.:</b> B-4        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21               |                               |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 53+45     | <b>Offset:</b> 92.6'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 2.4 ft              | <b>Latitude:</b> 32.408077    |
| <b>Longitude:</b> -80.463008                                        | <b>Date Started:</b> 9/16/2015    |                               |
| <b>Total Depth:</b> 80 ft                                           | <b>Soil Depth:</b> 80 ft          | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 9/16/2015                                    | <b>Bore Hole Diameter (in):</b> 4 | <b>Sampler Configuration</b>  |
| <b>Liner Required:</b> Y (N)                                        | <b>Liner Used:</b> Y (N)          |                               |
| <b>Drill Machine:</b> Deidrich D-25                                 | <b>Drill Method:</b> RW           | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 80%                                            | <b>Core Size:</b> N/A             | <b>Driller:</b> M.A.D.        |
| <b>Groundwater:</b> TOB                                             | <b>24HR:</b> TIDAL                | <b>Groundwater:</b> TOB 2 ft  |



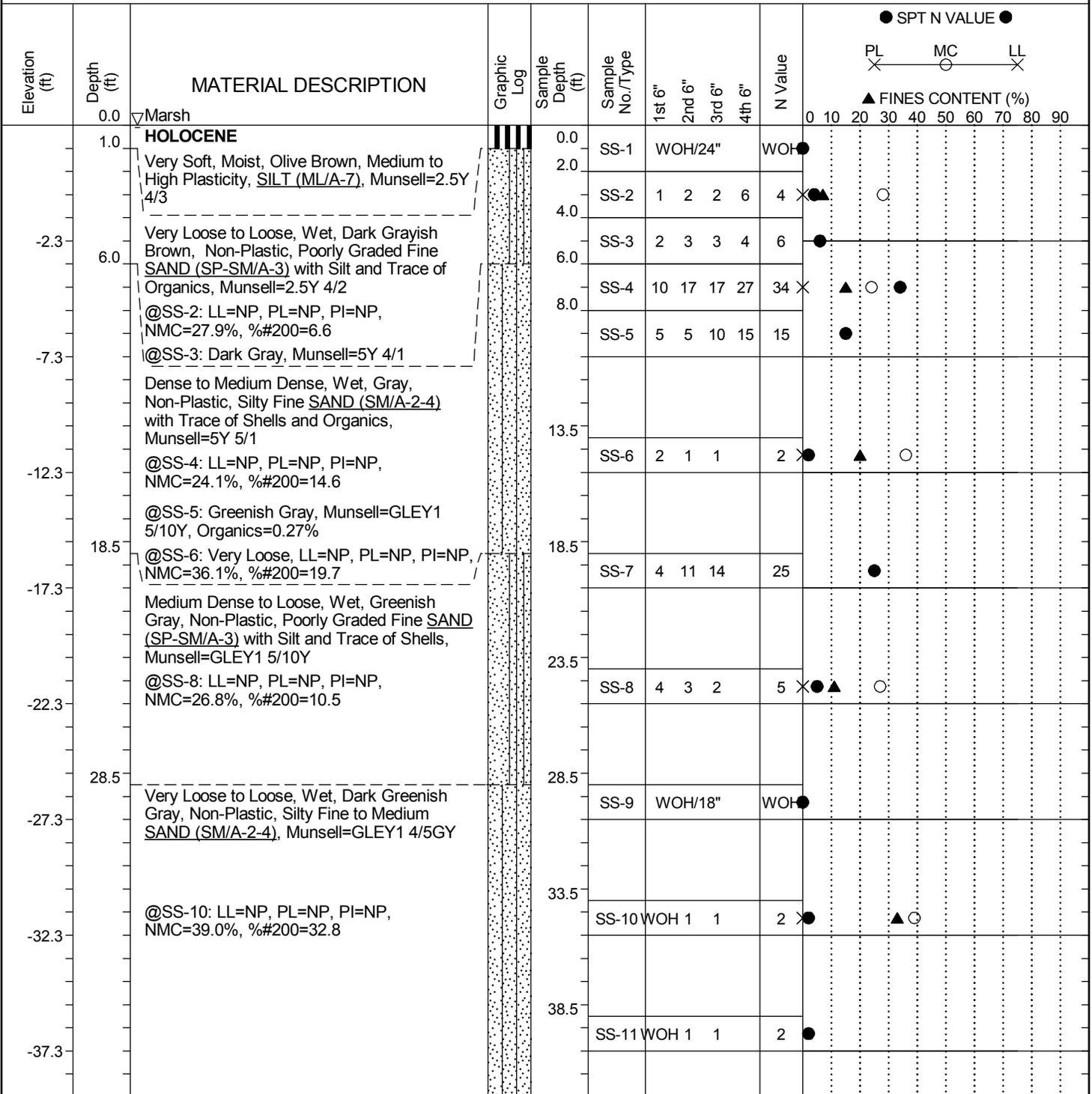
## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

SC\_DOT\_G5396 - HARBOR RIVER SPT AND CPT.GPJ FME2017.GDT 2/14/17

# SCDOT Soil Test Log

|                                                                     |                                   |                               |
|---------------------------------------------------------------------|-----------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort           | <b>Boring No.:</b> B-5        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21               |                               |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 116+48    | <b>Offset:</b> 81.7'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 2.7 ft              | <b>Latitude:</b> 32.400844    |
| <b>Longitude:</b> -80.444475                                        | <b>Date Started:</b> 9/17/2015    |                               |
| <b>Total Depth:</b> 80 ft                                           | <b>Soil Depth:</b> 80 ft          | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 9/17/2015                                    | <b>Bore Hole Diameter (in):</b> 4 | <b>Sampler Configuration:</b> |
| <b>Liner Required:</b> Y (N)                                        | <b>Liner Used:</b> Y (N)          |                               |
| <b>Drill Machine:</b> Deidrich D-25                                 | <b>Drill Method:</b> RW           | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 80%                                            | <b>Core Size:</b> N/A             | <b>Driller:</b> M.A.D.        |
| <b>Groundwater:</b> TOB 0 ft                                        | <b>24HR:</b>                      | <b>TIDAL:</b>                 |



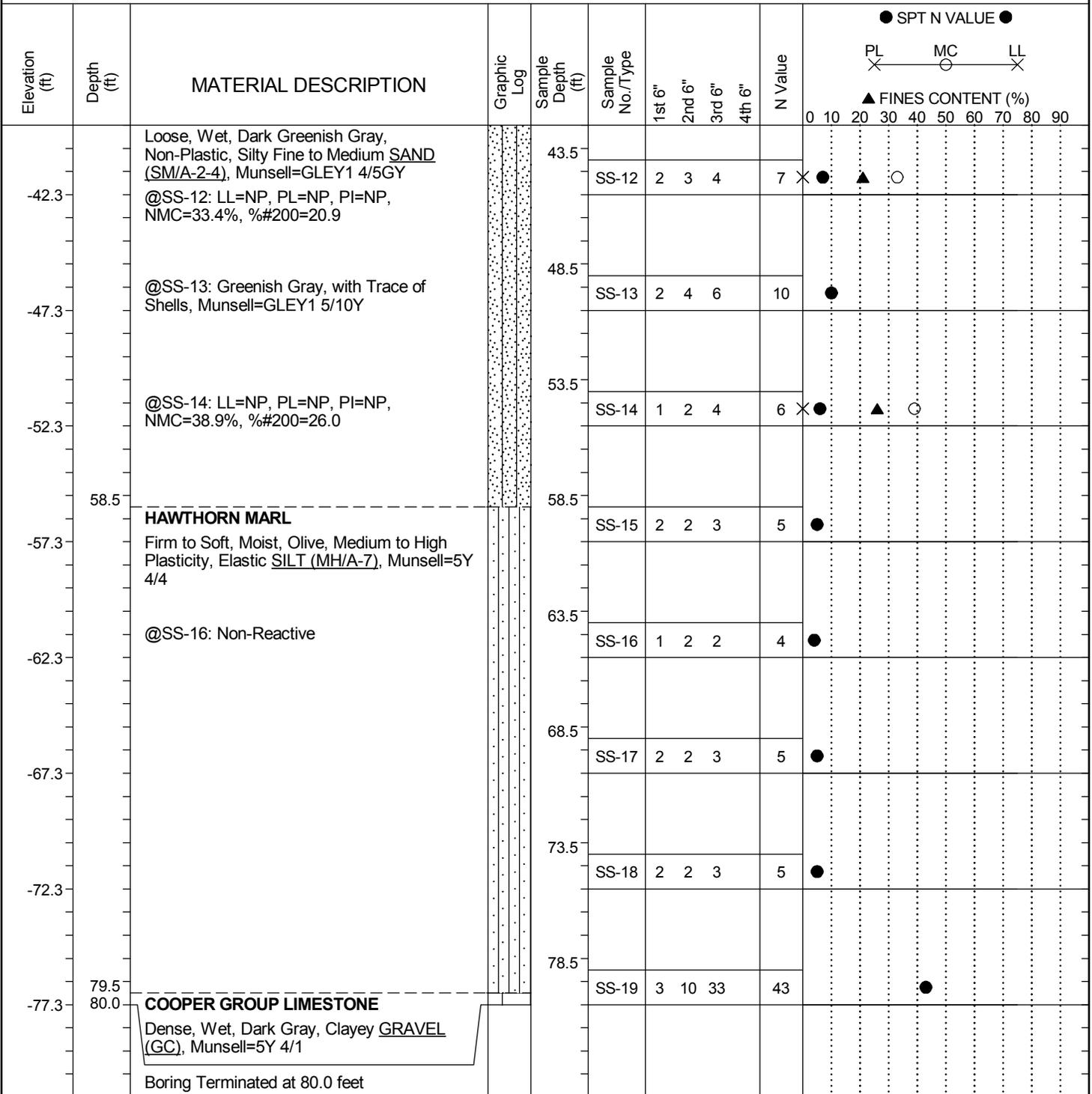
## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

Continued Next Page

# SCDOT Soil Test Log

|                                                                     |                                   |                               |
|---------------------------------------------------------------------|-----------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort           | <b>Boring No.:</b> B-5        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21               |                               |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 116+48    | <b>Offset:</b> 81.7'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 2.7 ft              | <b>Latitude:</b> 32.400844    |
| <b>Longitude:</b> -80.444475                                        | <b>Date Started:</b> 9/17/2015    |                               |
| <b>Total Depth:</b> 80 ft                                           | <b>Soil Depth:</b> 80 ft          | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 9/17/2015                                    | <b>Bore Hole Diameter (in):</b> 4 | <b>Sampler Configuration:</b> |
| <b>Liner Required:</b> Y (N)                                        | <b>Liner Used:</b> Y (N)          |                               |
| <b>Drill Machine:</b> Deidrich D-25                                 | <b>Drill Method:</b> RW           | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 80%                                            | <b>Core Size:</b> N/A             | <b>Driller:</b> M.A.D.        |
| <b>Groundwater:</b> TOB 0 ft                                        | <b>24HR:</b>                      | <b>TIDAL:</b>                 |

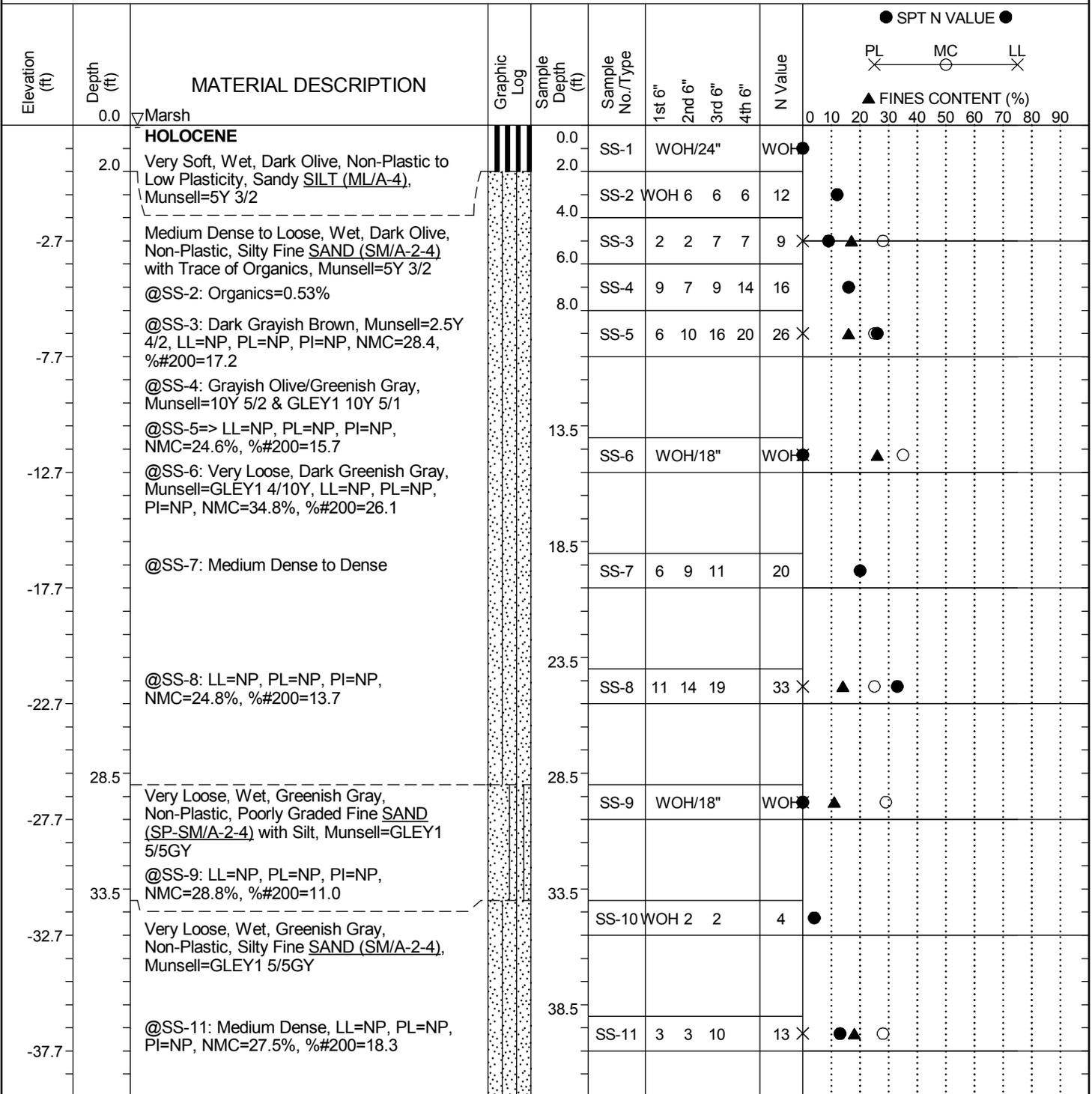


## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                                   |                               |
|---------------------------------------------------------------------|-----------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort           | <b>Boring No.:</b> B-6        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21               |                               |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 119+93    | <b>Offset:</b> 41.7'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 2.3 ft              | <b>Latitude:</b> 32.39997     |
| <b>Longitude:</b> -80.443953                                        | <b>Date Started:</b> 9/18/2015    |                               |
| <b>Total Depth:</b> 80 ft                                           | <b>Soil Depth:</b> 80 ft          | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 9/18/2015                                    | <b>Bore Hole Diameter (in):</b> 4 | <b>Sampler Configuration:</b> |
| <b>Liner Required:</b> Y (N)                                        | <b>Liner Used:</b> Y (N)          |                               |
| <b>Drill Machine:</b> Deidrich D-25                                 | <b>Drill Method:</b> RW           | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 80%                                            | <b>Core Size:</b> N/A             | <b>Driller:</b> M.A.D.        |
| <b>Groundwater:</b> TOB                                             | <b>0 ft</b>                       | <b>24HR:</b> TIDAL            |



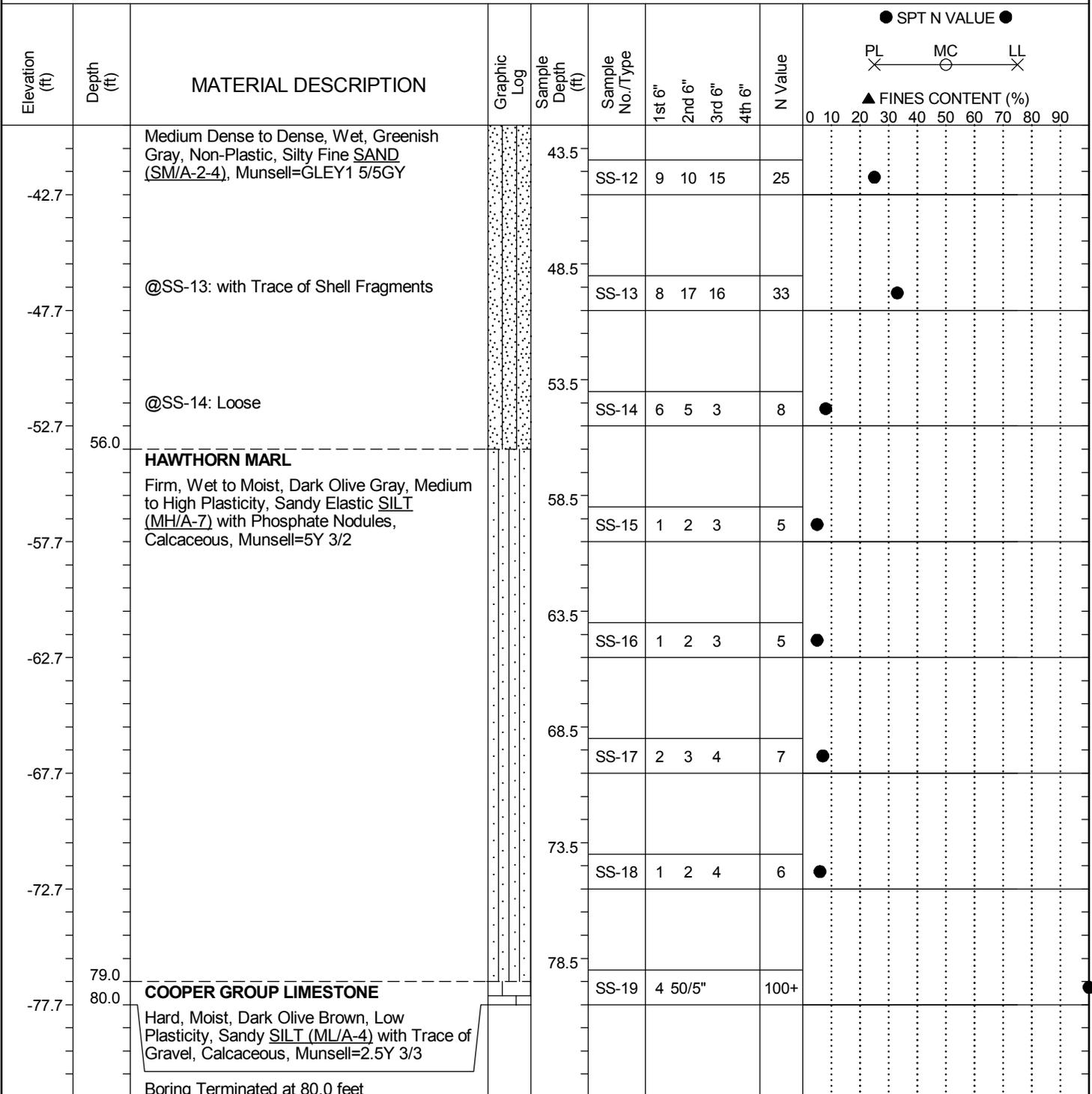
## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

Continued Next Page

# SCDOT Soil Test Log

|                                                                     |                                   |                               |
|---------------------------------------------------------------------|-----------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort           | <b>Boring No.:</b> B-6        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21               |                               |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 119+93    | <b>Offset:</b> 41.7'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 2.3 ft              | <b>Latitude:</b> 32.39997     |
| <b>Longitude:</b> -80.443953                                        | <b>Date Started:</b> 9/18/2015    |                               |
| <b>Total Depth:</b> 80 ft                                           | <b>Soil Depth:</b> 80 ft          | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 9/18/2015                                    | <b>Bore Hole Diameter (in):</b> 4 | <b>Sampler Configuration:</b> |
| <b>Liner Required:</b> Y (N)                                        | <b>Liner Used:</b> Y (N)          |                               |
| <b>Drill Machine:</b> Deidrich D-25                                 | <b>Drill Method:</b> RW           | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 80%                                            | <b>Core Size:</b> N/A             | <b>Driller:</b> M.A.D.        |
| <b>Groundwater:</b> TOB 0 ft                                        | <b>24HR:</b>                      | <b>TIDAL:</b>                 |



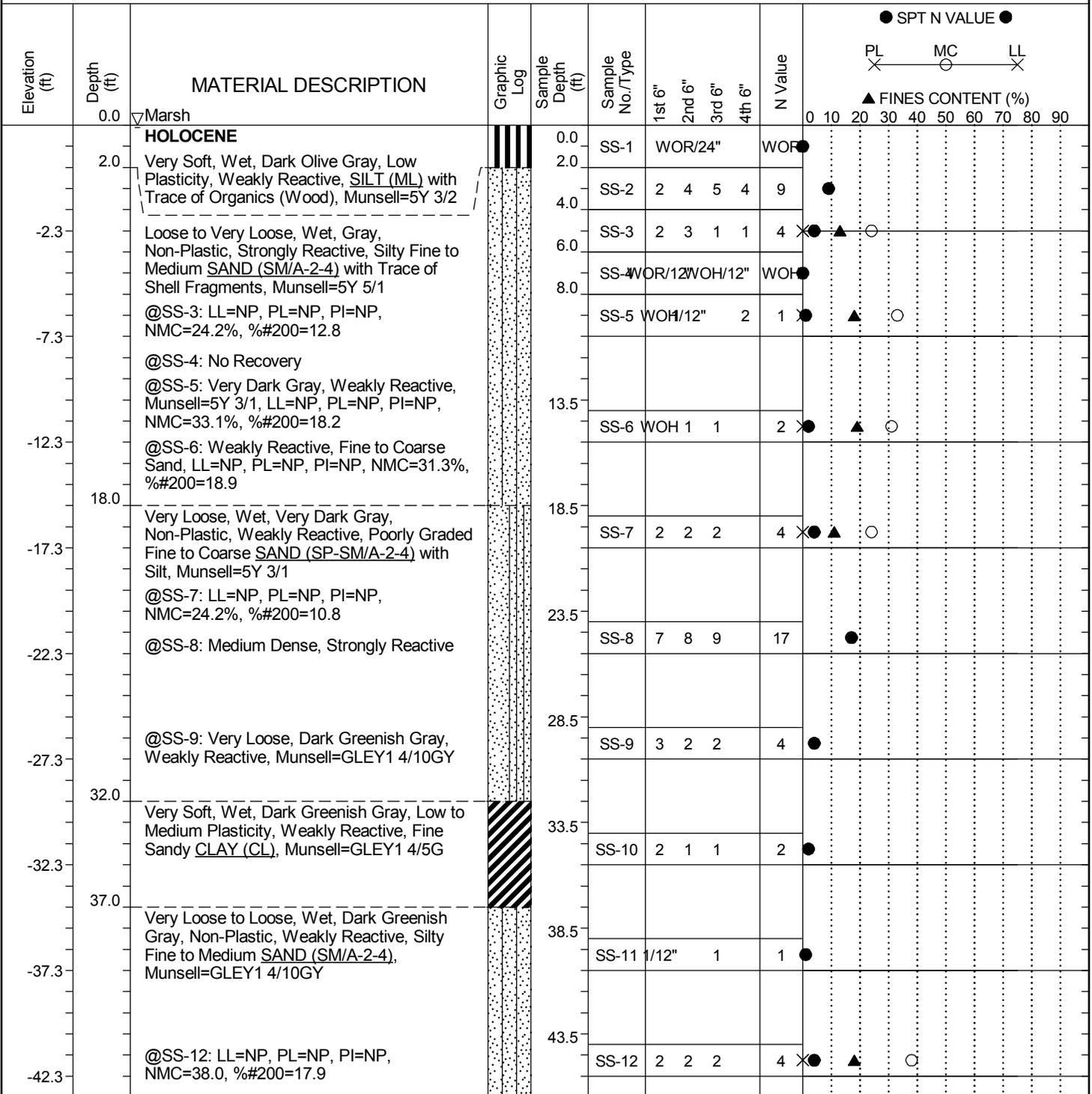
## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |



# SCDOT Soil Test Log

|                                                                     |                                   |                               |
|---------------------------------------------------------------------|-----------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort           | <b>Boring No.:</b> B-7        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21               |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 57+99     | <b>Offset:</b> 45.9'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 2.7 ft              | <b>Latitude:</b> 32.407501    |
| <b>Longitude:</b> -80.461704                                        | <b>Date Started:</b> 7/19/2016    |                               |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft         | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 7/20/2016                                    | <b>Bore Hole Diameter (in):</b> 4 | <b>Sampler Configuration:</b> |
| <b>Liner Required:</b> Y (N)                                        | <b>Liner Used:</b> Y (N)          |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW           | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          | <b>Core Size:</b> N/A             | <b>Driller:</b> M.A.D.        |
| <b>Groundwater:</b> TOB 0 ft                                        | <b>24HR:</b> TIDAL                |                               |



### LEGEND

|                         |                        |                                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

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SC\_DOT\_G5396 - HARBOR RIVER SPT AND CPT.GPJ FME2017.GDT 2/14/17

# SCDOT Soil Test Log

|                                                                     |                                   |                               |
|---------------------------------------------------------------------|-----------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort           | <b>Boring No.:</b> B-7        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21               |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 57+99     | <b>Offset:</b> 45.9'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 2.7 ft              | <b>Latitude:</b> 32.407501    |
| <b>Longitude:</b> -80.461704                                        | <b>Date Started:</b> 7/19/2016    |                               |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft         | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 7/20/2016                                    | <b>Bore Hole Diameter (in):</b> 4 | <b>Sampler Configuration:</b> |
| <b>Liner Required:</b> Y (N)                                        | <b>Liner Used:</b> Y (N)          |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW           | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          | <b>Core Size:</b> N/A             | <b>Driller:</b> M.A.D.        |
| <b>Groundwater:</b> TOB 0 ft                                        | <b>24HR:</b> TIDAL                |                               |

| Elevation (ft) | Depth (ft) | MATERIAL DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                          | Graphic Log      | Sample Depth (ft) | Sample No./Type | SPT N VALUE |        |        |        | FINES CONTENT (%)                   |
|----------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------|-----------------|-------------|--------|--------|--------|-------------------------------------|
|                |            |                                                                                                                                                                                                                                                                                                                                                                                               |                  |                   |                 | 1st 6"      | 2nd 6" | 3rd 6" | 4th 6" |                                     |
| -47.3          | 53.5       | Loose, Wet, Dark Greenish Gray, Non-Plastic, Weakly Reactive, Silty Fine to Medium SAND (SM/A-2-4), Munsell=GLEY1 4/10GY<br>@SS-13: Dark Gray, Munsell=GLEY1 4/N                                                                                                                                                                                                                              | [Dotted Pattern] | 48.5              | SS-13           | 1           | 2      | 3      | 5      | ● Hard Lense from 52.5 to 53.0 feet |
| -52.3          | 53.5       | <b>HAWTHORN MARL</b><br>Stiff, Wet, Olive Gray, Non-Plastic to Low Plasticity, Weakly Reactive, Sandy SILT (ML/A-4) with Phosphate Nodules, Munsell=5Y 4/2<br>@SS-15: Soft to Firm                                                                                                                                                                                                            | [Dotted Pattern] | 53.5              | SS-14           | 4           | 5      | 5      | 10     | ●                                   |
| -57.3          | 58.5       | @SS-15: Soft to Firm                                                                                                                                                                                                                                                                                                                                                                          | [Dotted Pattern] | 58.5              | SS-15           | 2           | 2      | 2      | 4      | ● Hard Lense from 58.0 to 58.5 feet |
| -62.3          | 63.5       |                                                                                                                                                                                                                                                                                                                                                                                               | [Dotted Pattern] | 63.5              | SS-16           | 3           | 4      | 4      | 8      | ●                                   |
| -67.3          | 68.5       | Loose, Wet, Olive Gray, Non-Plastic to Low Plasticity, Non-Reactive, Silty Fine SAND (SM/A-2-4), Munsell=5Y 4/2                                                                                                                                                                                                                                                                               | [Dotted Pattern] | 68.5              | SS-17           | 3           | 4      | 4      | 8      | ●                                   |
| -72.3          | 74.0       | <b>COOPER GROUP LIMESTONE</b><br>Very Dense, Wet, Dark Greenish Gray, Non-Plastic to Low Plasticity, Non-Reactive, Silty Fine SAND (SM/A-2-4) with Phosphate Nodules, Calcaceous, Munsell=GLEY1 4/5GY<br>@SS-19: Medium Dense to Loose, Light Greenish Gray, Strongly Reactive, Munsell=GLEY1 7/5GY<br>@SS-20: Greenish Gray, Fine to Medium Sand, Munsell=GLEY1 6/10Y<br>@SS-21: No Recovery | [Brick Pattern]  | 73.5              | SS-18           | 750/5.5"    |        |        | 100+   | ●                                   |
| -77.3          | 78.5       |                                                                                                                                                                                                                                                                                                                                                                                               | [Brick Pattern]  | 78.5              | SS-19           | 30          | 6      | 6      | 12     | ●                                   |
| -82.3          | 83.5       |                                                                                                                                                                                                                                                                                                                                                                                               | [Brick Pattern]  | 83.5              | SS-20           | 3           | 2      | 4      | 6      | ●                                   |
| -87.3          | 88.5       |                                                                                                                                                                                                                                                                                                                                                                                               | [Brick Pattern]  | 88.5              | SS-21           | 2           | 3      | 3      | 6      | ●                                   |

## LEGEND

Continued Next Page

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |







# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-8        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 65+00 | <b>Offset:</b> 0.1'-RT        |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 3.0 ft                                                | <b>Latitude:</b> 32.406749    | <b>Longitude:</b> -80.459611  |
| <b>Date Started:</b> 7/25/2016                                      |                               |                               |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft     | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 7/26/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |

| Elevation (ft) | Depth (ft) | MATERIAL DESCRIPTION                                                                                                                                                                        | Graphic Log | Sample Depth (ft) | Sample No./Type | SPT N VALUE |        |        |        | N Value | FINES CONTENT (%)                 |    |    |                     |  |  |  |  |  |  |
|----------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------|-----------------|-------------|--------|--------|--------|---------|-----------------------------------|----|----|---------------------|--|--|--|--|--|--|
|                |            |                                                                                                                                                                                             |             |                   |                 | 1st 6"      | 2nd 6" | 3rd 6" | 4th 6" |         | PL                                | MC | LL | ▲ FINES CONTENT (%) |  |  |  |  |  |  |
| -52.0          | 58.5       | <b>HAWTHORN MARL</b><br>Loose, Wet, Olive Gray, Medium Plasticity, Non-Reactive, Silty Fine to Medium SAND (SM/A-2-6) with Phosphate Nodules, Munsell=5Y 4/2                                |             | 53.5              | SS-15           | 3           | 3      | 2      |        | 5       |                                   |    |    |                     |  |  |  |  |  |  |
| -57.0          | 58.5       | Firm, Wet, Olive Gray, Low to Medium Plasticity, Non-Reactive, Fine Sandy SILT (ML/A-4), Munsell=5Y 4/2                                                                                     |             | 58.5              | SS-16           | 3           | 3      | 3      |        | 6       |                                   |    |    |                     |  |  |  |  |  |  |
| -62.0          | 63.5       |                                                                                                                                                                                             |             | 63.5              | SS-17           | 3           | 2      | 4      |        | 6       |                                   |    |    |                     |  |  |  |  |  |  |
| -67.0          | 68.5       |                                                                                                                                                                                             |             | 68.5              | SS-18           | 2           | 2      | 3      |        | 5       |                                   |    |    |                     |  |  |  |  |  |  |
| -72.0          | 75.0       | @SS-19: Very Stiff                                                                                                                                                                          |             | 73.5              | SS-19           | 3           | 4      | 14     |        | 18      | Hard Dense from 75.0 to 75.5 feet |    |    |                     |  |  |  |  |  |  |
| -77.0          | 78.5       | <b>COOPER GROUP LIMESTONE</b><br>Medium Dense to Loose, Wet, Light Greenish Gray, Low Plasticity, Strongly Reactive, Silty Fine to Medium SAND (SM/A-2-4), Calcaceous, Munsell=GLE Y1 7/5GY |             | 78.5              | SS-20           | 21          | 8      | 5      |        | 13      |                                   |    |    |                     |  |  |  |  |  |  |
| -82.0          | 83.5       |                                                                                                                                                                                             |             | 83.5              | SS-21           | 3           | 2      | 3      |        | 5       |                                   |    |    |                     |  |  |  |  |  |  |
| -87.0          | 88.5       | @SS-22: No Recovery                                                                                                                                                                         |             | 88.5              | SS-22           | 2           | 3      | 5      |        | 8       |                                   |    |    |                     |  |  |  |  |  |  |
| -92.0          | 93.5       | @SS-23: No Recovery                                                                                                                                                                         |             | 93.5              | SS-23           | 2           | 4      | 5      |        | 9       |                                   |    |    |                     |  |  |  |  |  |  |
| -97.0          | 98.5       |                                                                                                                                                                                             |             | 98.5              | SS-24           | 3           | 3      | 5      |        | 8       |                                   |    |    |                     |  |  |  |  |  |  |
|                | 103.5      | @SS-25: Greenish Gray, Munsell=GLE Y1 6/5GY                                                                                                                                                 |             | 103.5             | SS-25           | 4           | 4      | 5      |        | 9       |                                   |    |    |                     |  |  |  |  |  |  |

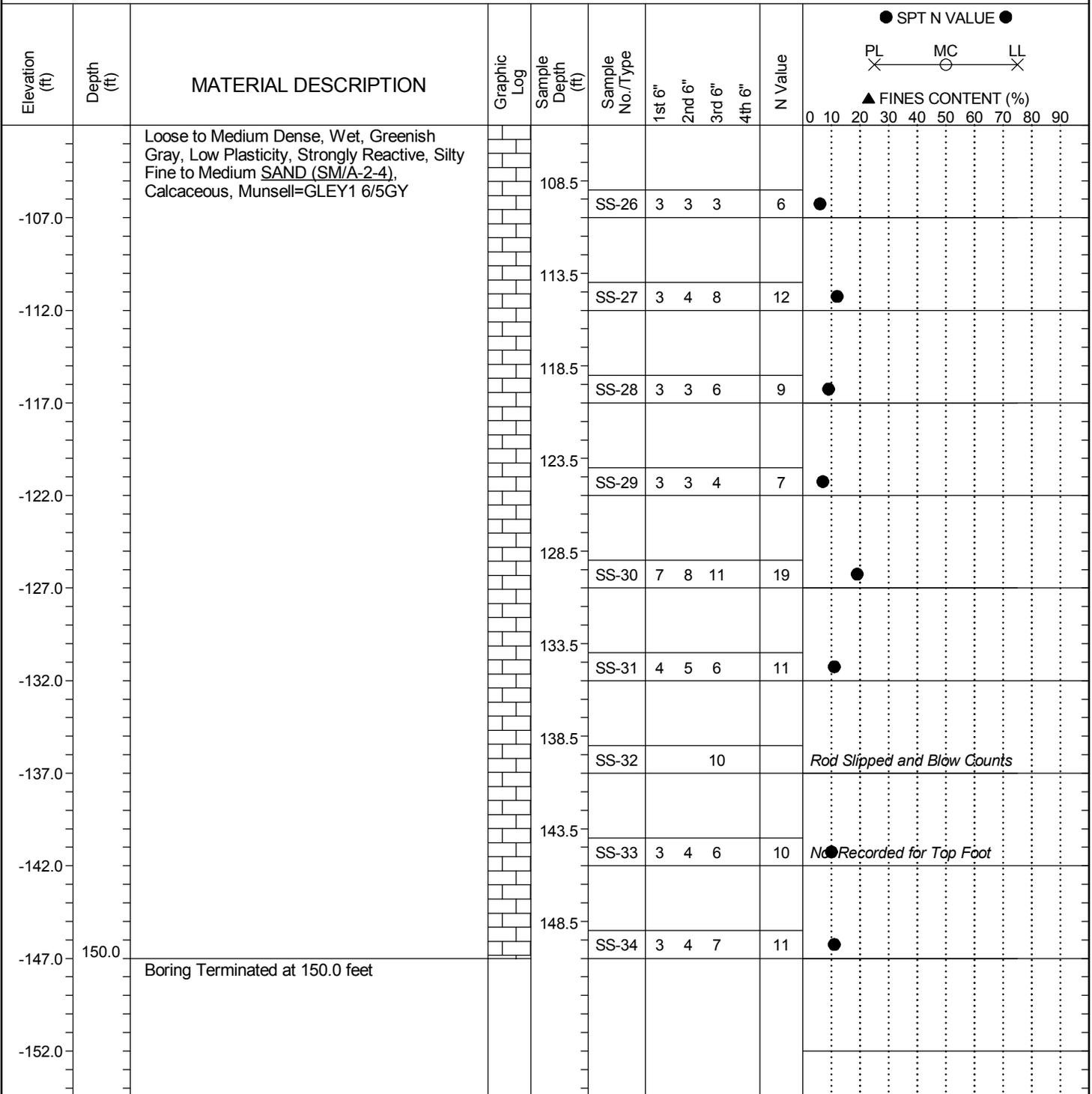
## LEGEND

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| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-8        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 65+00 | <b>Offset:</b> 0.1'-RT        |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 3.0 ft                                                | <b>Latitude:</b> 32.406749    | <b>Longitude:</b> -80.459611  |
| <b>Date Started:</b> 7/25/2016                                      |                               |                               |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft     | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 7/26/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |



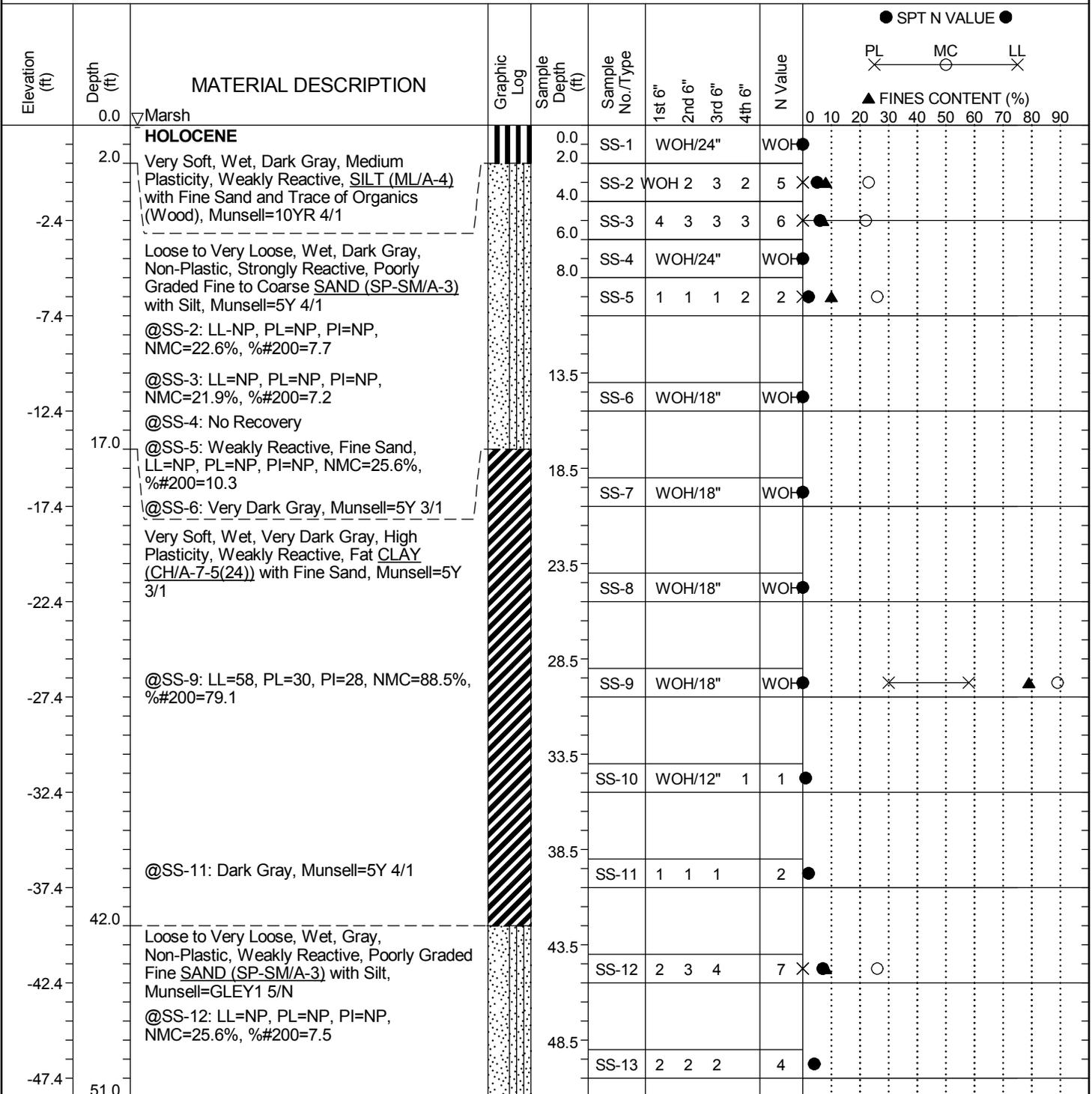
## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

SC\_DOT\_G5396 - HARBOR RIVER SPT AND CPT.GPJ FME2017.GDT 2/14/17

# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-9        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 67+04 | <b>Offset:</b> 9.3'-LT        |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 2.6 ft                                                | <b>Latitude:</b> 32.406583    | <b>Longitude:</b> -80.458978  |
| <b>Date Started:</b> 7/27/2016                                      |                               |                               |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft     | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 7/28/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |



## LEGEND

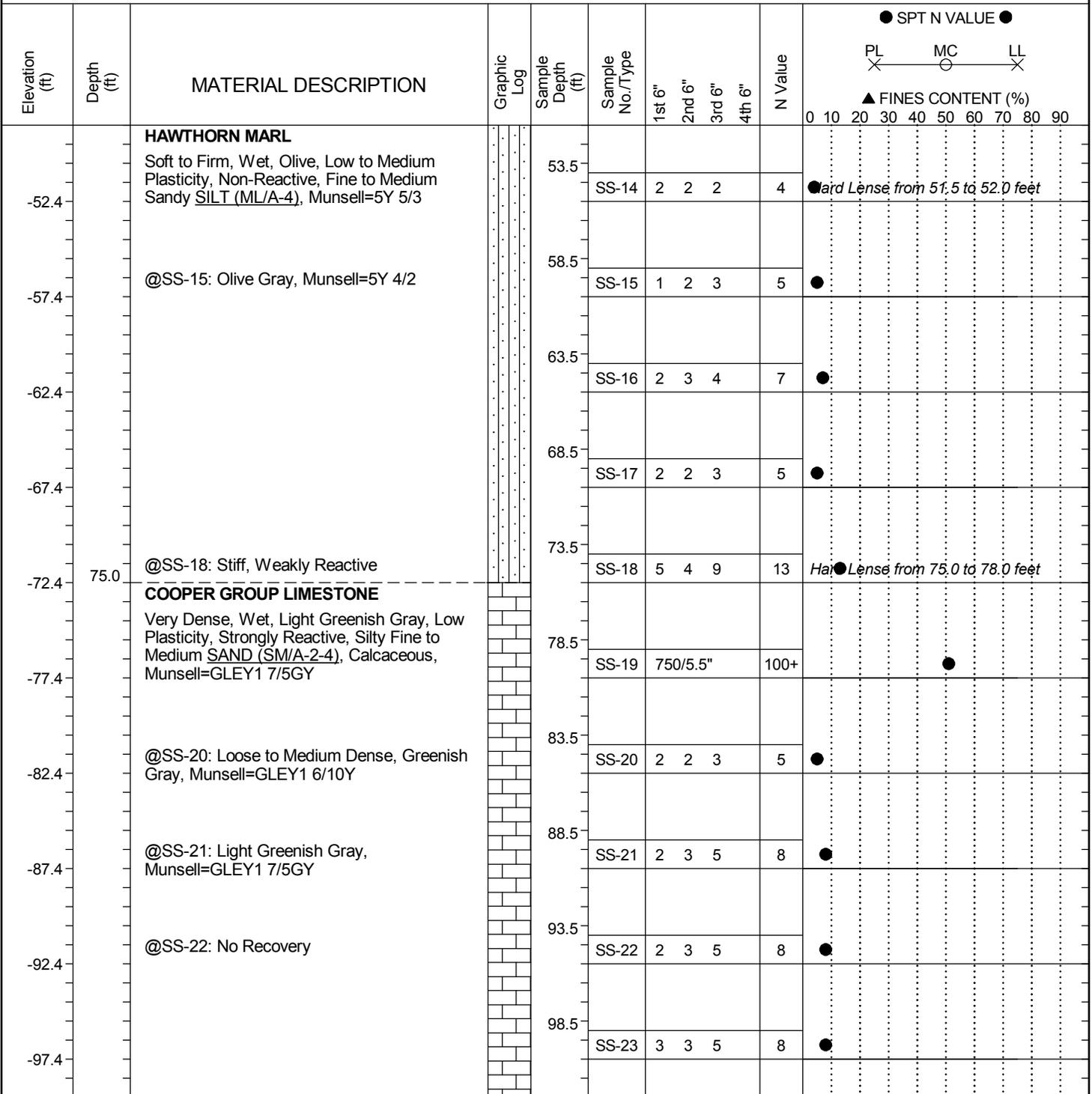
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| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |



# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-9        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 67+04 | <b>Offset:</b> 9.3'-LT        |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 2.6 ft                                                | <b>Latitude:</b> 32.406583    | <b>Longitude:</b> -80.458978  |
| <b>Date Started:</b> 7/27/2016                                      |                               |                               |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft     | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 7/28/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |



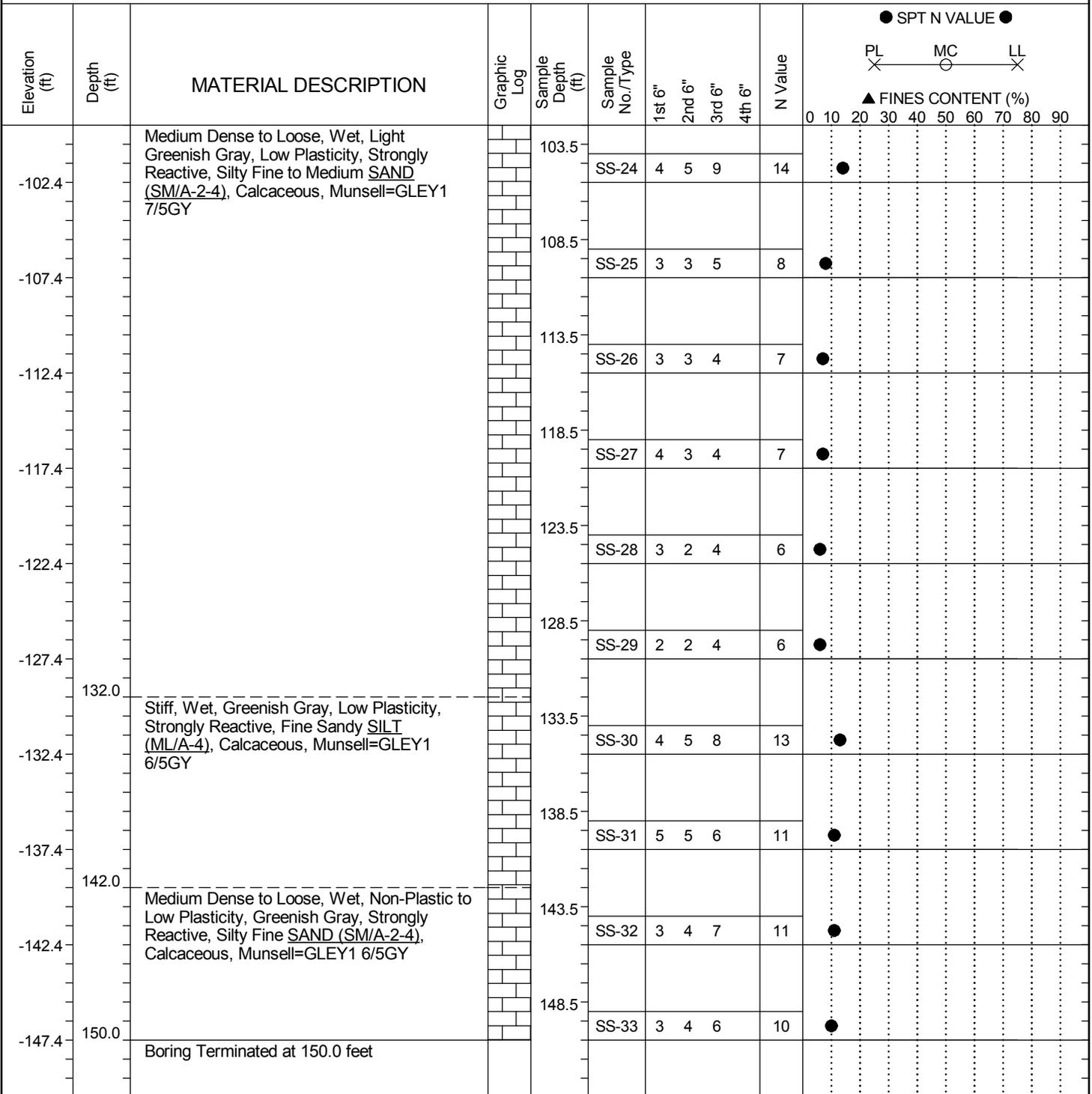
## LEGEND

Continued Next Page

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-9        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 67+04 | <b>Offset:</b> 9.3'-LT        |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 2.6 ft                                                | <b>Latitude:</b> 32.406583    | <b>Longitude:</b> -80.458978  |
| <b>Date Started:</b> 7/27/2016                                      |                               |                               |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft     | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 7/28/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |



## LEGEND

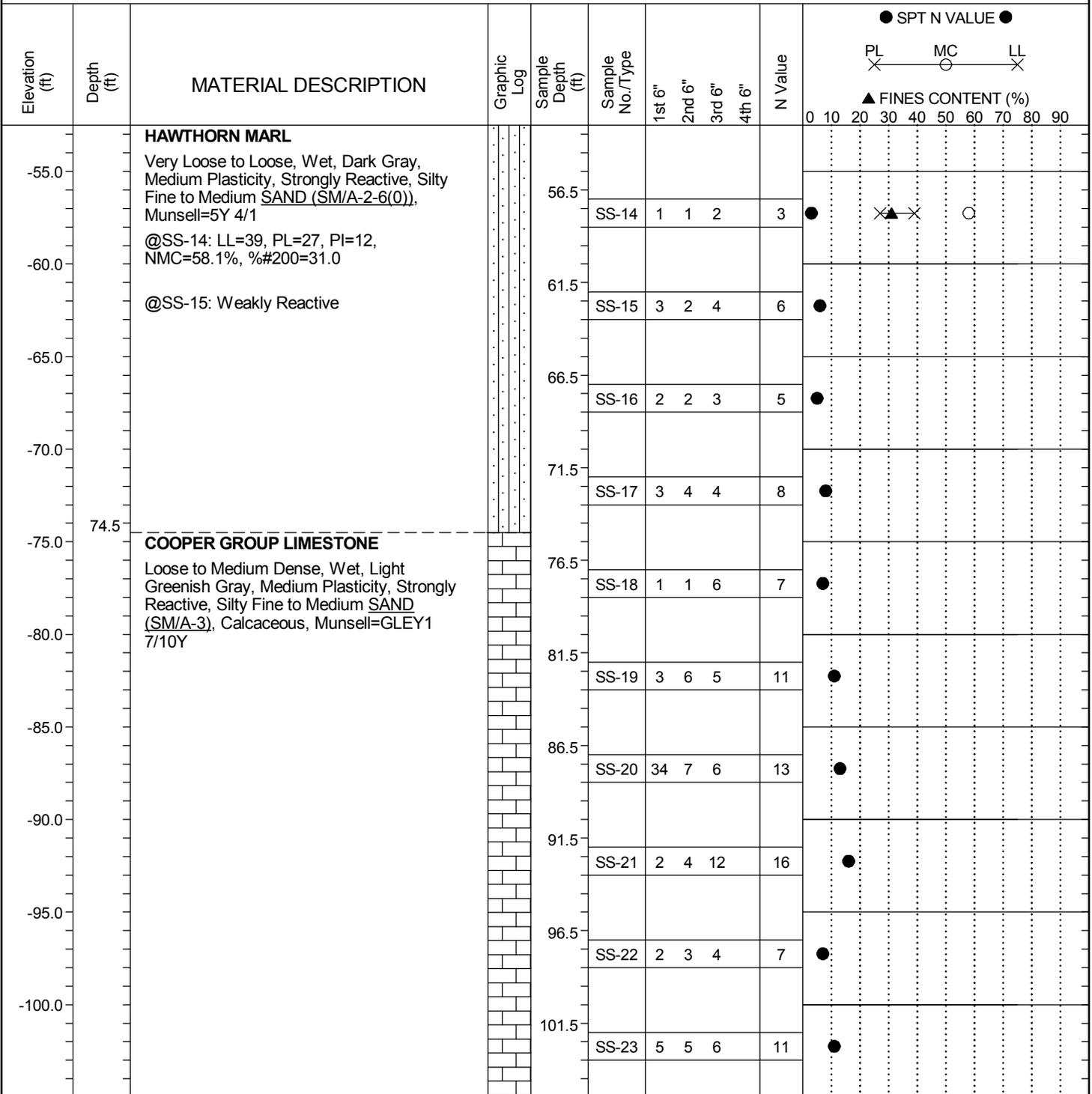
| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

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# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-10       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> J. Wessinger                                      | <b>Boring Location:</b> 78+24 | <b>Offset:</b> 21.4'-RT       |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 0.0 ft                                                | <b>Latitude:</b> 32.405352    | <b>Longitude:</b> -80.455652  |
| <b>Date Started:</b> 6/23/2016                                      |                               |                               |
| <b>Total Depth:</b> 193 ft                                          | <b>Soil Depth:</b> 191.5 ft   | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 6/27/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b>                                                        |                               | <b>TIDAL</b>                  |



## LEGEND

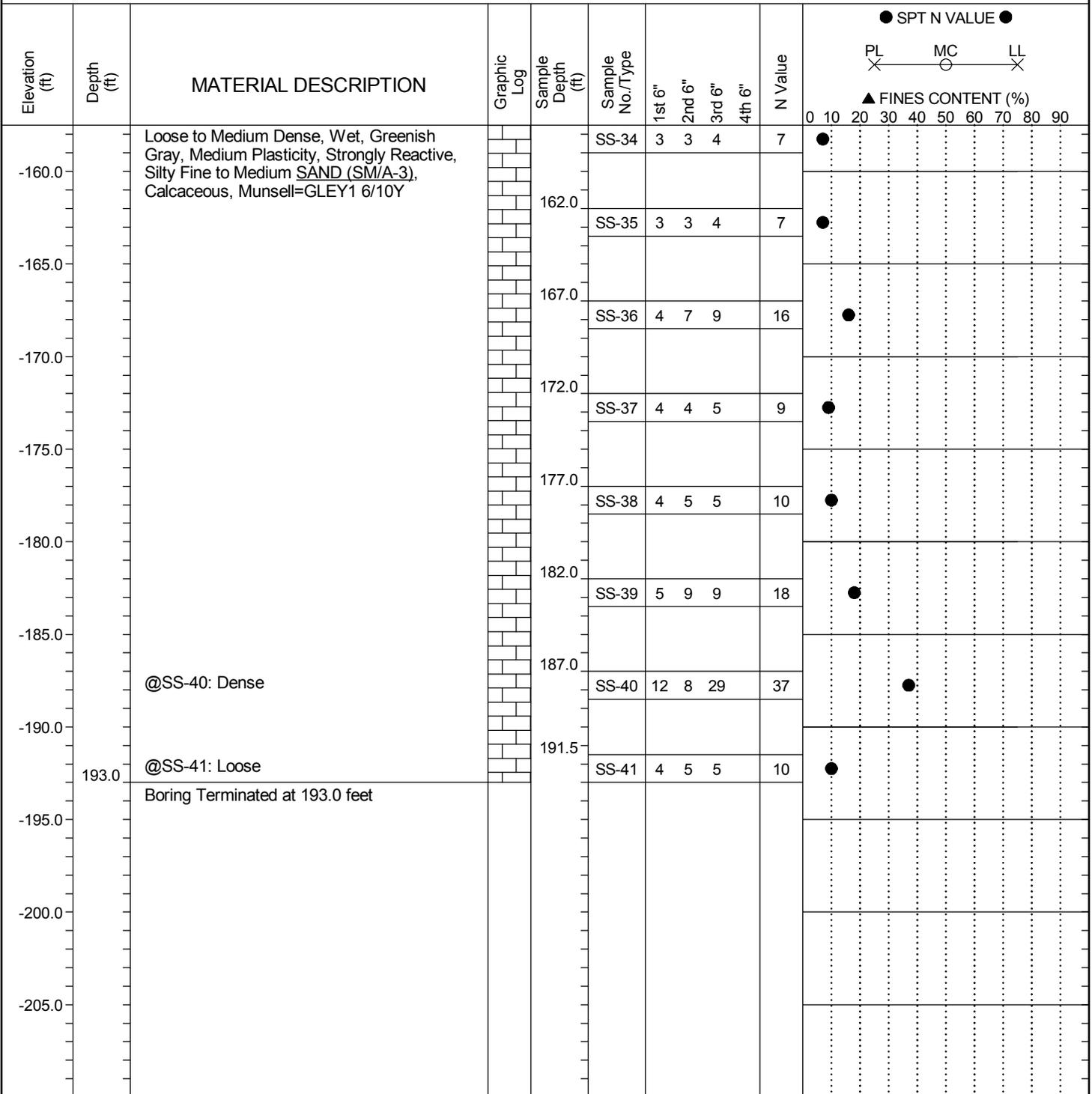
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|                                                                                                                                                                  |  |                                                                                                                                                  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>SAMPLER TYPE</b><br>SS - Split Spoon<br>UD - Undisturbed Sample<br>AWG - Rock Core, 1-1/8"<br>NQ - Rock Core, 1-7/8"<br>CU - Cuttings<br>CT - Continuous Tube |  | <b>DRILLING METHOD</b><br>HSA - Hollow Stem Auger<br>CFA - Continuous Flight Augers<br>DC - Driving Casing<br>RW - Rotary Wash<br>RC - Rock Core |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------|--|



# SCDOT Soil Test Log

|                                                                     |                                |                              |
|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-10      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                              |
| <b>Eng./Geo.:</b> J. Wessinger                                      | <b>Boring Location:</b> 78+24  | <b>Offset:</b> 21.4'-RT      |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 6/23/2016 |                              |
| <b>Elev.:</b> 0.0 ft                                                | <b>Latitude:</b> 32.405352     | <b>Longitude:</b> -80.455652 |
| <b>Total Depth:</b> 193 ft                                          | <b>Soil Depth:</b> 191.5 ft    | <b>Core Depth:</b> N/A ft    |
| <b>Date Completed:</b> 6/27/2016                                    |                                |                              |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 45B  | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 83.1%     |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft |
|                                                                     |                                | <b>24HR:</b> TIDAL           |



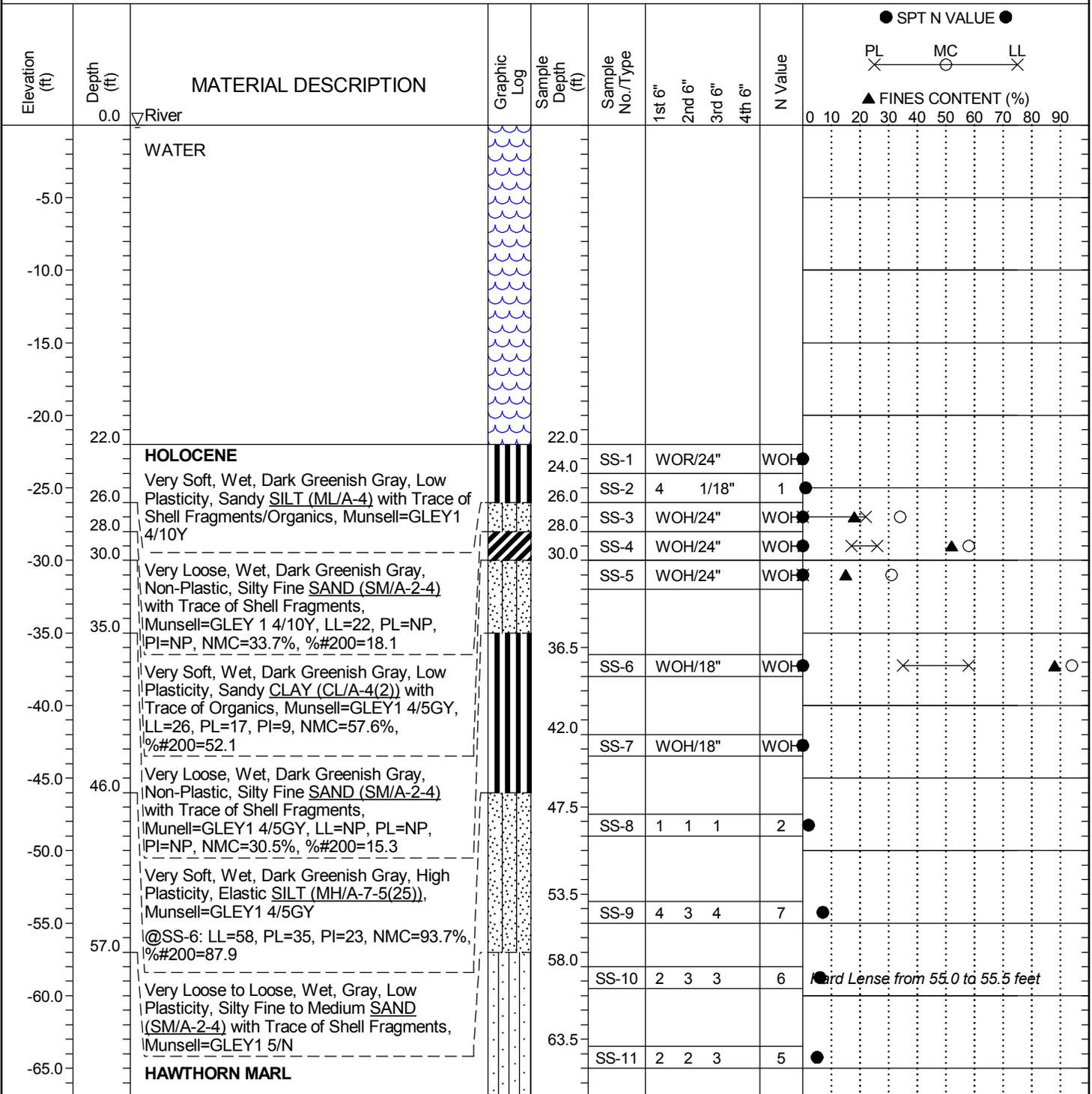
## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

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# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-11       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> J. Wessinger                                      | <b>Boring Location:</b> 82+65 | <b>Offset:</b> 4.4'-LT        |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 0.0 ft                                                | <b>Latitude:</b> 32.404954    | <b>Longitude:</b> -80.454298  |
| <b>Date Started:</b> 6/29/2016                                      |                               |                               |
| <b>Total Depth:</b> 192 ft                                          | <b>Soil Depth:</b> 170 ft     | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 6/30/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |



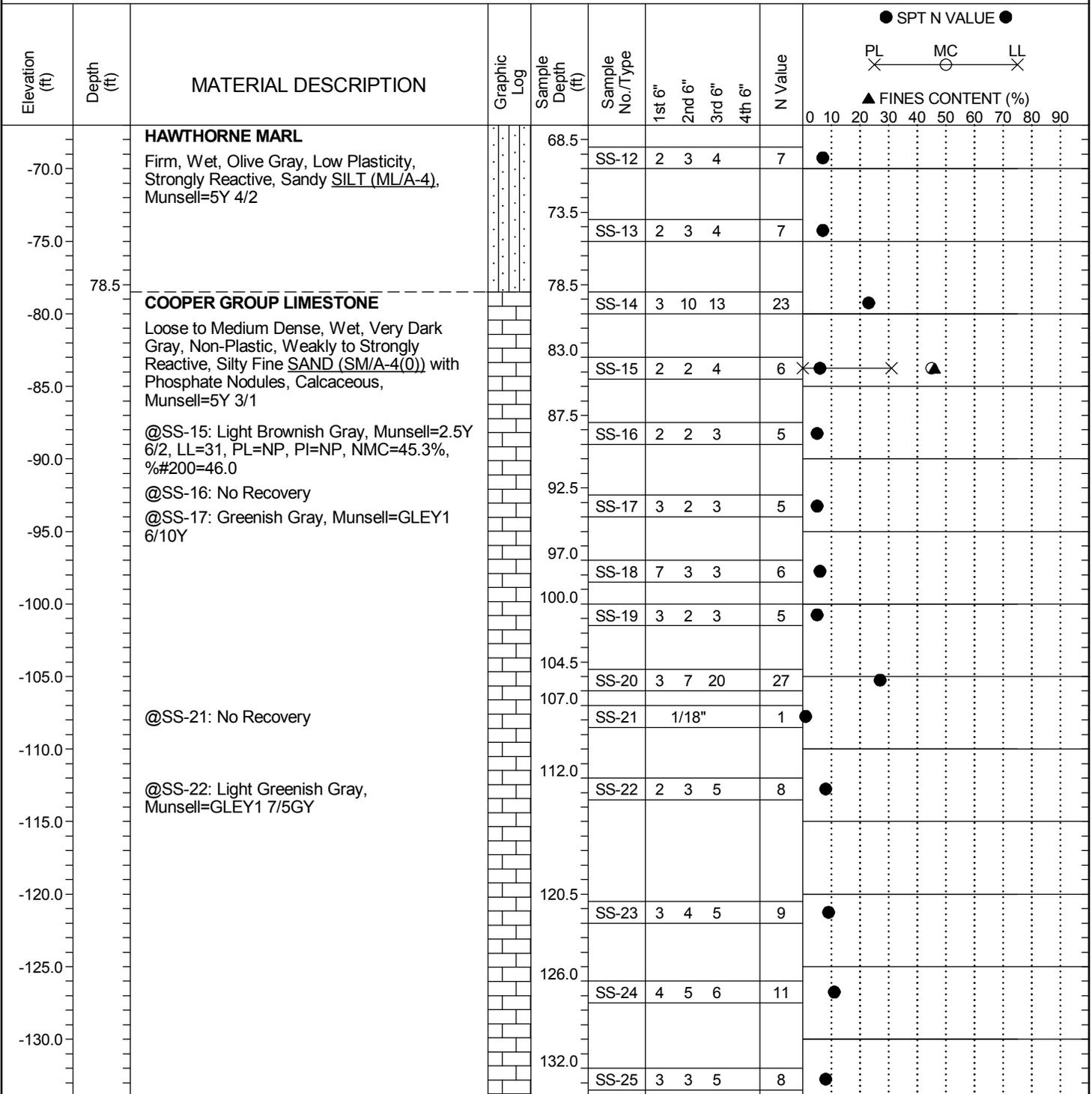
### LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

Continued Next Page

# SCDOT Soil Test Log

|                                                                     |                                |                              |
|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-11      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                              |
| <b>Eng./Geo.:</b> J. Wessinger                                      | <b>Boring Location:</b> 82+65  | <b>Offset:</b> 4.4'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 6/29/2016 |                              |
| <b>Elev.:</b> 0.0 ft                                                | <b>Latitude:</b> 32.404954     | <b>Longitude:</b> -80.454298 |
| <b>Total Depth:</b> 192 ft                                          | <b>Soil Depth:</b> 170 ft      | <b>Core Depth:</b> N/A ft    |
| <b>Date Completed:</b> 6/30/2016                                    |                                |                              |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 45B  | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 83.1%     |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft |
| <b>24HR:</b> TIDAL                                                  |                                |                              |



## LEGEND

Continued Next Page

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |



# SCDOT Soil Test Log

|                                                                     |                                |                              |
|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-11      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                              |
| <b>Eng./Geo.:</b> J. Wessinger                                      | <b>Boring Location:</b> 82+65  | <b>Offset:</b> 4.4'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 0.0 ft           | <b>Latitude:</b> 32.404954   |
| <b>Longitude:</b> -80.454298                                        | <b>Date Started:</b> 6/29/2016 |                              |
| <b>Total Depth:</b> 192 ft                                          | <b>Soil Depth:</b> 170 ft      | <b>Core Depth:</b> N/A ft    |
| <b>Date Completed:</b> 6/30/2016                                    |                                |                              |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 45B  | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 83.1%     |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft |
| <b>24HR</b>                                                         | <b>TIDAL</b>                   |                              |

| Elevation (ft) | Depth (ft) | MATERIAL DESCRIPTION                                                                                                                                                                                                                                                                                                            | Graphic Log     | Sample Depth (ft)               | Sample No./Type | SPT N VALUE |        |        |        | N Value | FINES CONTENT (%) |    |    |                     |  |  |  |  |  |  |  |  |  |
|----------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|-----------------|-------------|--------|--------|--------|---------|-------------------|----|----|---------------------|--|--|--|--|--|--|--|--|--|
|                |            |                                                                                                                                                                                                                                                                                                                                 |                 |                                 |                 | 1st 6"      | 2nd 6" | 3rd 6" | 4th 6" |         | PL                | MC | LL | ▲ FINES CONTENT (%) |  |  |  |  |  |  |  |  |  |
| -135.0         |            | Loose to Medium Dense, Wet, Light Greenish Gray, Non-Plastic, Weakly to Strongly Reactive, Silty Fine SAND (SM/A-4(0)) with Phosphate Nodules, Calcaceous, Munsell=GLE Y1 7/5GY<br><br>@SS-27: Greenish Gray, Munsell=GLE Y1 5/10Y<br><br>@SS-34: Light Greenish Gray, Munsell=GLE Y1 7/10Y<br><br>@SS-37: Munsell=GLE Y1 7/5GY | [Brick Pattern] | 137.5                           | SS-26           | 4           | 4      | 6      |        | 10      | ●                 |    |    |                     |  |  |  |  |  |  |  |  |  |
| -140.0         |            |                                                                                                                                                                                                                                                                                                                                 |                 | 143.5                           | SS-27           | 3           | 3      | 5      |        | 8       | ●                 |    |    |                     |  |  |  |  |  |  |  |  |  |
| -145.0         |            |                                                                                                                                                                                                                                                                                                                                 |                 | 147.5                           | SS-28           | 3           | 4      | 6      |        | 10      | ●                 |    |    |                     |  |  |  |  |  |  |  |  |  |
| -150.0         |            |                                                                                                                                                                                                                                                                                                                                 |                 | 154.0                           | SS-29           | 4           | 4      | 5      |        | 9       | ●                 |    |    |                     |  |  |  |  |  |  |  |  |  |
| -155.0         |            |                                                                                                                                                                                                                                                                                                                                 |                 | 159.0                           | SS-30           | 2           | 4      | 6      |        | 10      | ●                 |    |    |                     |  |  |  |  |  |  |  |  |  |
| -160.0         |            |                                                                                                                                                                                                                                                                                                                                 |                 | 163.5                           | SS-31           | 3           | 5      | 7      |        | 12      | ●                 |    |    |                     |  |  |  |  |  |  |  |  |  |
| -165.0         |            |                                                                                                                                                                                                                                                                                                                                 |                 | 168.0                           | SS-32           | 3           | 4      | 6      |        | 10      | ●                 |    |    |                     |  |  |  |  |  |  |  |  |  |
| -170.0         |            |                                                                                                                                                                                                                                                                                                                                 |                 | 172.5                           | SS-33           | 3           | 3      | 5      |        | 8       | ●                 |    |    |                     |  |  |  |  |  |  |  |  |  |
| -175.0         |            |                                                                                                                                                                                                                                                                                                                                 |                 | 177.0                           | SS-34           | 4           | 8      | 11     |        | 19      | ●                 |    |    |                     |  |  |  |  |  |  |  |  |  |
| -180.0         |            |                                                                                                                                                                                                                                                                                                                                 |                 | 181.5                           | SS-35           | 3           | 4      | 6      |        | 10      | ●                 |    |    |                     |  |  |  |  |  |  |  |  |  |
| -185.0         |            |                                                                                                                                                                                                                                                                                                                                 |                 | 186.0                           | SS-36           | 1           | 4      | 5      |        | 9       | ●                 |    |    |                     |  |  |  |  |  |  |  |  |  |
| -190.0         | 192.0      |                                                                                                                                                                                                                                                                                                                                 |                 | Boring Terminated at 192.0 feet |                 | 190.5       | SS-37  | 2      | 4      | 5       |                   | 9  | ●  |                     |  |  |  |  |  |  |  |  |  |

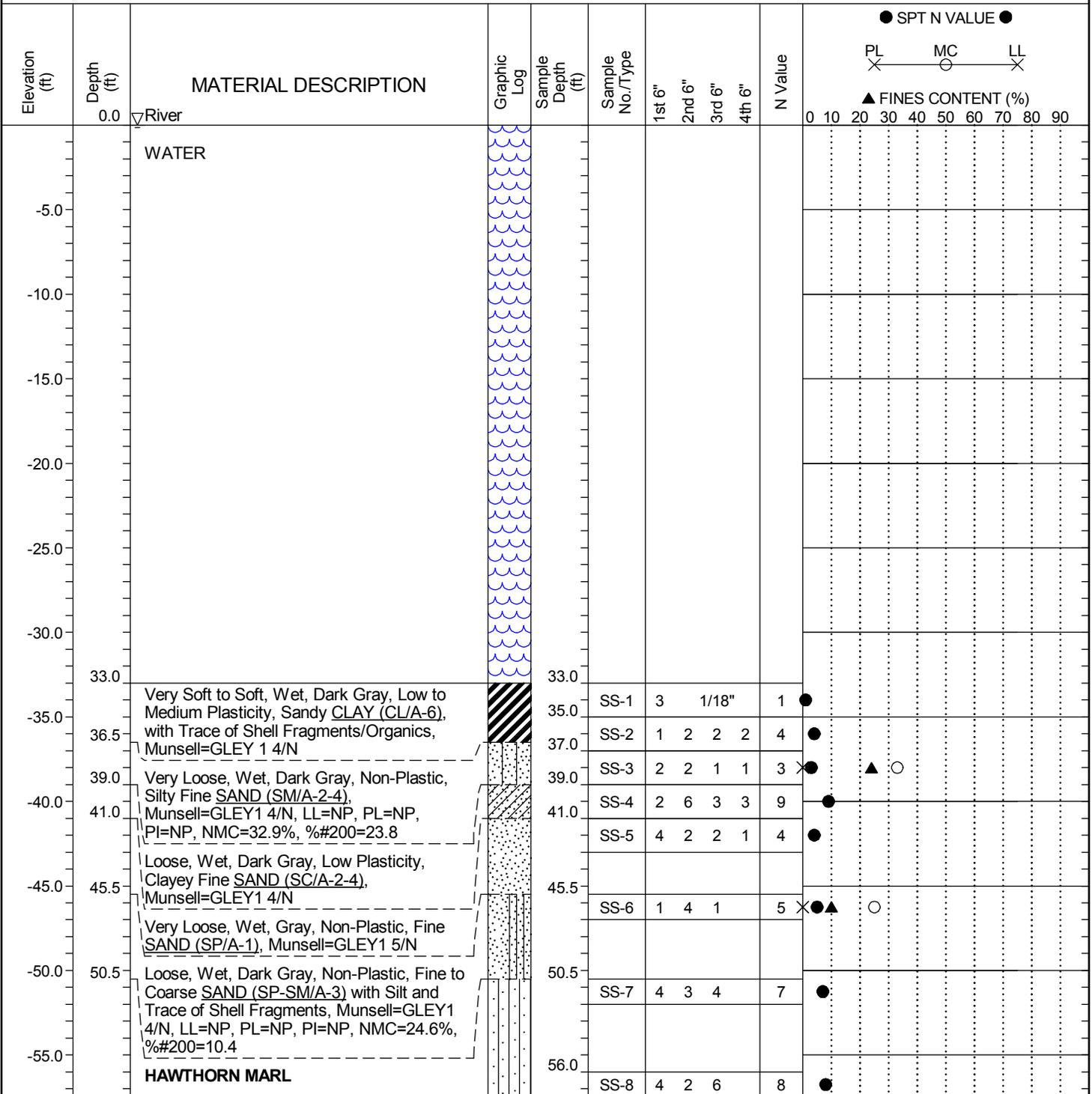
## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

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# SCDOT Soil Test Log

|                                                                     |                               |                              |
|---------------------------------------------------------------------|-------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-12      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                              |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 87+88 | <b>Offset:</b> 79.3'-LT      |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 7/6/2016 |                              |
| <b>Elev.:</b> 0.0 ft                                                | <b>Latitude:</b> 32.404595    | <b>Longitude:</b> -80.45264  |
| <b>Total Depth:</b> 192 ft                                          | <b>Soil Depth:</b> 159 ft     | <b>Core Depth:</b> N/A ft    |
| <b>Date Completed:</b> 7/11/2016                                    |                               |                              |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 45B | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 83.1%    |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft |
| <b>24HR:</b> TIDAL                                                  |                               |                              |



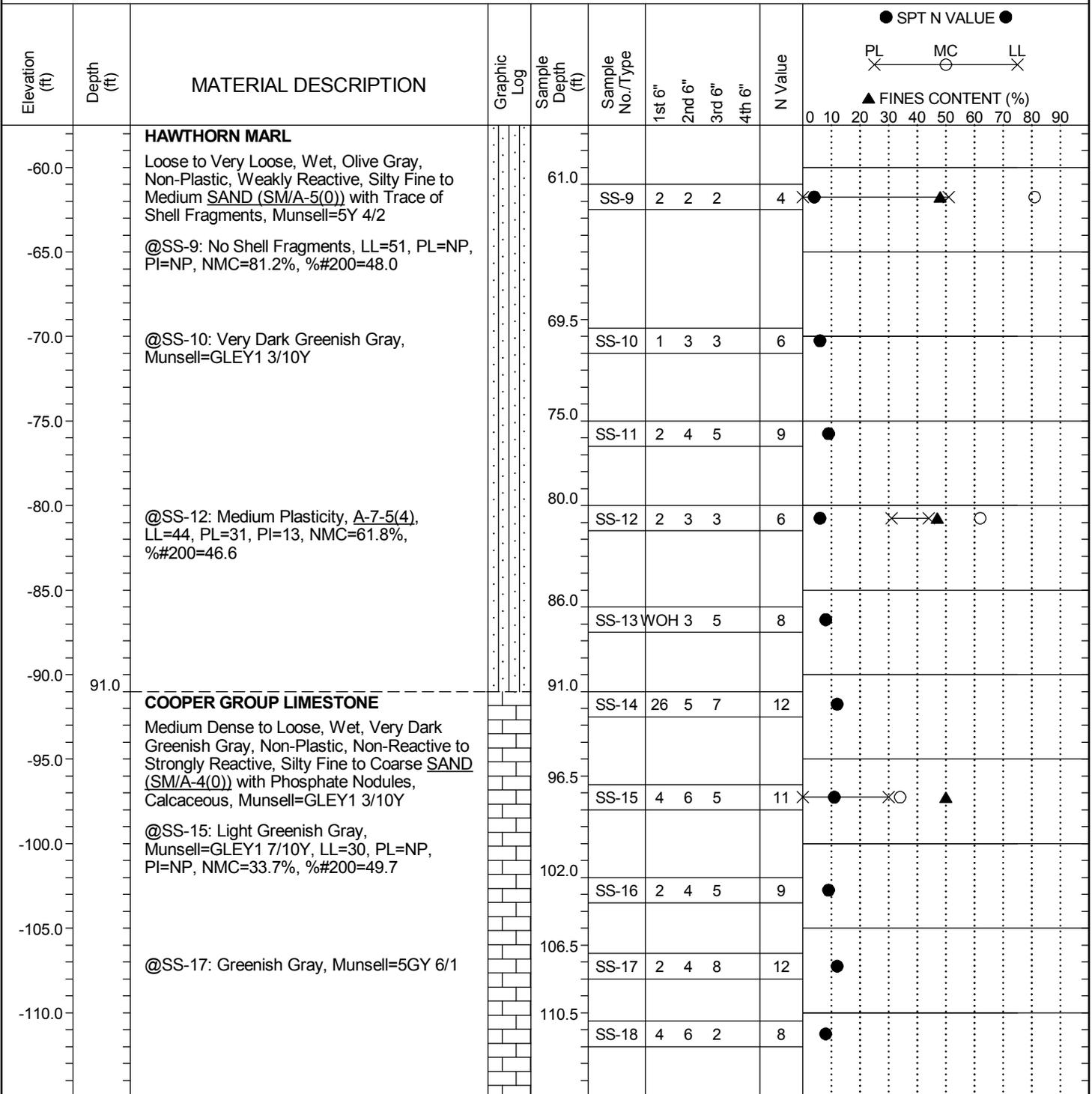
## LEGEND

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| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-12       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 87+88 | <b>Offset:</b> 79.3'-LT       |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 0.0 ft                                                | <b>Latitude:</b> 32.404595    | <b>Longitude:</b> -80.45264   |
| <b>Date Started:</b> 7/6/2016                                       |                               |                               |
| <b>Total Depth:</b> 192 ft                                          | <b>Soil Depth:</b> 159 ft     | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 7/11/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |



## LEGEND

Continued Next Page

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-12       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 87+88 | <b>Offset:</b> 79.3'-LT       |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 0.0 ft                                                | <b>Latitude:</b> 32.404595    | <b>Longitude:</b> -80.45264   |
| <b>Date Started:</b> 7/6/2016                                       |                               |                               |
| <b>Total Depth:</b> 192 ft                                          | <b>Soil Depth:</b> 159 ft     | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 7/11/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |

| Elevation (ft) | Depth (ft) | MATERIAL DESCRIPTION                                                                                                                                                                                                                | Graphic Log     | Sample Depth (ft)                                                                                                          | Sample No./Type | SPT N VALUE |        |        |        | N Value | ● SPT N VALUE ●<br>PL — MC — LL<br>▲ FINES CONTENT (%)<br>0 10 20 30 40 50 60 70 80 90 |                               |
|----------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------|-----------------|-------------|--------|--------|--------|---------|----------------------------------------------------------------------------------------|-------------------------------|
|                |            |                                                                                                                                                                                                                                     |                 |                                                                                                                            |                 | 1st 6"      | 2nd 6" | 3rd 6" | 4th 6" |         |                                                                                        |                               |
| -120.0         | 115.5      | Loose to Medium Dense, Wet, Greenish Gray, Non-Plastic, Non-Reactive to Strongly Reactive, Silty Fine to Coarse SAND (SM/A-4(0)) with Phosphate Nodules, Calcaceous, Munsell=5GY 6/1<br>@SS-20: Greenish Gray, Munsell=GLE Y1 6/10Y | [Brick Pattern] | 115.5                                                                                                                      | SS-19           | 2           | 3      |        |        | 5       | ● Not Recorded for Top 6"                                                              |                               |
| -125.0         | 120.5      |                                                                                                                                                                                                                                     |                 | 120.5                                                                                                                      | SS-20           |             |        |        |        |         |                                                                                        | ● Rod Slipped and Blow Counts |
| -130.0         | 125.5      |                                                                                                                                                                                                                                     |                 | 125.5                                                                                                                      | SS-21           | 4           | 6      | 8      |        |         | 14                                                                                     | ● Rod Slipped and Blow Counts |
| -135.0         | 130.5      |                                                                                                                                                                                                                                     |                 | 130.5                                                                                                                      | SS-22           | 5           | 4      | 8      |        |         | 12                                                                                     | ● Not Recorded                |
| -140.0         | 135.5      |                                                                                                                                                                                                                                     |                 | Firm to Stiff, Greenish Gray, Medium to High Plasticity, Strongly Reactive, Fine Sandy SILT (ML/A-6), Munsell=GLE Y1 6/10Y | 135.5           | SS-23       | 3      | 2      | 5      |         |                                                                                        | 7                             |
| -145.0         | 141.0      | 141.0                                                                                                                                                                                                                               | SS-24           |                                                                                                                            | 3               | 4           | 8      |        |        | 12      | ●                                                                                      |                               |
| -150.0         | 148.5      | 148.5                                                                                                                                                                                                                               | SS-25           |                                                                                                                            | 3               | 4           | 4      |        |        | 8       | ●                                                                                      |                               |
| -155.0         | 151.5      | Medium Dense to Loose, Wet, Greenish Gray, Low Plasticity, Strongly Reactive, Silty Fine SAND (SM/A-2-4), Munsell=GLE Y1 6/10Y                                                                                                      | 151.5           | SS-26                                                                                                                      | 4               | 5           | 6      |        |        | 11      | ●                                                                                      |                               |
| -160.0         | 155.5      |                                                                                                                                                                                                                                     | 155.5           | SS-27                                                                                                                      | 4               | 4           | 5      |        |        | 9       | ●                                                                                      |                               |
| -165.0         | 160.0      |                                                                                                                                                                                                                                     | 160.0           | SS-28                                                                                                                      | 5               | 7           | 12     |        |        | 19      | ●                                                                                      |                               |
| -170.0         | 165.0      | Stiff to Firm, Wet, Light Greenish Gray, Low to Medium Plasticity, Strongly Reactive, Fine Sandy SILT (ML/A-4), Munsell=GLE Y1 7/10Y                                                                                                | 165.0           | SS-29                                                                                                                      | 4               | 4           | 6      |        |        | 10      | ●                                                                                      |                               |
| -170.0         | 170.0      |                                                                                                                                                                                                                                     | 170.0           | SS-30                                                                                                                      | 3               | 4           | 4      |        |        | 8       | ●                                                                                      |                               |

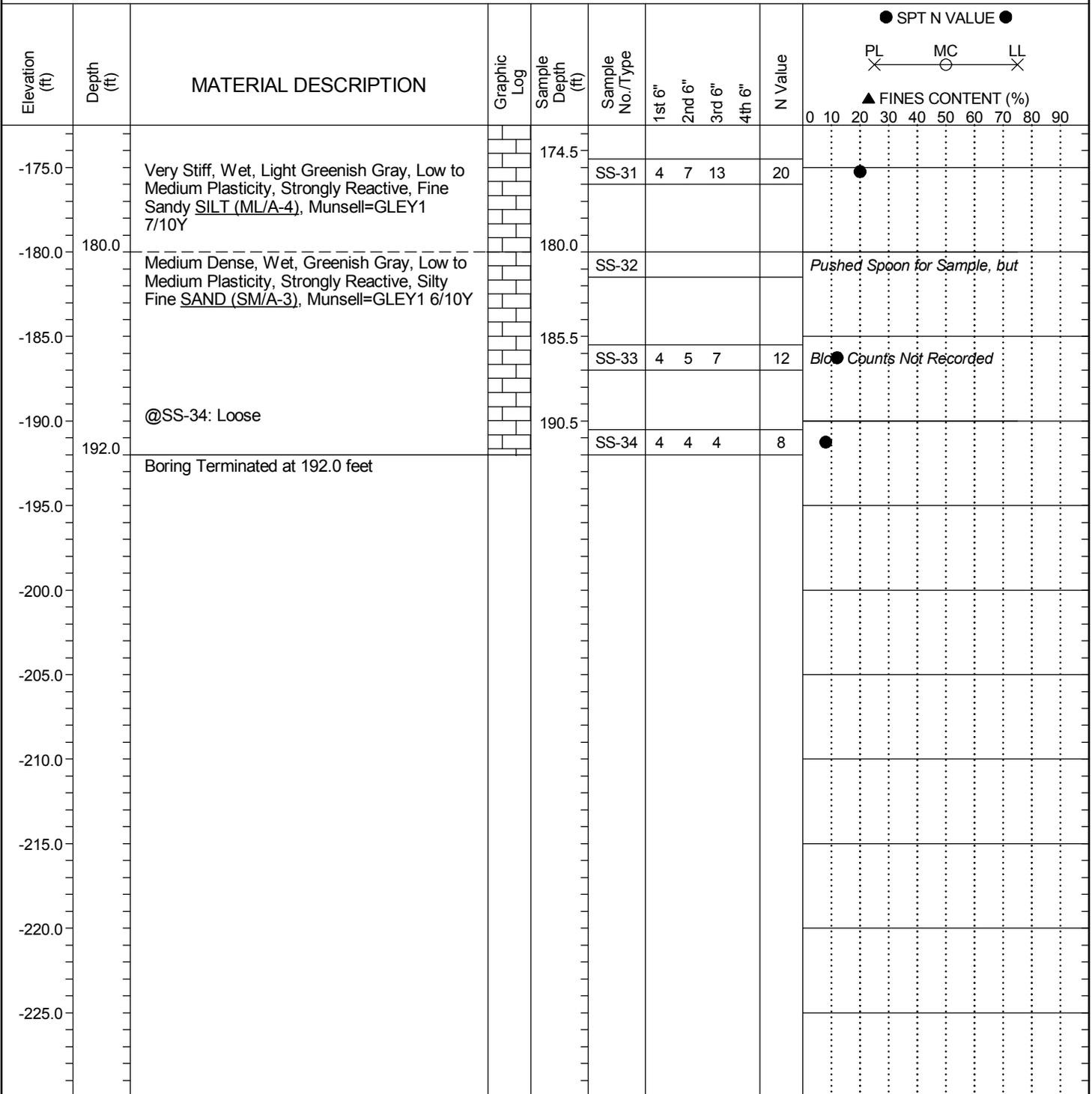
## LEGEND

Continued Next Page

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                               |                              |
|---------------------------------------------------------------------|-------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-12      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                              |
| <b>Eng./Geo.:</b> R. Wessinger                                      | <b>Boring Location:</b> 87+88 | <b>Offset:</b> 79.3'-LT      |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 7/6/2016 |                              |
| <b>Elev.:</b> 0.0 ft                                                | <b>Latitude:</b> 32.404595    | <b>Longitude:</b> -80.45264  |
| <b>Date Completed:</b> 7/11/2016                                    |                               |                              |
| <b>Total Depth:</b> 192 ft                                          | <b>Soil Depth:</b> 159 ft     | <b>Core Depth:</b> N/A ft    |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration:</b> | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 45B | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 83.1%    |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft |
| <b>24HR:</b>                                                        |                               | <b>TIDAL</b>                 |

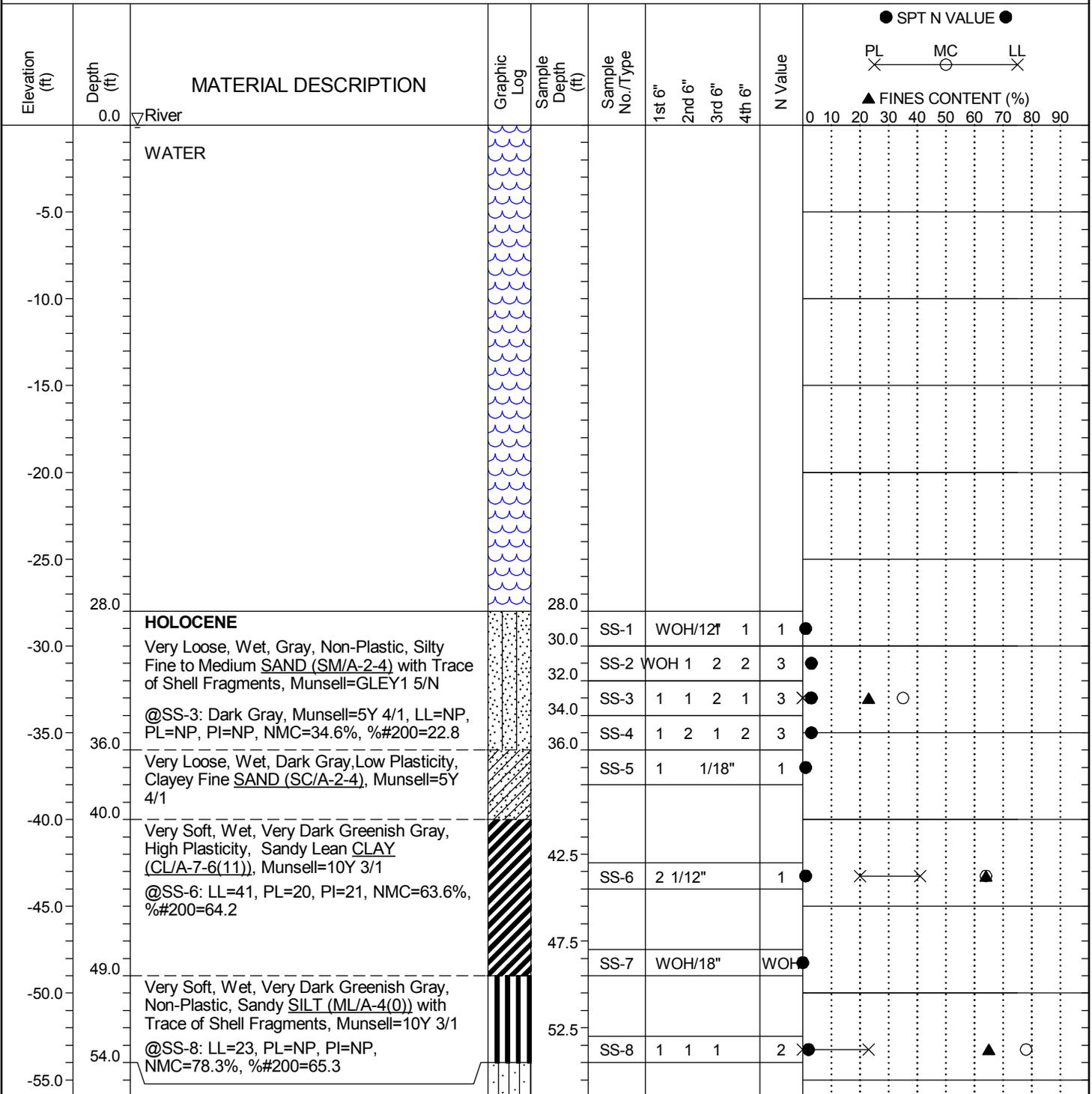


### LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-13       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> J. Wessinger                                      | <b>Boring Location:</b> 92+79 | <b>Offset:</b> 16.2'-RT       |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 0.0 ft                                                | <b>Latitude:</b> 32.403837    | <b>Longitude:</b> -80.451288  |
| <b>Date Started:</b> 6/16/2016                                      |                               |                               |
| <b>Total Depth:</b> 190.5 ft                                        | <b>Soil Depth:</b> 162.5 ft   | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 6/21/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |



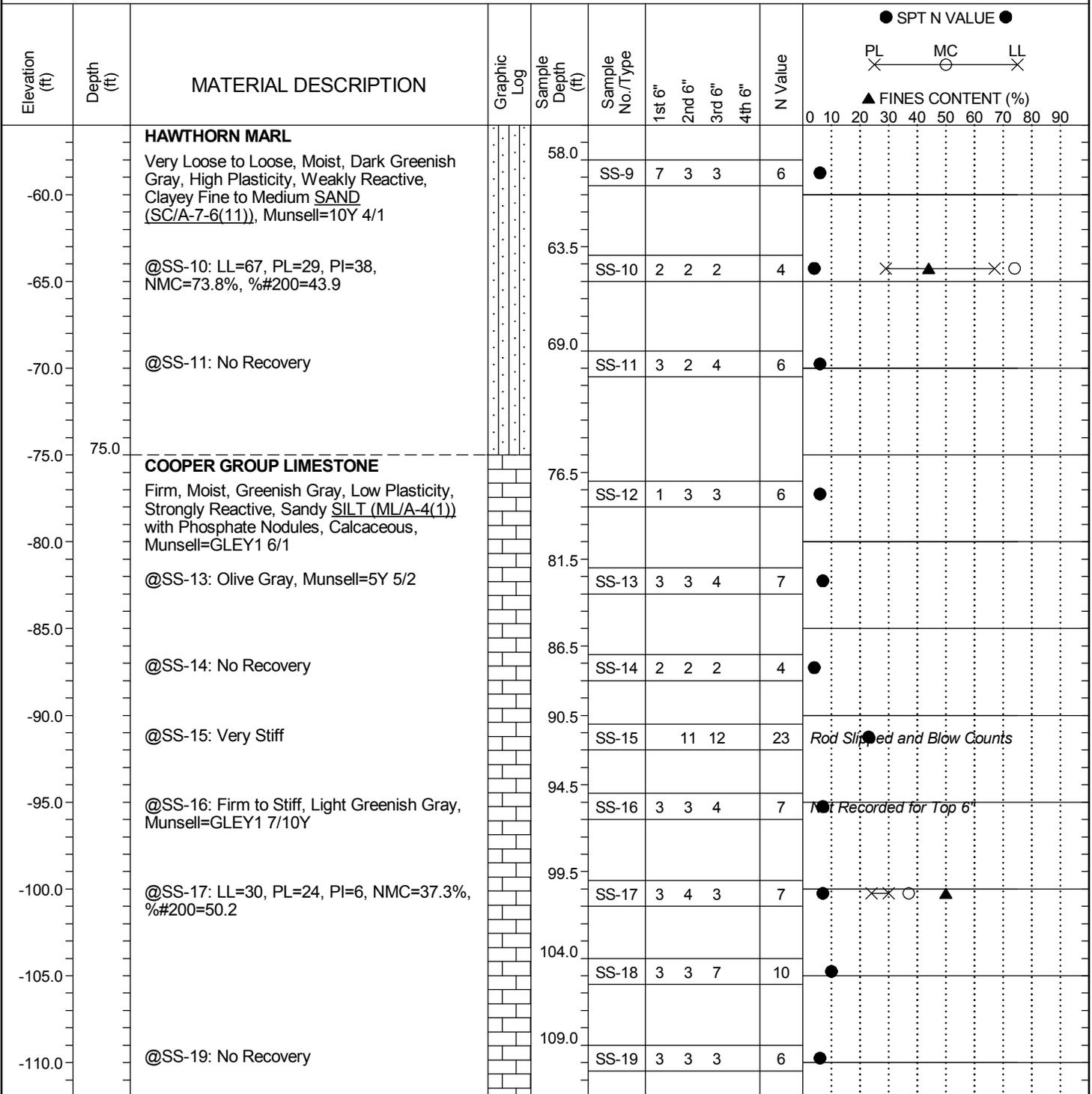
## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

Continued Next Page

# SCDOT Soil Test Log

|                                                                     |                                |                              |
|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-13      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                              |
| <b>Eng./Geo.:</b> J. Wessinger                                      | <b>Boring Location:</b> 92+79  | <b>Offset:</b> 16.2'-RT      |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 6/16/2016 |                              |
| <b>Elev.:</b> 0.0 ft                                                | <b>Latitude:</b> 32.403837     | <b>Longitude:</b> -80.451288 |
| <b>Date Completed:</b> 6/21/2016                                    |                                |                              |
| <b>Total Depth:</b> 190.5 ft                                        | <b>Soil Depth:</b> 162.5 ft    | <b>Core Depth:</b> N/A ft    |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 45B  | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 83.1%     |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft |
| <b>24HR</b>                                                         | <b>TIDAL</b>                   |                              |



## LEGEND

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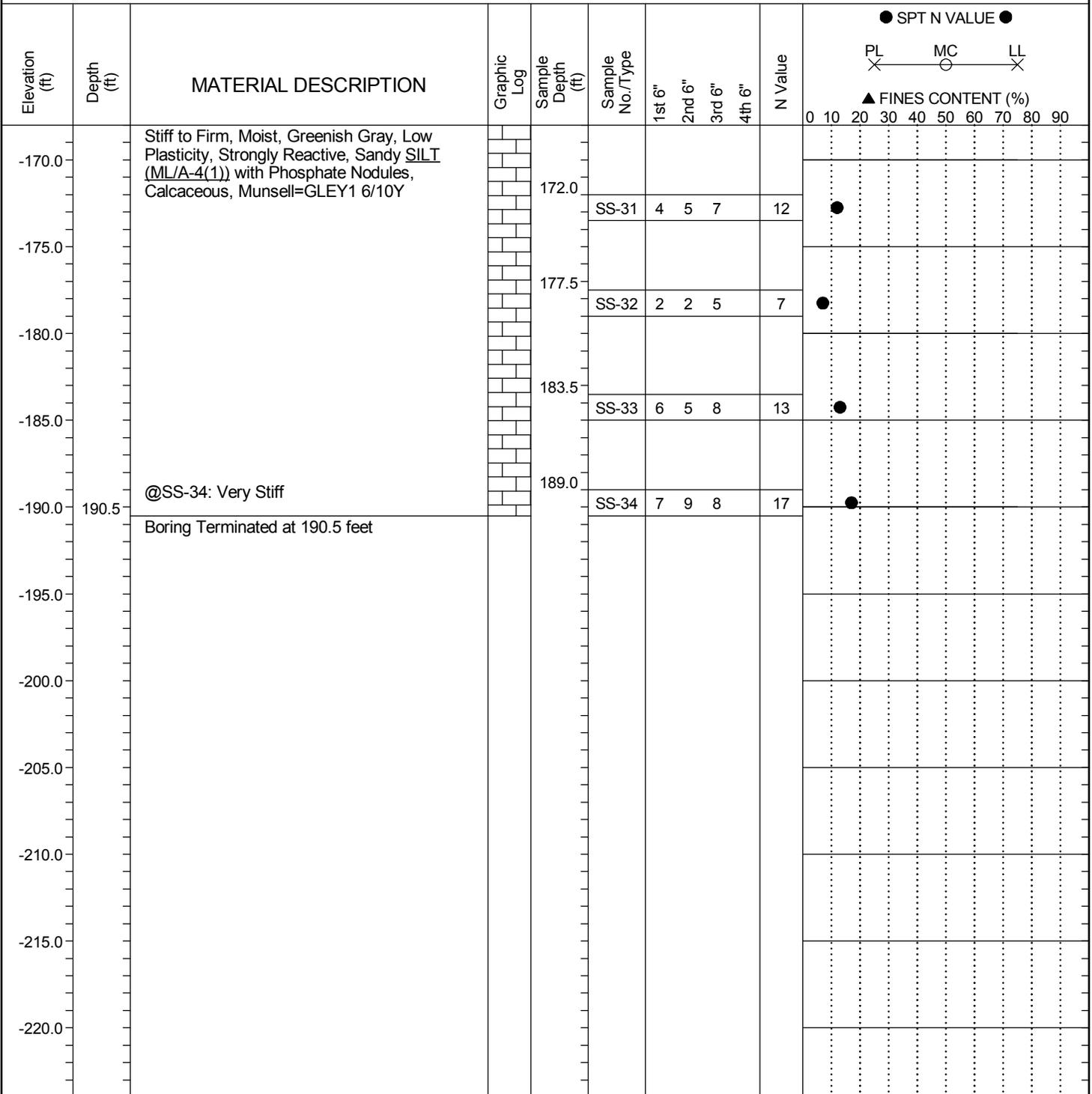
| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |





# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-13       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> J. Wessinger                                      | <b>Boring Location:</b> 92+79 | <b>Offset:</b> 16.2'-RT       |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 0.0 ft                                                | <b>Latitude:</b> 32.403837    | <b>Longitude:</b> -80.451288  |
| <b>Date Started:</b> 6/16/2016                                      |                               |                               |
| <b>Total Depth:</b> 190.5 ft                                        | <b>Soil Depth:</b> 162.5 ft   | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 6/21/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |

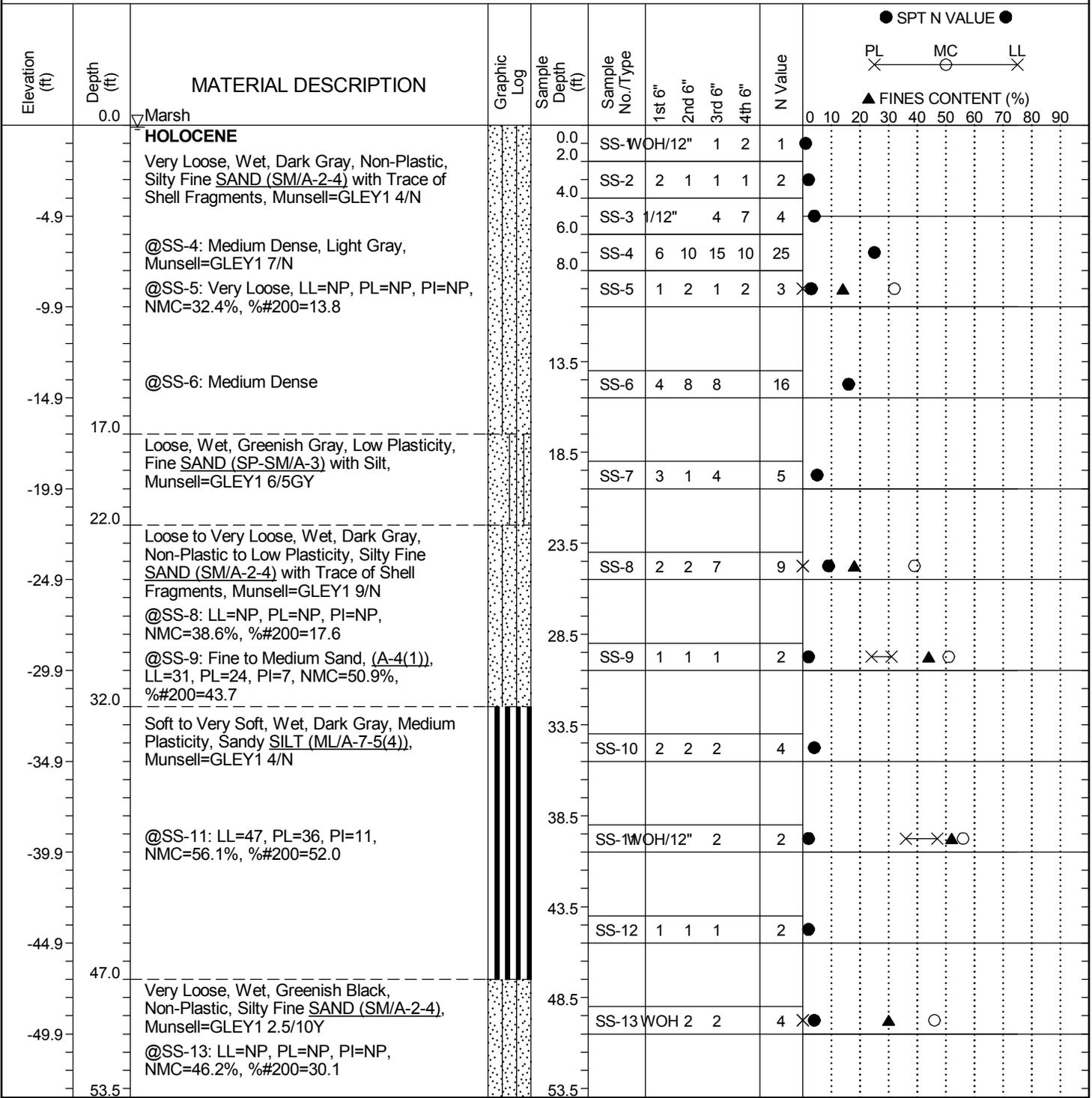


## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                               |                                |
|---------------------------------------------------------------------|-------------------------------|--------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> B-14        |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                                |
| <b>Eng./Geo.:</b> J. Wessinger                                      | <b>Boring Location:</b> 97+18 | <b>Offset:</b> 5.6'-LT         |
| <b>Alignment:</b> ALT 1B                                            |                               |                                |
| <b>Elev.:</b> 0.1 ft                                                | <b>Latitude:</b> 32.403431    | <b>Longitude:</b> -80.449948   |
| <b>Date Started:</b> 6/13/2016                                      |                               |                                |
| <b>Total Depth:</b> 190 ft                                          | <b>Soil Depth:</b> 190 ft     | <b>Core Depth:</b> N/A ft      |
| <b>Date Completed:</b> 6/15/2016                                    |                               |                                |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)   |
| <b>Liner Used:</b> Y (N)                                            |                               |                                |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic  |
| <b>Energy Ratio:</b> 83.1%                                          |                               |                                |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.        | <b>Groundwater:</b> TOB 0.1 ft |
| <b>24HR:</b> TIDAL                                                  |                               |                                |



**LEGEND**

*Continued Next Page*

|                         |                                |
|-------------------------|--------------------------------|
| <b>SAMPLER TYPE</b>     | <b>DRILLING METHOD</b>         |
| SS - Split Spoon        | HSA - Hollow Stem Auger        |
| UD - Undisturbed Sample | RW - Rotary Wash               |
| AWG - Rock Core, 1-1/8" | CFA - Continuous Flight Augers |
| NQ - Rock Core, 1-7/8"  | RC - Rock Core                 |
| CU - Cuttings           | DC - Driving Casing            |
| CT - Continuous Tube    |                                |

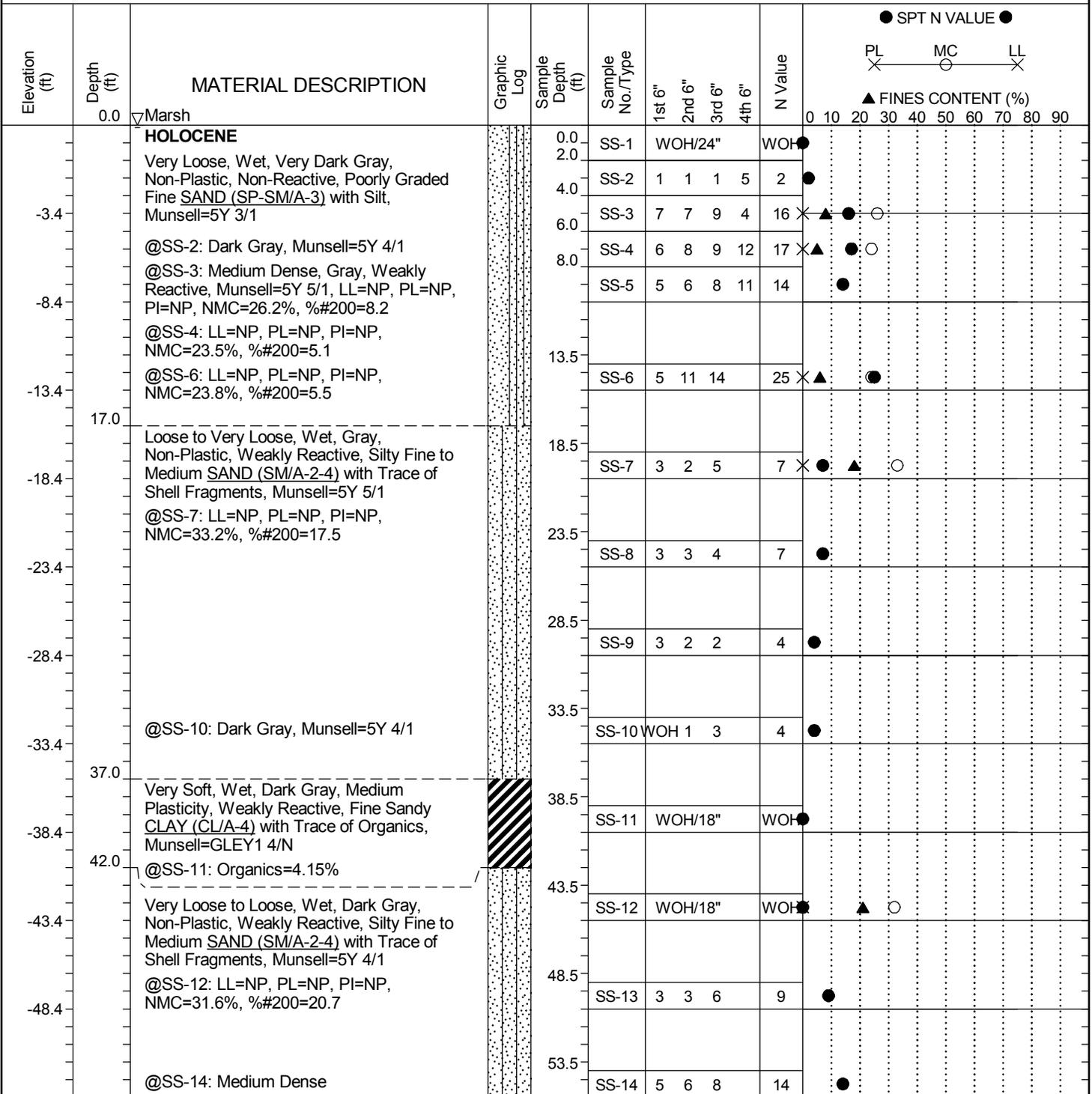






# SCDOT Soil Test Log

|                                                                     |                                |                               |
|---------------------------------------------------------------------|--------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-15       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 100+78 | <b>Offset:</b> 9.6'-RT        |
| <b>Alignment:</b> ALT 1B                                            |                                |                               |
| <b>Elev.:</b> 1.6 ft                                                | <b>Latitude:</b> 32.403014     | <b>Longitude:</b> -80.448888  |
| <b>Date Started:</b> 8/3/2016                                       |                                |                               |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft      | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 8/3/2016                                     |                                |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                                |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW        | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                                |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                                |                               |



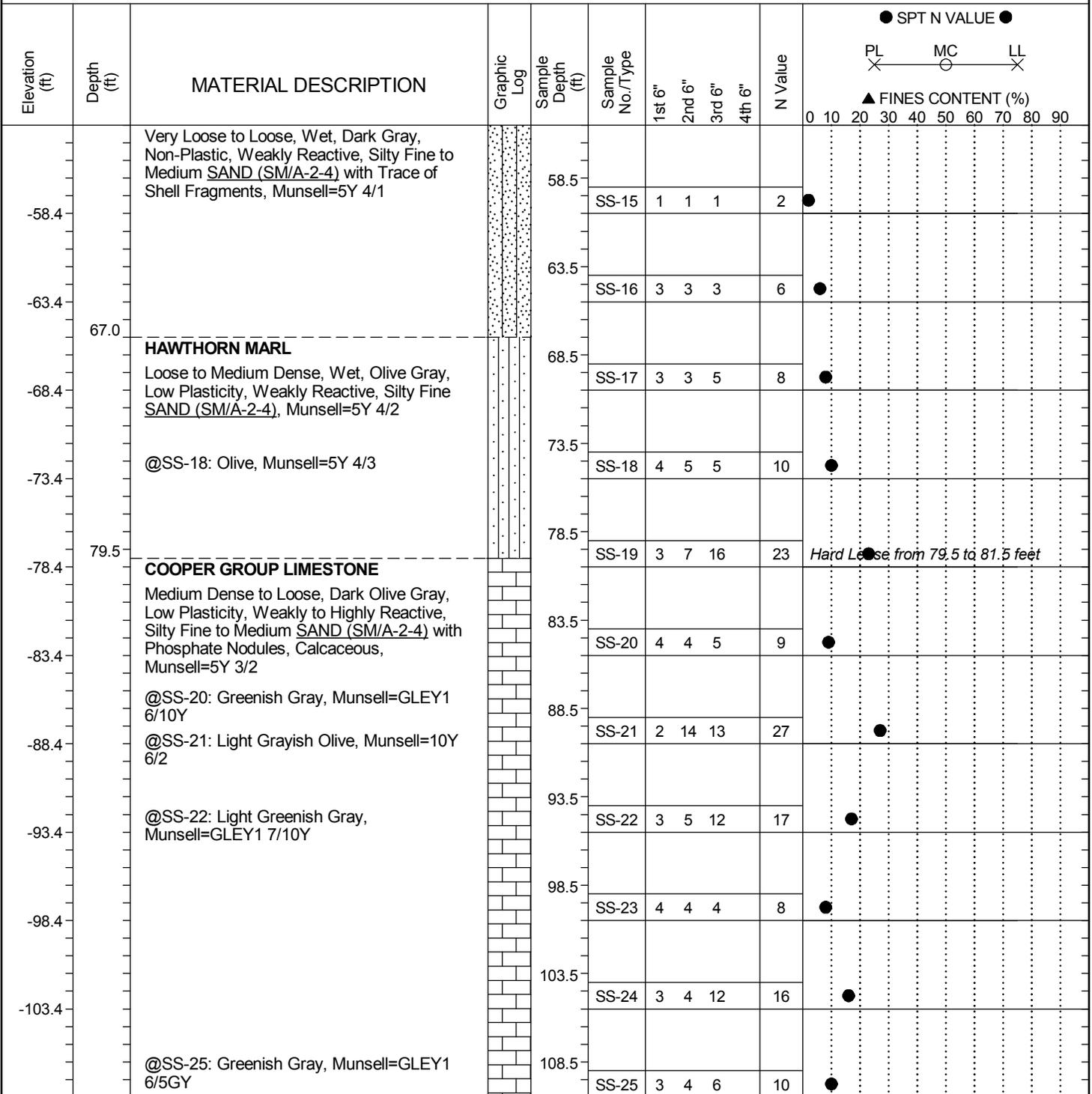
## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

Continued Next Page

# SCDOT Soil Test Log

|                                                                     |                                |                               |
|---------------------------------------------------------------------|--------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-15       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 100+78 | <b>Offset:</b> 9.6'-RT        |
| <b>Alignment:</b> ALT 1B                                            |                                |                               |
| <b>Elev.:</b> 1.6 ft                                                | <b>Latitude:</b> 32.403014     | <b>Longitude:</b> -80.448888  |
| <b>Date Started:</b> 8/3/2016                                       |                                |                               |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft      | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 8/3/2016                                     |                                |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                                |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW        | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                                |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                                |                               |



## LEGEND

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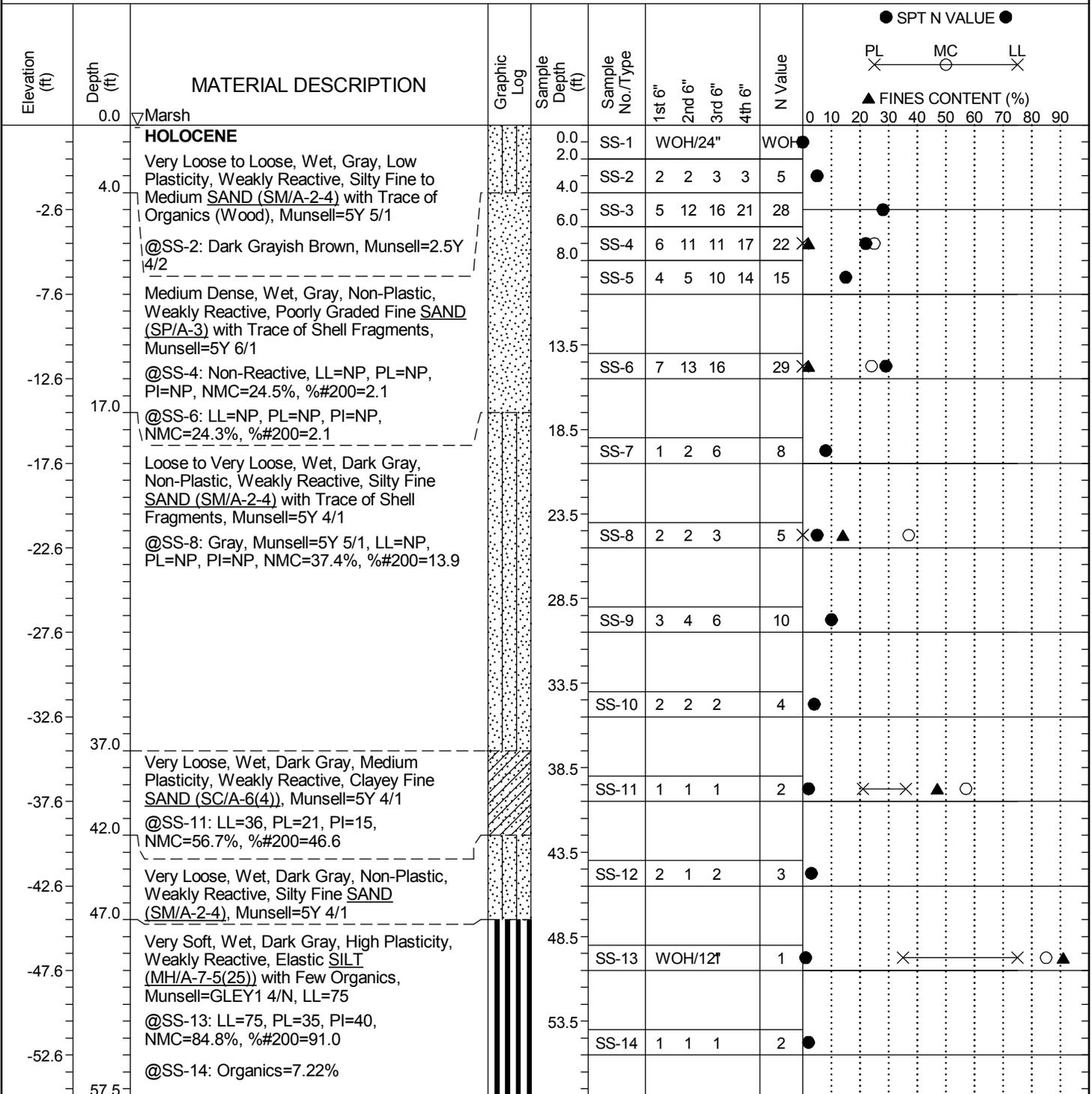
| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |





# SCDOT Soil Test Log

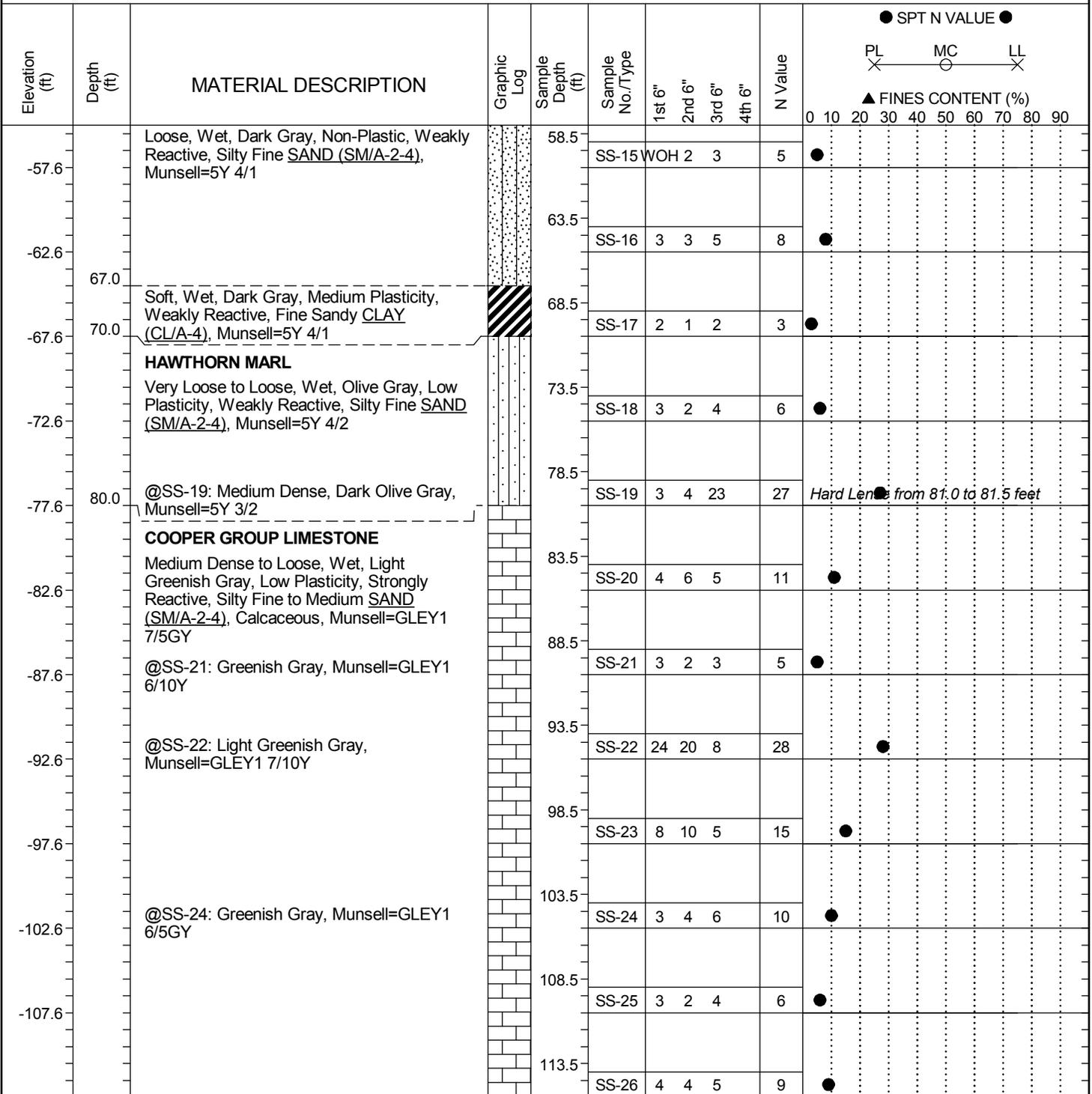
|                                                                     |                                |                              |
|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-16      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                              |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 105+97 | <b>Offset:</b> 25.2'-LT      |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 8/1/2016  |                              |
| <b>Elev.:</b> 2.4 ft                                                | <b>Latitude:</b> 32.402552     | <b>Longitude:</b> -80.447291 |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft      | <b>Core Depth:</b> N/A ft    |
| <b>Date Completed:</b> 8/2/2016                                     |                                |                              |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 45B  | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 83.1%     |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft |
| <b>24HR</b>                                                         |                                | <b>TIDAL</b>                 |



Continued Next Page

# SCDOT Soil Test Log

|                                                                     |                                |                               |
|---------------------------------------------------------------------|--------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-16       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 105+97 | <b>Offset:</b> 25.2'-LT       |
| <b>Alignment:</b> ALT 1B                                            |                                |                               |
| <b>Elev.:</b> 2.4 ft                                                | <b>Latitude:</b> 32.402552     | <b>Longitude:</b> -80.447291  |
| <b>Date Started:</b> 8/1/2016                                       |                                |                               |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft      | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 8/2/2016                                     |                                |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                                |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW        | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                                |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                                |                               |



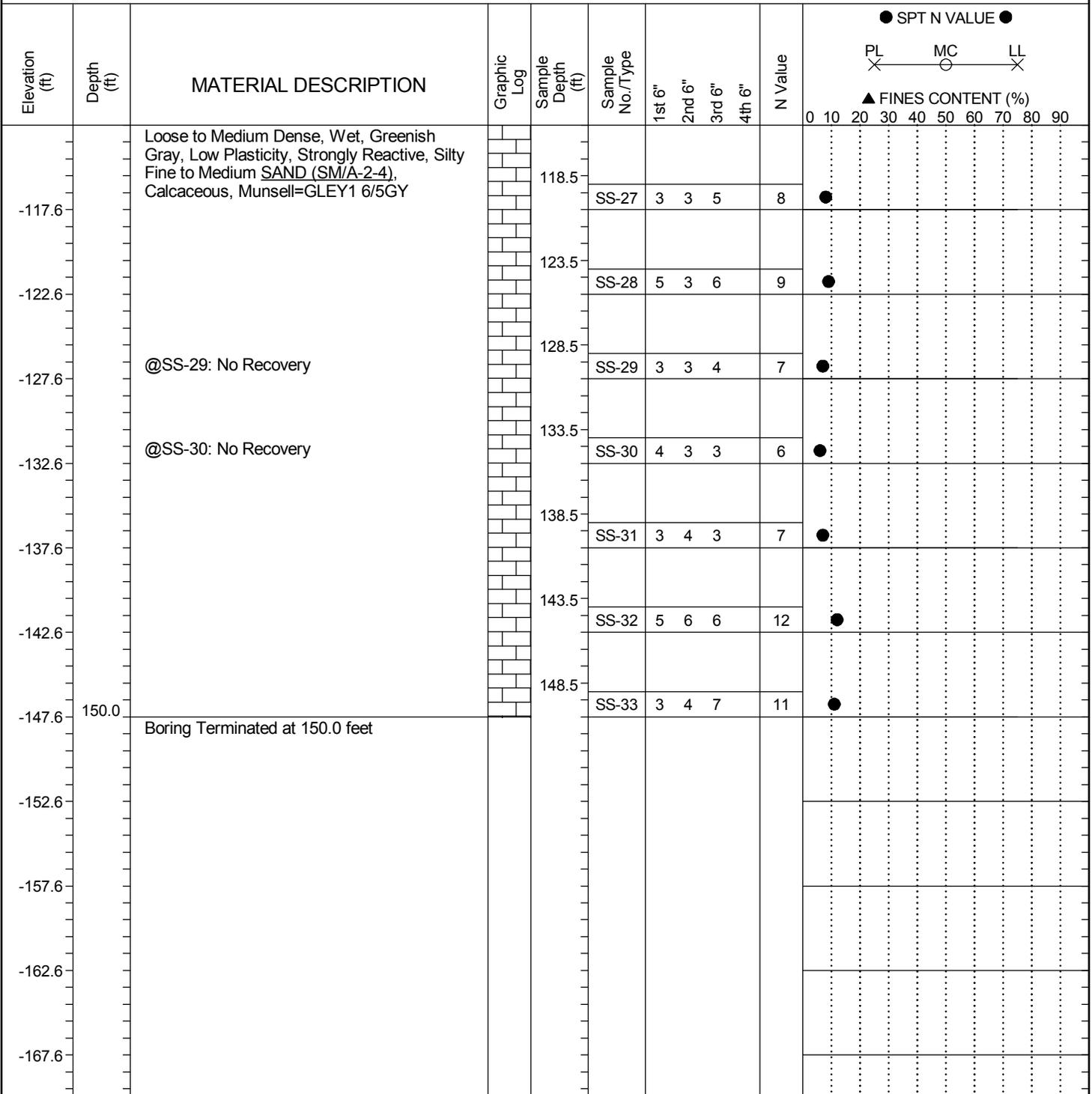
## LEGEND

Continued Next Page

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                                |                              |
|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> B-16      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                              |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 105+97 | <b>Offset:</b> 25.2'-LT      |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 8/1/2016  |                              |
| <b>Elev.:</b> 2.4 ft                                                | <b>Latitude:</b> 32.402552     | <b>Longitude:</b> -80.447291 |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft      | <b>Core Depth:</b> N/A ft    |
| <b>Date Completed:</b> 8/2/2016                                     |                                |                              |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 45B  | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 83.1%     |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft |
| <b>24HR:</b> TIDAL                                                  |                                |                              |



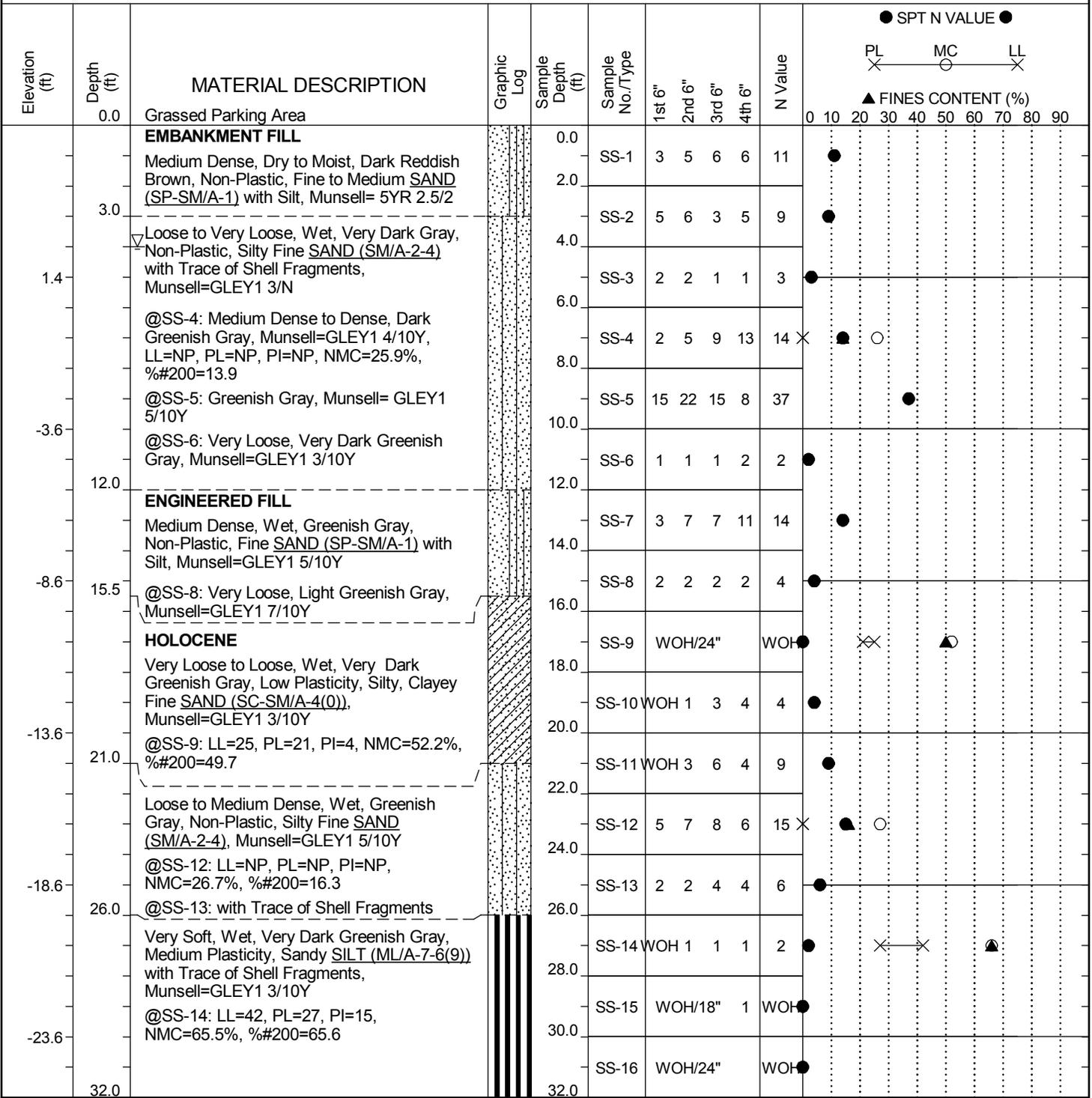
## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

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# SCDOT Soil Test Log

|                                                                     |                                 |                              |
|---------------------------------------------------------------------|---------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort         | <b>Boring No.:</b> TS-1      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21             |                              |
| <b>Eng./Geo.:</b> M. Touchberry                                     | <b>Boring Location:</b> 40+78   | <b>Offset:</b> 305.9'-RT     |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 11/16/2015 |                              |
| <b>Elev.:</b> 6.4 ft                                                | <b>Latitude:</b> 32.408395      | <b>Longitude:</b> -80.467293 |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft       | <b>Core Depth:</b> 0 ft      |
| <b>Date Completed:</b> 11/17/2015                                   |                                 |                              |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>    | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 550X  | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 74%        |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> Ameridrill      | <b>Groundwater:</b> TOB 4 ft |
| <b>24HR:</b> TIDAL                                                  |                                 |                              |



### LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

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# SCDOT Soil Test Log

|                                                                     |                                   |                               |
|---------------------------------------------------------------------|-----------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort           | <b>Boring No.:</b> TS-1       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21               |                               |
| <b>Eng./Geo.:</b> M. Touchberry                                     | <b>Boring Location:</b> 40+78     | <b>Offset:</b> 305.9'-RT      |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 6.4 ft              | <b>Latitude:</b> 32.408395    |
| <b>Longitude:</b> -80.467293                                        | <b>Date Started:</b> 11/16/2015   |                               |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft         | <b>Core Depth:</b> 0 ft       |
| <b>Date Completed:</b> 11/17/2015                                   | <b>Bore Hole Diameter (in):</b> 4 | <b>Sampler Configuration:</b> |
| <b>Liner Required:</b> Y (N)                                        | <b>Liner Used:</b> Y (N)          |                               |
| <b>Drill Machine:</b> CME 550X                                      | <b>Drill Method:</b> RW           | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 74%                                            | <b>Core Size:</b> N/A             | <b>Driller:</b> Ameridrill    |
| <b>Groundwater:</b> TOB                                             | <b>4 ft</b>                       | <b>24HR:</b> TIDAL            |

| Elevation (ft) | Depth (ft) | MATERIAL DESCRIPTION                                                                                                                                                                         | Graphic Log | Sample Depth (ft) | Sample No./Type | SPT N Value |           |        |        | FINES CONTENT (%) |    |    |
|----------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------|-----------------|-------------|-----------|--------|--------|-------------------|----|----|
|                |            |                                                                                                                                                                                              |             |                   |                 | 1st 6"      | 2nd 6"    | 3rd 6" | 4th 6" | PL                | MC | LL |
| -28.6          | 34.0       | Very Loose, Wet, Very Dark Greenish Gray, Non-Plastic, Silty Fine SAND (SM/A-2-4) with Shell Fragments, Munsell=GLE Y1 3/10Y<br>@SS-17: LL=NP, PL=NP, PI=NP, NMC=40.2%, % #200=28.3          |             | 34.0              | SS-17           | 3           | 1 1/2"    | 1      | 1      | ●                 | ▲  | ○  |
|                | 36.0       |                                                                                                                                                                                              |             | 36.0              | SS-18           | 3           | 1 1 2 2   |        |        | ●                 |    |    |
|                | 38.0       |                                                                                                                                                                                              |             | 38.0              | SS-19           | 2           | 1 1 1 1   |        |        | ●                 |    |    |
| -33.6          | 40.0       |                                                                                                                                                                                              |             | 40.0              | SS-20           | 3           | 2 2 1 1   |        |        | ●                 |    |    |
| 41.0           | 42.0       | Soft to Very Soft, Wet, Very Dark Greenish Gray, Non-Plastic to Low Plasticity, SILT (ML/A-4), Munsell=GLE Y1 3/10Y                                                                          |             | 42.0              | SS-21           | 3           | 2 1 2 1   |        |        | ●                 |    |    |
| 44.0           | 44.0       | @SS-22: with Fine Sand and Trace of Shell Fragments                                                                                                                                          |             | 44.0              | SS-22           | 2           | 1 1 1 WOH |        |        | ●                 |    |    |
| -38.6          | 46.0       | Very Loose, Wet, Very Dark Greenish Gray, Non-Plastic, Silty Fine to Coarse SAND (SM/A-2-4), Munsell=GLE Y1 3/10Y, LL=NP, PL=NP, PI=NP, NMC=24.0%, % #200=12.2                               |             | 46.0              | SS-23           | 3           | WOH 2 1 3 |        |        | ●                 | ▲  | ○  |
| 48.0           | 48.0       | Medium Dense, Wet, Gray, Non-Plastic, Poorly Graded Fine to Coarse SAND (SP-SM/A-1-b) with Silt and Trace of Shell Fragments, Munsell=GLE Y1 5/N, LL=NP, PL=NP, PI=NP, NMC=20.1%, % #200=9.8 |             | 48.0              | SS-24           | 21          | 7 10 11 5 |        |        | ●                 | ▲  | ○  |
| -43.6          | 50.0       | <b>HAWTHORN MARL</b>                                                                                                                                                                         |             | 50.0              | SS-25           | 17          | 2 6 11 8  |        |        | ●                 |    |    |
|                | 52.0       | Very Stiff, Moist, Olive/Dark Greenish Gray, Low Plasticity, Sandy SILT (ML/A-5(4)), Munsell=10Y 4/4 & 4/2                                                                                   |             | 52.0              | SS-26           | 6           | 2 3 3 5   |        |        | ●                 |    |    |
|                | 54.0       | @SS-26: Firm                                                                                                                                                                                 |             | 54.0              | SS-27           | 6           | 3 3 3 4   |        |        | ●                 |    |    |
| -48.6          | 56.0       | @SS-27: with Trace of Shell Fragments                                                                                                                                                        |             | 56.0              | SS-28           | 10          | 4 5 5 5   |        |        | ●                 |    |    |
|                | 58.0       | @SS-28: Very Stiff, Dark Grayish Olive, Munsell=10Y 4/2                                                                                                                                      |             | 58.0              | SS-29           | 4           | WOH 2 2 3 |        |        | ●                 | ×  | ○  |
|                | 60.0       | @SS-29: Soft to Firm, LL=44, PL=39, PI=5, NMC=62.4%, % #200=64.2                                                                                                                             |             | 60.0              | SS-30           | 8           | 4 4 4 5   |        |        | ●                 |    |    |
| -53.6          | 62.0       | @SS-32: Stiff                                                                                                                                                                                |             | 62.0              | SS-31           | 6           | 2 2 4 5   |        |        | ●                 |    |    |
|                | 64.0       |                                                                                                                                                                                              |             | 64.0              | SS-32           | 10          | 3 4 6 8   |        |        | ●                 |    |    |

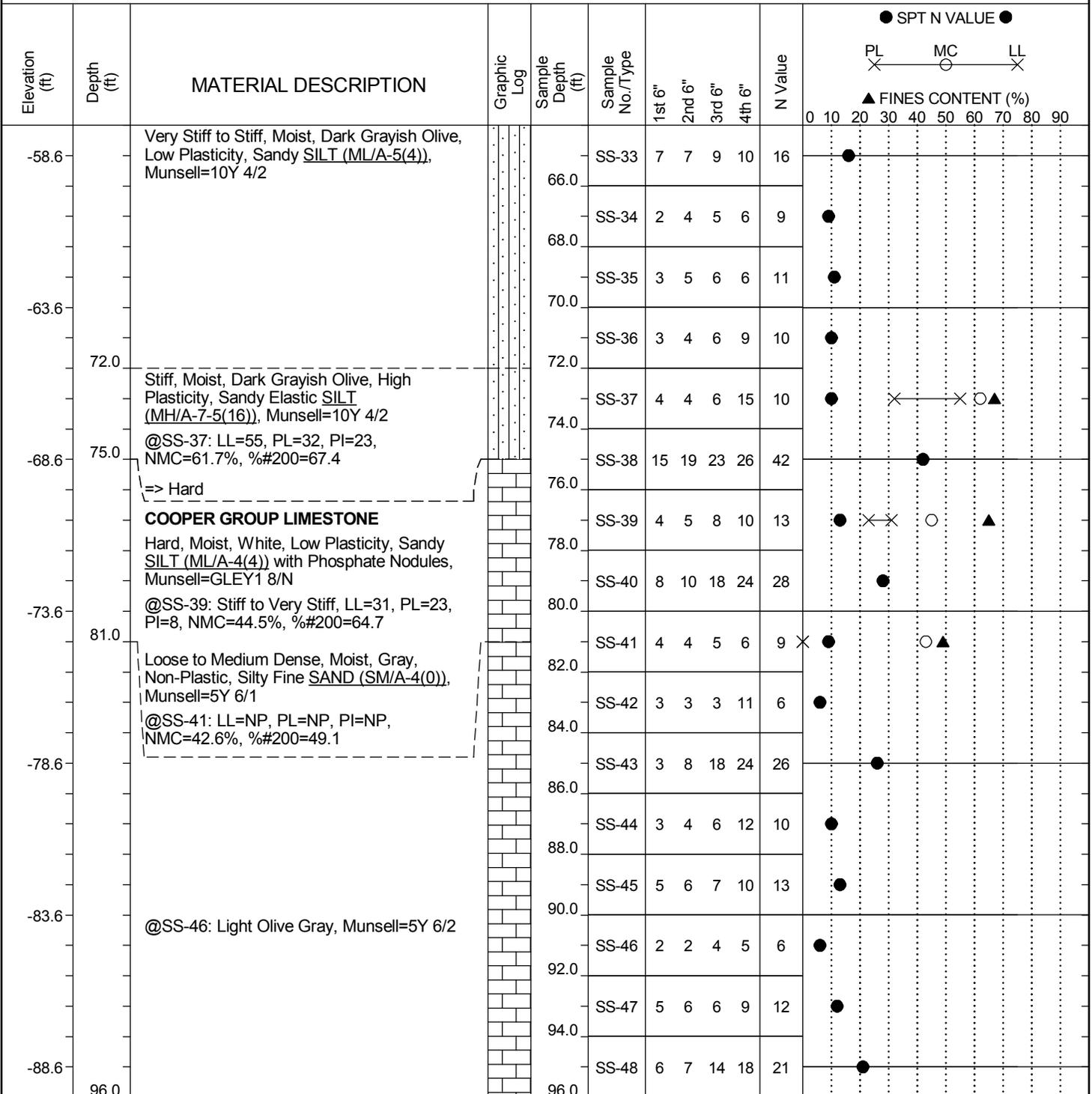
## LEGEND

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| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                                 |                              |
|---------------------------------------------------------------------|---------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort         | <b>Boring No.:</b> TS-1      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River |                                 | <b>Route:</b> US 21          |
| <b>Eng./Geo.:</b> M. Touchberry                                     | <b>Boring Location:</b> 40+78   | <b>Offset:</b> 305.9'-RT     |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 11/16/2015 |                              |
| <b>Elev.:</b> 6.4 ft                                                | <b>Latitude:</b> 32.408395      | <b>Longitude:</b> -80.467293 |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft       | <b>Core Depth:</b> 0 ft      |
| <b>Date Completed:</b> 11/17/2015                                   |                                 |                              |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>    | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 550X  | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 74%        |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> Ameridrill      | <b>Groundwater:</b> TOB 4 ft |
| <b>24HR</b>                                                         | <b>TIDAL</b>                    |                              |



## LEGEND

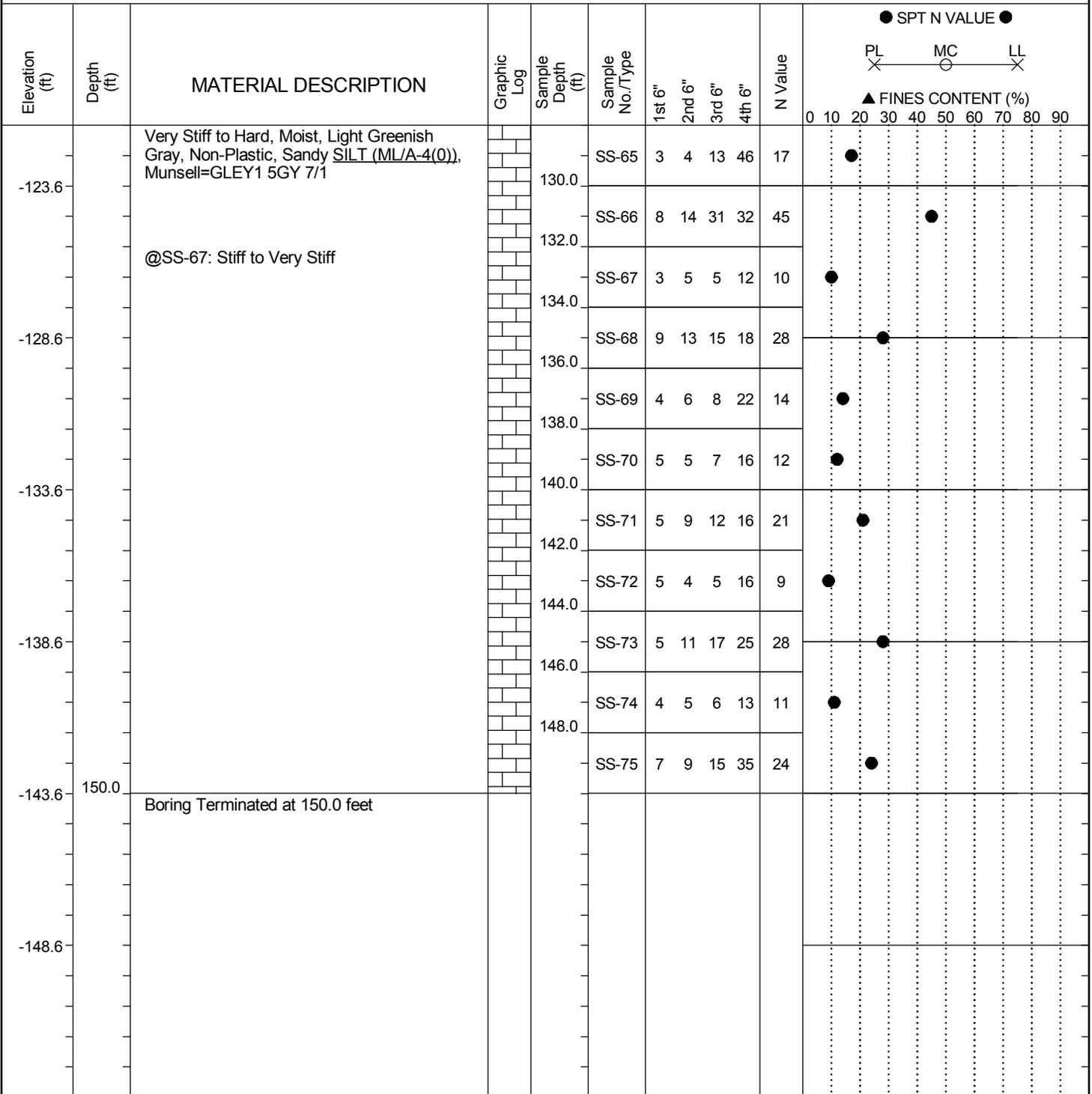
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| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |



# SCDOT Soil Test Log

|                                                                     |                                 |                              |
|---------------------------------------------------------------------|---------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort         | <b>Boring No.:</b> TS-1      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21             |                              |
| <b>Eng./Geo.:</b> M. Touchberry                                     | <b>Boring Location:</b> 40+78   | <b>Offset:</b> 305.9'-RT     |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 6.4 ft            | <b>Latitude:</b> 32.408395   |
| <b>Longitude:</b> -80.467293                                        | <b>Date Started:</b> 11/16/2015 |                              |
| <b>Total Depth:</b> 150 ft                                          | <b>Soil Depth:</b> 150 ft       | <b>Core Depth:</b> 0 ft      |
| <b>Date Completed:</b> 11/17/2015                                   |                                 |                              |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>    | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 550X  | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 74%        |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> Ameridrill      | <b>Groundwater:</b> TOB 4 ft |
| <b>24HR</b>                                                         | <b>TIDAL</b>                    |                              |



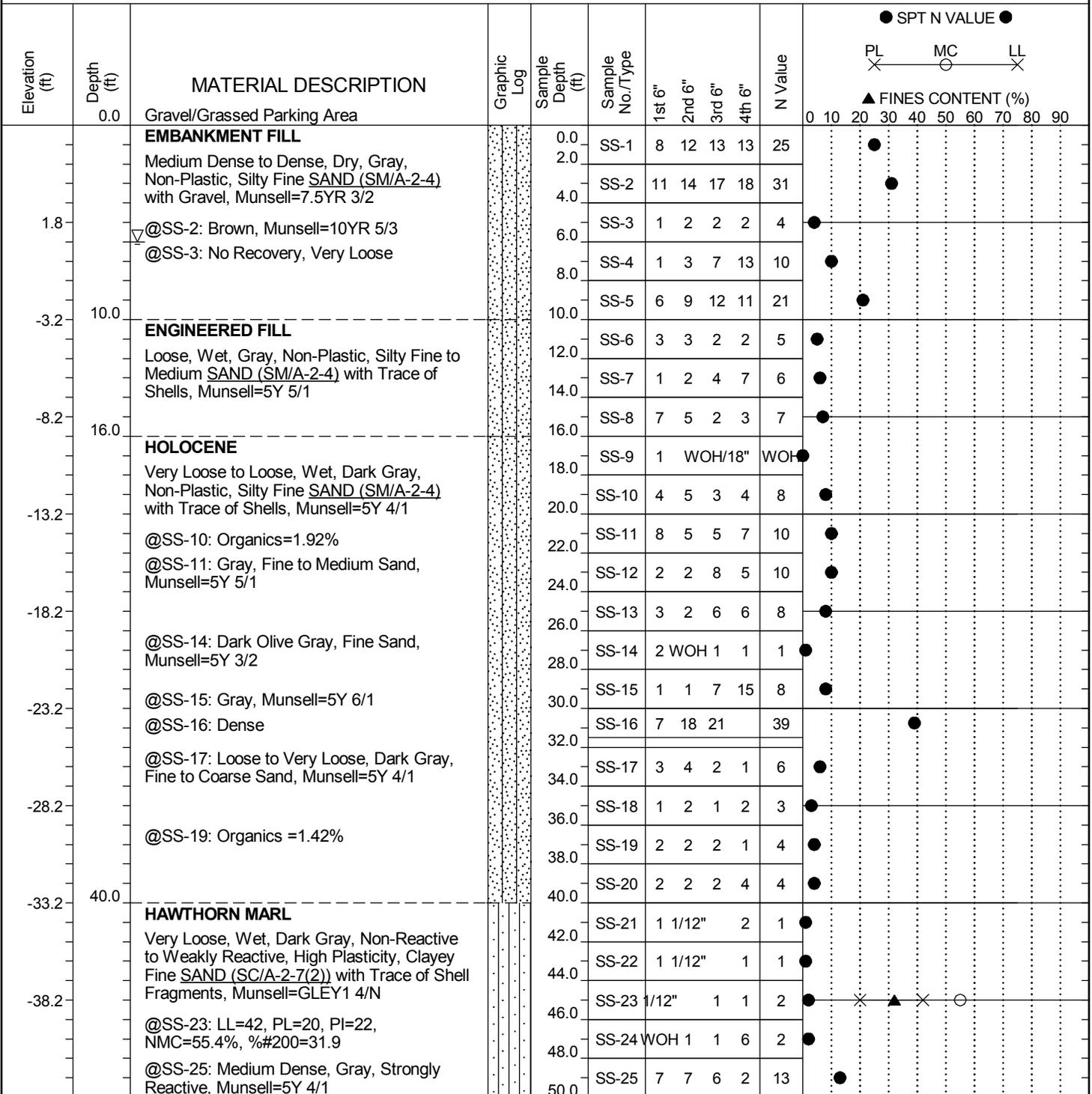
## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |



# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> SB-1       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> M. Miller                                         | <b>Boring Location:</b> 40+85 | <b>Offset:</b> 293.6'-RT      |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 6.8 ft                                                | <b>Latitude:</b> 32.408419    | <b>Longitude:</b> -80.467258  |
| <b>Date Started:</b> 7/6/2016                                       |                               |                               |
| <b>Total Depth:</b> 520 ft                                          | <b>Soil Depth:</b> 520 ft     | <b>Core Depth:</b> 250 ft     |
| <b>Date Completed:</b> 7/14/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 5                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> Failing 1500                                  | <b>Drill Method:</b> RW/RC    | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 75.4%                                          |                               |                               |
| <b>Core Size:</b> NQ                                                | <b>Driller:</b> Huss          | <b>Groundwater:</b> TOB 6 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |



## LEGEND

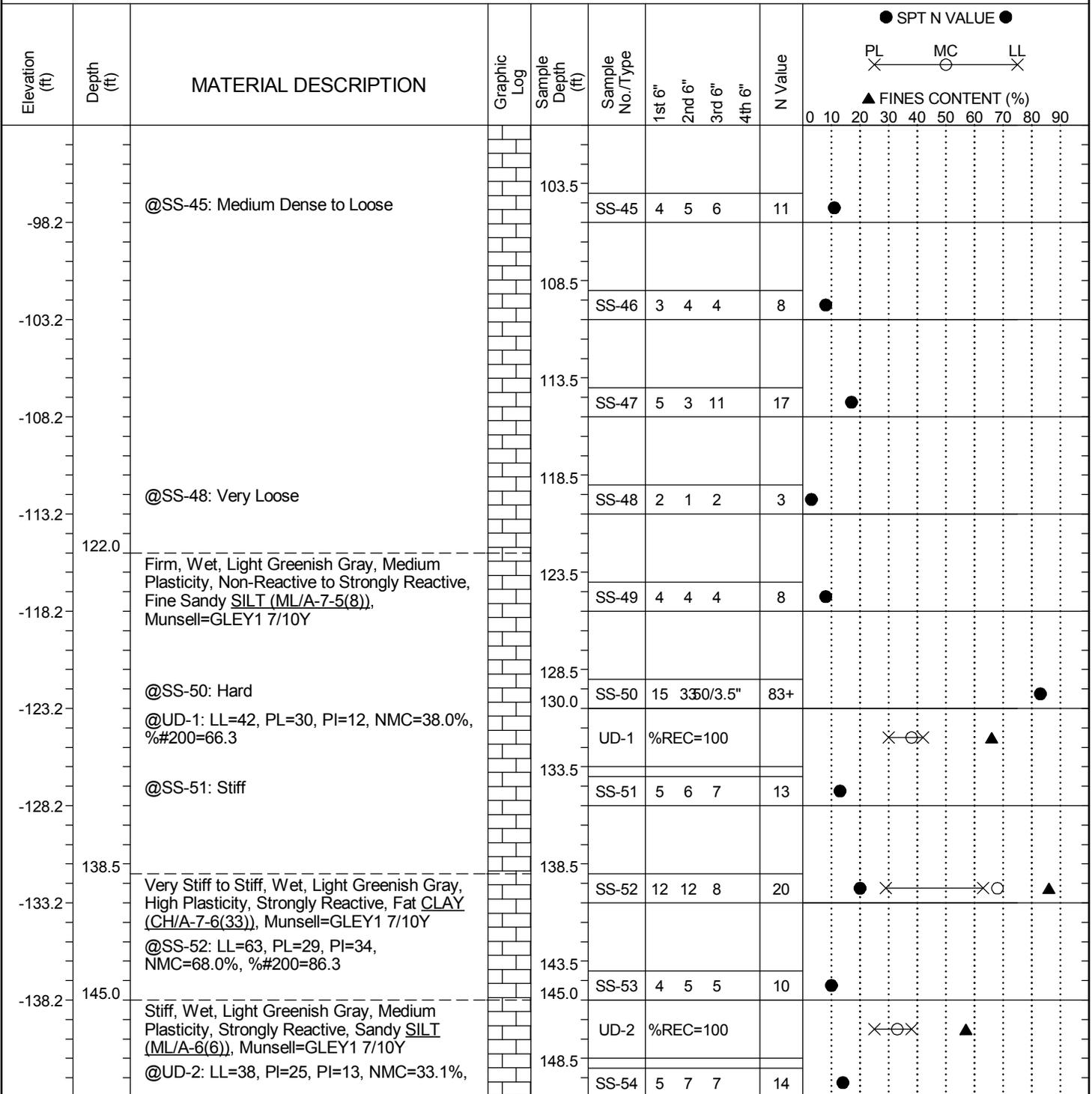
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| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |



# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> SB-1       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> M. Miller                                         | <b>Boring Location:</b> 40+85 | <b>Offset:</b> 293.6'-RT      |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 6.8 ft                                                | <b>Latitude:</b> 32.408419    | <b>Longitude:</b> -80.467258  |
| <b>Date Started:</b> 7/6/2016                                       |                               |                               |
| <b>Total Depth:</b> 520 ft                                          | <b>Soil Depth:</b> 520 ft     | <b>Core Depth:</b> 250 ft     |
| <b>Date Completed:</b> 7/14/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 5                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> Failing 1500                                  | <b>Drill Method:</b> RW/RC    | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 75.4%                                          |                               |                               |
| <b>Core Size:</b> NQ                                                | <b>Driller:</b> Huss          | <b>Groundwater:</b> TOB 6 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |



## LEGEND

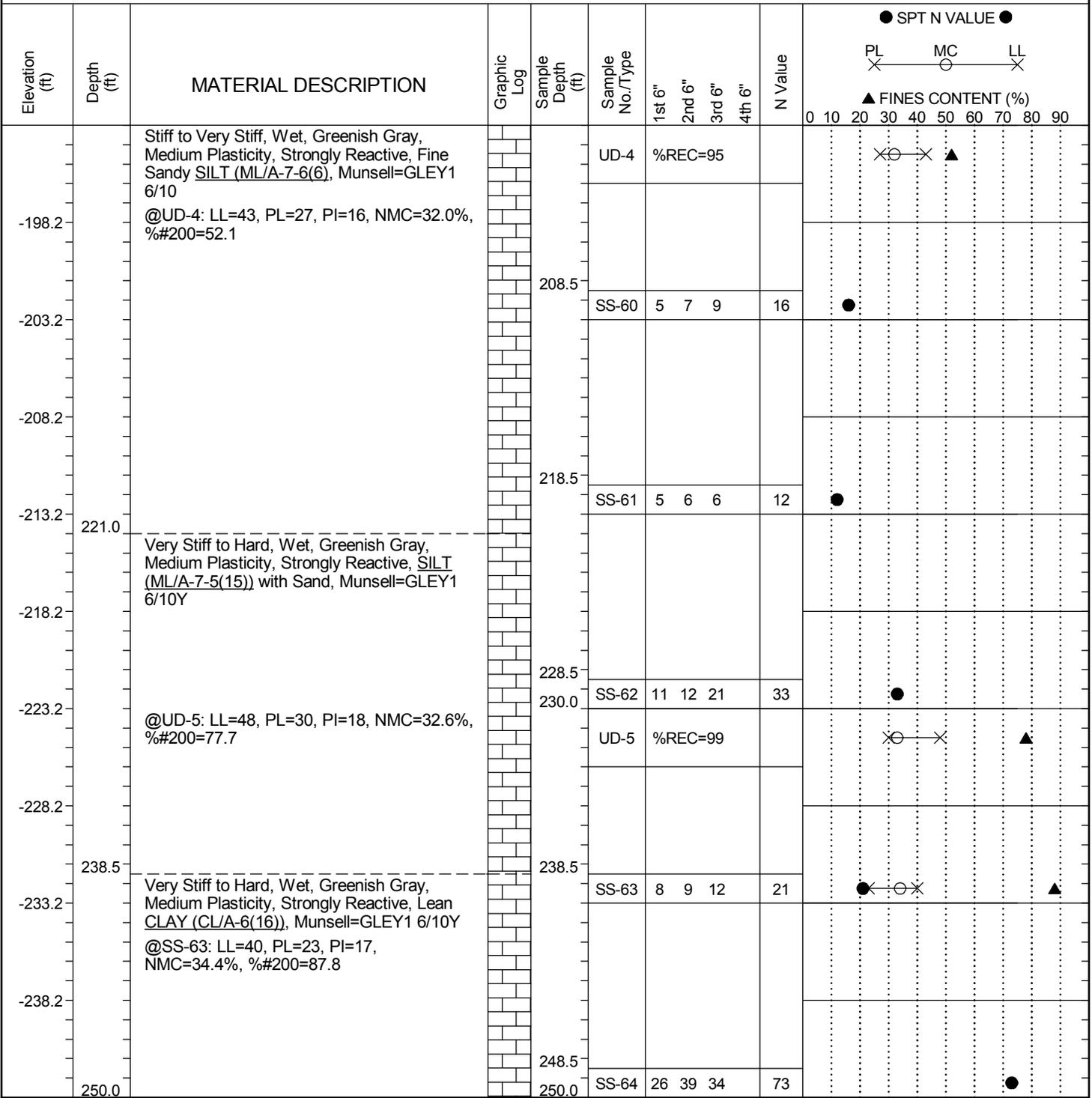
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| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
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# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> SB-1       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> M. Miller                                         | <b>Boring Location:</b> 40+85 | <b>Offset:</b> 293.6'-RT      |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 6.8 ft                                                | <b>Latitude:</b> 32.408419    | <b>Longitude:</b> -80.467258  |
| <b>Date Started:</b> 7/6/2016                                       |                               |                               |
| <b>Total Depth:</b> 520 ft                                          | <b>Soil Depth:</b> 520 ft     | <b>Core Depth:</b> 250 ft     |
| <b>Date Completed:</b> 7/14/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 5                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> Failing 1500                                  | <b>Drill Method:</b> RW/RC    | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 75.4%                                          |                               |                               |
| <b>Core Size:</b> NQ                                                | <b>Driller:</b> Huss          | <b>Groundwater:</b> TOB 6 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |



### LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

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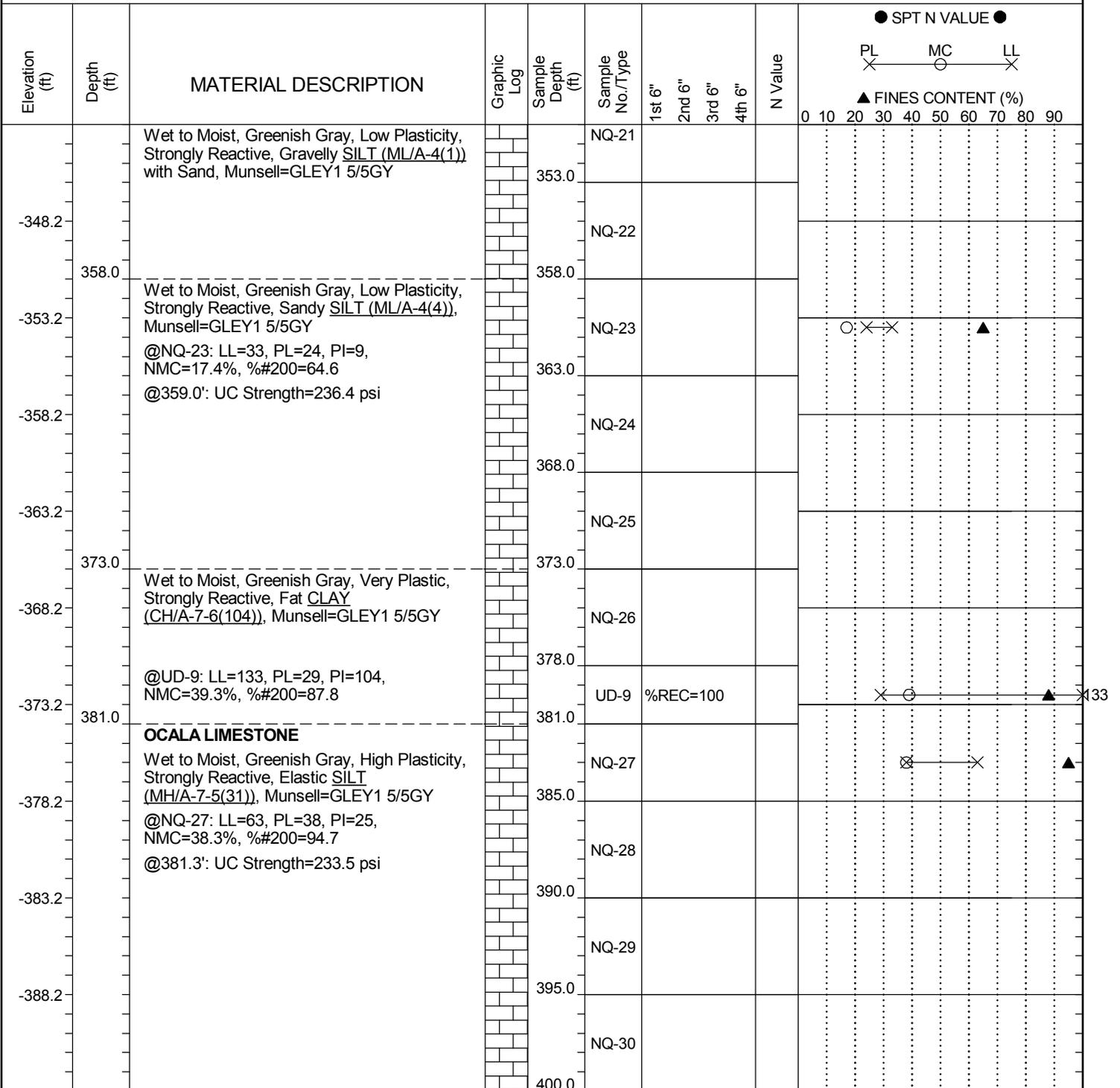
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# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> SB-1       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> M. Miller                                         | <b>Boring Location:</b> 40+85 | <b>Offset:</b> 293.6'-RT      |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 6.8 ft                                                | <b>Latitude:</b> 32.408419    | <b>Longitude:</b> -80.467258  |
| <b>Date Started:</b> 7/6/2016                                       |                               |                               |
| <b>Total Depth:</b> 520 ft                                          | <b>Soil Depth:</b> 520 ft     | <b>Core Depth:</b> 250 ft     |
| <b>Date Completed:</b> 7/14/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 5                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> Failing 1500                                  | <b>Drill Method:</b> RW/RC    | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 75.4%                                          |                               |                               |
| <b>Core Size:</b> NQ                                                | <b>Driller:</b> Huss          | <b>Groundwater:</b> TOB 6 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |



## LEGEND

Continued Next Page

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |



# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> SB-1       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> M. Miller                                         | <b>Boring Location:</b> 40+85 | <b>Offset:</b> 293.6'-RT      |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 6.8 ft                                                | <b>Latitude:</b> 32.408419    | <b>Longitude:</b> -80.467258  |
| <b>Date Started:</b> 7/6/2016                                       |                               |                               |
| <b>Total Depth:</b> 520 ft                                          | <b>Soil Depth:</b> 520 ft     | <b>Core Depth:</b> 250 ft     |
| <b>Date Completed:</b> 7/14/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 5                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> Failing 1500                                  | <b>Drill Method:</b> RW/RC    | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 75.4%                                          |                               |                               |
| <b>Core Size:</b> NQ                                                | <b>Driller:</b> Huss          | <b>Groundwater:</b> TOB 6 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |

| Elevation (ft) | Depth (ft) | MATERIAL DESCRIPTION                                                                                              | Graphic Log | Sample Depth (ft)                                                                        | Sample No./Type | 1st 6" | 2nd 6" | 3rd 6" | 4th 6" | N Value | SPT N VALUE |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |
|----------------|------------|-------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------------------------------------------------------------|-----------------|--------|--------|--------|--------|---------|-------------|----|----|-------------------|----|----|----|----|----|----|--|--|--|--|--|
|                |            |                                                                                                                   |             |                                                                                          |                 |        |        |        |        |         | PL          | MC | LL | FINES CONTENT (%) |    |    |    |    |    |    |  |  |  |  |  |
|                |            |                                                                                                                   |             |                                                                                          |                 |        |        |        |        |         | 0           | 10 | 20 | 30                | 40 | 50 | 60 | 70 | 80 | 90 |  |  |  |  |  |
| -398.2         |            | Wet to Moist, Greenish Gray, High Plasticity, Strongly Reactive, Elastic SILT (MH/A-7-5(31)), Munsell=GLEY1 5/5GY |             | 405.0                                                                                    | NQ-31           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |
| -403.2         |            |                                                                                                                   |             | 410.0                                                                                    | NQ-32           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |
| -408.2         |            |                                                                                                                   |             | 415.0                                                                                    | NQ-33           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |
| -413.2         |            |                                                                                                                   |             | 420.0                                                                                    | NQ-34           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |
| -418.2         |            |                                                                                                                   |             | 425.0                                                                                    | NQ-35           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |
| -423.2         |            |                                                                                                                   |             | 430.0                                                                                    | NQ-36           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |
| -428.2         |            |                                                                                                                   |             | 435.0                                                                                    | NQ-37           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |
| -433.2         | 440.0      |                                                                                                                   |             | Wet to Moist, Greenish Gray, Low Plasticity, Strongly Reactive, Fine Sandy SILT (ML/A-4) |                 | 440.0  | NQ-38  |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |
| -438.2         |            |                                                                                                                   |             |                                                                                          |                 | 445.0  | NQ-39  |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |
|                |            |                                                                                                                   |             |                                                                                          |                 | 450.0  | NQ-40  |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |
|                |            |                                                                                                                   |             |                                                                                          |                 |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |  |

**LEGEND**

*Continued Next Page*

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

SC\_DOT\_G5396 - HARBOR RIVER SPT AND CPT.GPJ FME2017.GDT 2/14/17

# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> SB-1       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> M. Miller                                         | <b>Boring Location:</b> 40+85 | <b>Offset:</b> 293.6'-RT      |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 6.8 ft                                                | <b>Latitude:</b> 32.408419    | <b>Longitude:</b> -80.467258  |
| <b>Date Started:</b> 7/6/2016                                       |                               |                               |
| <b>Total Depth:</b> 520 ft                                          | <b>Soil Depth:</b> 520 ft     | <b>Core Depth:</b> 250 ft     |
| <b>Date Completed:</b> 7/14/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 5                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> Failing 1500                                  | <b>Drill Method:</b> RW/RC    | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 75.4%                                          |                               |                               |
| <b>Core Size:</b> NQ                                                | <b>Driller:</b> Huss          | <b>Groundwater:</b> TOB 6 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |

| Elevation (ft) | Depth (ft) | MATERIAL DESCRIPTION                                                                     | Graphic Log | Sample Depth (ft)                                                                                            | Sample No./Type | 1st 6" | 2nd 6" | 3rd 6" | 4th 6" | N Value | SPT N VALUE |    |    |                   |    |    |    |    |    |    |  |  |  |  |
|----------------|------------|------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------|-----------------|--------|--------|--------|--------|---------|-------------|----|----|-------------------|----|----|----|----|----|----|--|--|--|--|
|                |            |                                                                                          |             |                                                                                                              |                 |        |        |        |        |         | PL          | MC | LL | FINES CONTENT (%) |    |    |    |    |    |    |  |  |  |  |
|                |            |                                                                                          |             |                                                                                                              |                 |        |        |        |        |         | 0           | 10 | 20 | 30                | 40 | 50 | 60 | 70 | 80 | 90 |  |  |  |  |
| -448.2         |            | Wet to Moist, Greenish Gray, Low Plasticity, Strongly Reactive, Fine Sandy SILT (ML/A-4) |             | 455.0                                                                                                        | NQ-41           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |
| -453.2         |            |                                                                                          |             | 460.0                                                                                                        | NQ-42           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |
| -458.2         |            |                                                                                          |             | 465.0                                                                                                        | NQ-43           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |
| -463.2         |            |                                                                                          |             | 470.0                                                                                                        | NQ-44           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |
| -468.2         |            |                                                                                          |             | 475.0                                                                                                        | NQ-45           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |
| -473.2         |            |                                                                                          |             | 480.0                                                                                                        | NQ-46           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |
| -478.2         |            |                                                                                          |             | 485.0                                                                                                        | NQ-47           |        |        |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |
| -483.2         | 490.0      |                                                                                          |             | SANTEE LIMESTONE<br>Wet to Moist, Greenish Gray, Low Plasticity, Strongly Reactive, Fine Sandy SILT (ML/A-4) |                 | 490.0  | NQ-48  |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |
| -488.2         |            |                                                                                          |             |                                                                                                              |                 | 495.0  | NQ-49  |        |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |
| 500.0          |            |                                                                                          |             |                                                                                                              |                 |        | 500.0  | NQ-50  |        |         |             |    |    |                   |    |    |    |    |    |    |  |  |  |  |

## LEGEND

Continued Next Page

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                               |                               |
|---------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort       | <b>Boring No.:</b> SB-1       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21           |                               |
| <b>Eng./Geo.:</b> M. Miller                                         | <b>Boring Location:</b> 40+85 | <b>Offset:</b> 293.6'-RT      |
| <b>Alignment:</b> ALT 1B                                            |                               |                               |
| <b>Elev.:</b> 6.8 ft                                                | <b>Latitude:</b> 32.408419    | <b>Longitude:</b> -80.467258  |
| <b>Date Started:</b> 7/6/2016                                       |                               |                               |
| <b>Total Depth:</b> 520 ft                                          | <b>Soil Depth:</b> 520 ft     | <b>Core Depth:</b> 250 ft     |
| <b>Date Completed:</b> 7/14/2016                                    |                               |                               |
| <b>Bore Hole Diameter (in):</b> 5                                   | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                               |                               |
| <b>Drill Machine:</b> Failing 1500                                  | <b>Drill Method:</b> RW/RC    | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 75.4%                                          |                               |                               |
| <b>Core Size:</b> NQ                                                | <b>Driller:</b> Huss          | <b>Groundwater:</b> TOB 6 ft  |
| <b>24HR:</b> TIDAL                                                  |                               |                               |

| Elevation (ft) | Depth (ft) | MATERIAL DESCRIPTION                                                                                                     | Graphic Log | Sample Depth (ft) | Sample No./Type | SPT N VALUE |        |        |        | FINES CONTENT (%) |    |
|----------------|------------|--------------------------------------------------------------------------------------------------------------------------|-------------|-------------------|-----------------|-------------|--------|--------|--------|-------------------|----|
|                |            |                                                                                                                          |             |                   |                 | 1st 6"      | 2nd 6" | 3rd 6" | 4th 6" | PL                | LL |
|                |            | Core Sampling Terminated at 500 feet. Borehole advanced to 520 feet using roller cone to facilitate geophysical testing. |             |                   |                 |             |        |        |        |                   |    |
| -498.2         |            |                                                                                                                          |             |                   |                 |             |        |        |        |                   |    |
| -503.2         |            |                                                                                                                          |             |                   |                 |             |        |        |        |                   |    |
| -508.2         |            |                                                                                                                          |             |                   |                 |             |        |        |        |                   |    |
| -513.2         | 520.0      | Boring Terminated at 520.0 feet                                                                                          |             |                   |                 |             |        |        |        |                   |    |
| -518.2         |            |                                                                                                                          |             |                   |                 |             |        |        |        |                   |    |
| -523.2         |            |                                                                                                                          |             |                   |                 |             |        |        |        |                   |    |
| -528.2         |            |                                                                                                                          |             |                   |                 |             |        |        |        |                   |    |
| -533.2         |            |                                                                                                                          |             |                   |                 |             |        |        |        |                   |    |
| -538.2         |            |                                                                                                                          |             |                   |                 |             |        |        |        |                   |    |

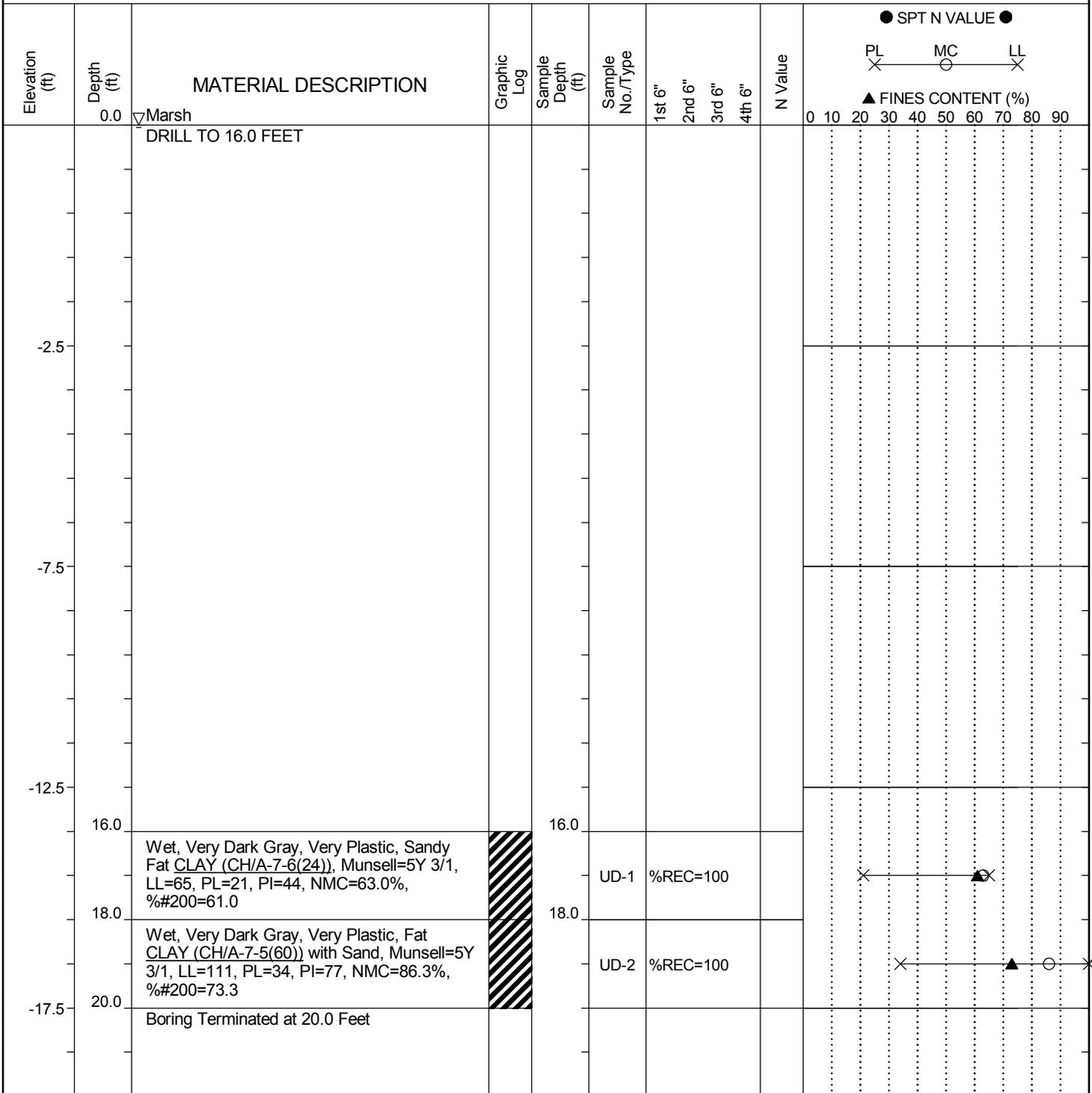
### LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

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# SCDOT Soil Test Log

|                                                                     |                                |                              |
|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> AP-1      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                              |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 65+07  | <b>Offset:</b> 7.2'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 7/27/2016 |                              |
| <b>Elev.:</b> 2.5 ft                                                | <b>Latitude:</b> 32.406761     | <b>Longitude:</b> -80.459581 |
| <b>Date Completed:</b> 7/27/2016                                    |                                |                              |
| <b>Total Depth:</b> 20 ft                                           | <b>Soil Depth:</b> 20 ft       | <b>Core Depth:</b> N/A ft    |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration:</b>  | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 45B  | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 83.1%     |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft |
| <b>24HR:</b>                                                        |                                | <b>TIDAL</b>                 |

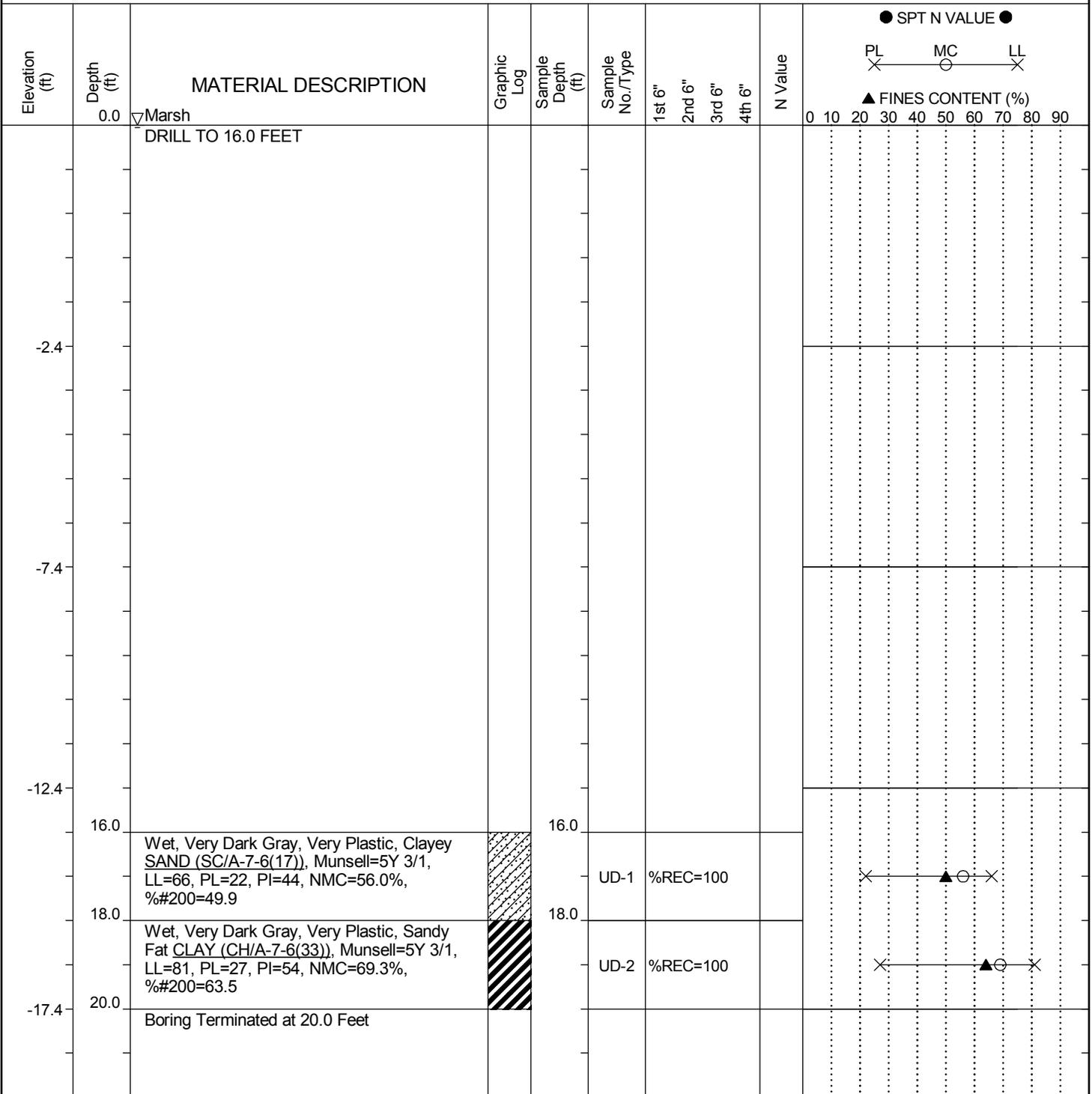


### LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

# SCDOT Soil Test Log

|                                                                     |                                |                              |
|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> AP-2      |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                              |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 67+03  | <b>Offset:</b> 15.9'-LT      |
| <b>Alignment:</b> ALT 1B                                            | <b>Date Started:</b> 7/28/2016 |                              |
| <b>Elev.:</b> 2.6 ft                                                | <b>Latitude:</b> 32.406601     | <b>Longitude:</b> -80.458973 |
| <b>Total Depth:</b> 20 ft                                           | <b>Soil Depth:</b> 20 ft       | <b>Core Depth:</b> N/A ft    |
| <b>Date Completed:</b> 7/28/2016                                    |                                |                              |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N) |
| <b>Liner Used:</b> Y (N)                                            | <b>Drill Machine:</b> CME 45B  | <b>Drill Method:</b> RW      |
| <b>Hammer Type:</b> Automatic                                       | <b>Energy Ratio:</b> 83.1%     |                              |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft |
| <b>24HR</b>                                                         | <b>TIDAL</b>                   |                              |



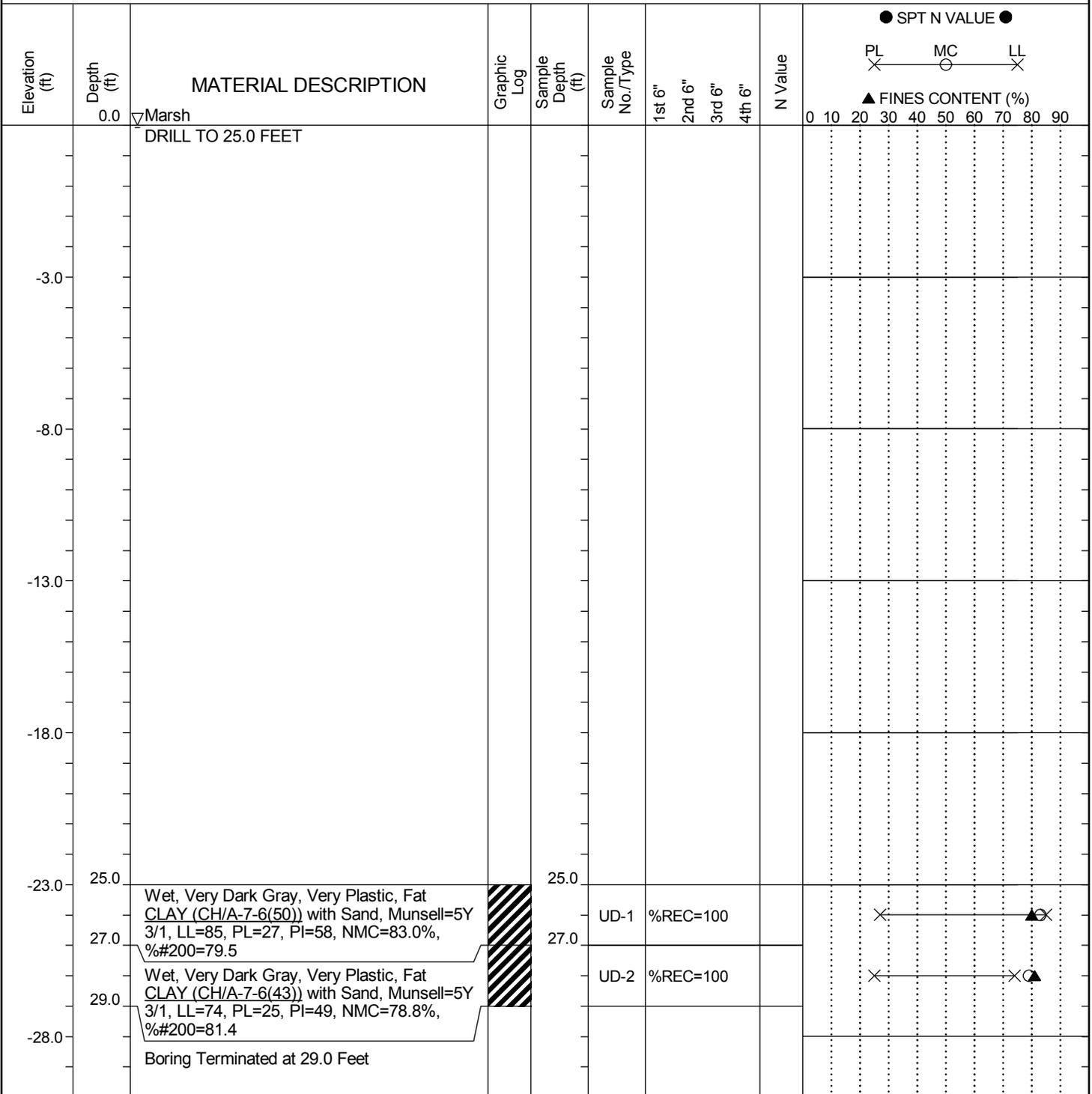
### LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |
|-------------------------|------------------------|--------------------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        |
| UD - Undisturbed Sample | CU - Cuttings          | RW - Rotary Wash               |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | CFA - Continuous Flight Augers |
|                         |                        | RC - Rock Core                 |
|                         |                        | DC - Driving Casing            |

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# SCDOT Soil Test Log

|                                                                     |                                   |                               |
|---------------------------------------------------------------------|-----------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort           | <b>Boring No.:</b> AP-3       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21               |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 69+09     | <b>Offset:</b> 39.8'-LT       |
| <b>Alignment:</b> ALT 1B                                            | <b>Elev.:</b> 2.0 ft              | <b>Latitude:</b> 32.406462    |
| <b>Longitude:</b> -80.458322                                        | <b>Date Started:</b> 7/28/2016    |                               |
| <b>Total Depth:</b> 29 ft                                           | <b>Soil Depth:</b> 29 ft          | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 7/28/2016                                    | <b>Bore Hole Diameter (in):</b> 4 | <b>Sampler Configuration:</b> |
| <b>Liner Required:</b> Y (N)                                        | <b>Liner Used:</b> Y (N)          |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW           | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          | <b>Core Size:</b> N/A             | <b>Driller:</b> M.A.D.        |
| <b>Groundwater:</b> TOB 0 ft                                        | <b>24HR:</b> TIDAL                |                               |



## LEGEND

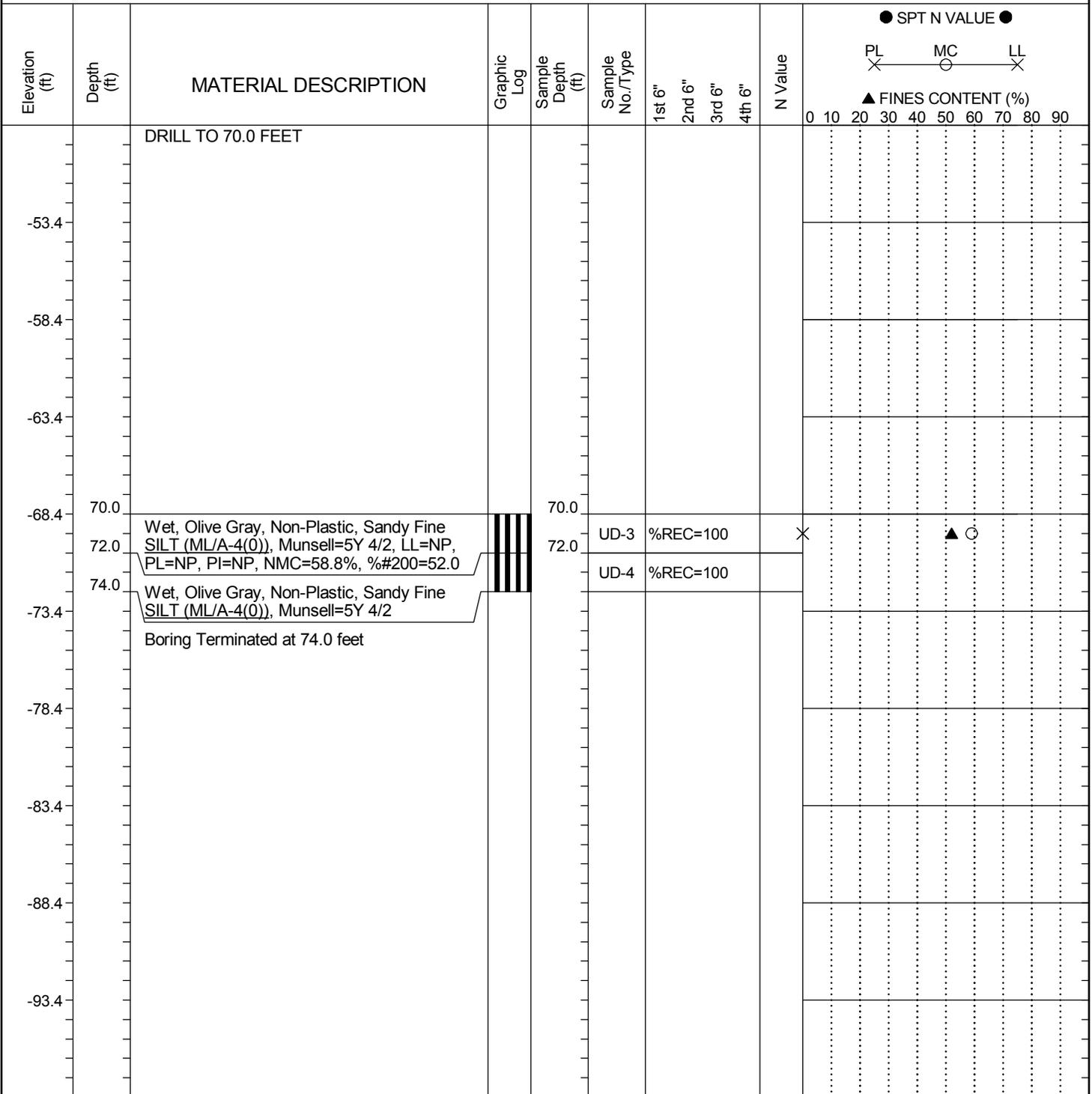
| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |

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# SCDOT Soil Test Log

|                                                                     |                                |                               |
|---------------------------------------------------------------------|--------------------------------|-------------------------------|
| <b>Project ID:</b> P026862                                          | <b>County:</b> Beaufort        | <b>Boring No.:</b> AP-4       |
| <b>Site Description:</b> US 21 Bridge Replacement over Harbor River | <b>Route:</b> US 21            |                               |
| <b>Eng./Geo.:</b> C. Piercy                                         | <b>Boring Location:</b> 100+73 | <b>Offset:</b> 8.7'-RT        |
| <b>Alignment:</b> ALT 1B                                            |                                |                               |
| <b>Elev.:</b> 1.6 ft                                                | <b>Latitude:</b> 32.403021     | <b>Longitude:</b> -80.448901  |
| <b>Date Started:</b> 8/4/2016                                       |                                |                               |
| <b>Total Depth:</b> 74 ft                                           | <b>Soil Depth:</b> 74 ft       | <b>Core Depth:</b> N/A ft     |
| <b>Date Completed:</b> 8/4/2016                                     |                                |                               |
| <b>Bore Hole Diameter (in):</b> 4                                   | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                            |                                |                               |
| <b>Drill Machine:</b> CME 45B                                       | <b>Drill Method:</b> RW        | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 83.1%                                          |                                |                               |
| <b>Core Size:</b> N/A                                               | <b>Driller:</b> M.A.D.         | <b>Groundwater:</b> TOB 0 ft  |
| <b>24HR:</b> TIDAL                                                  |                                |                               |



## LEGEND

| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger        | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings          | CFA - Continuous Flight Augers | RC - Rock Core   |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube   | DC - Driving Casing            |                  |



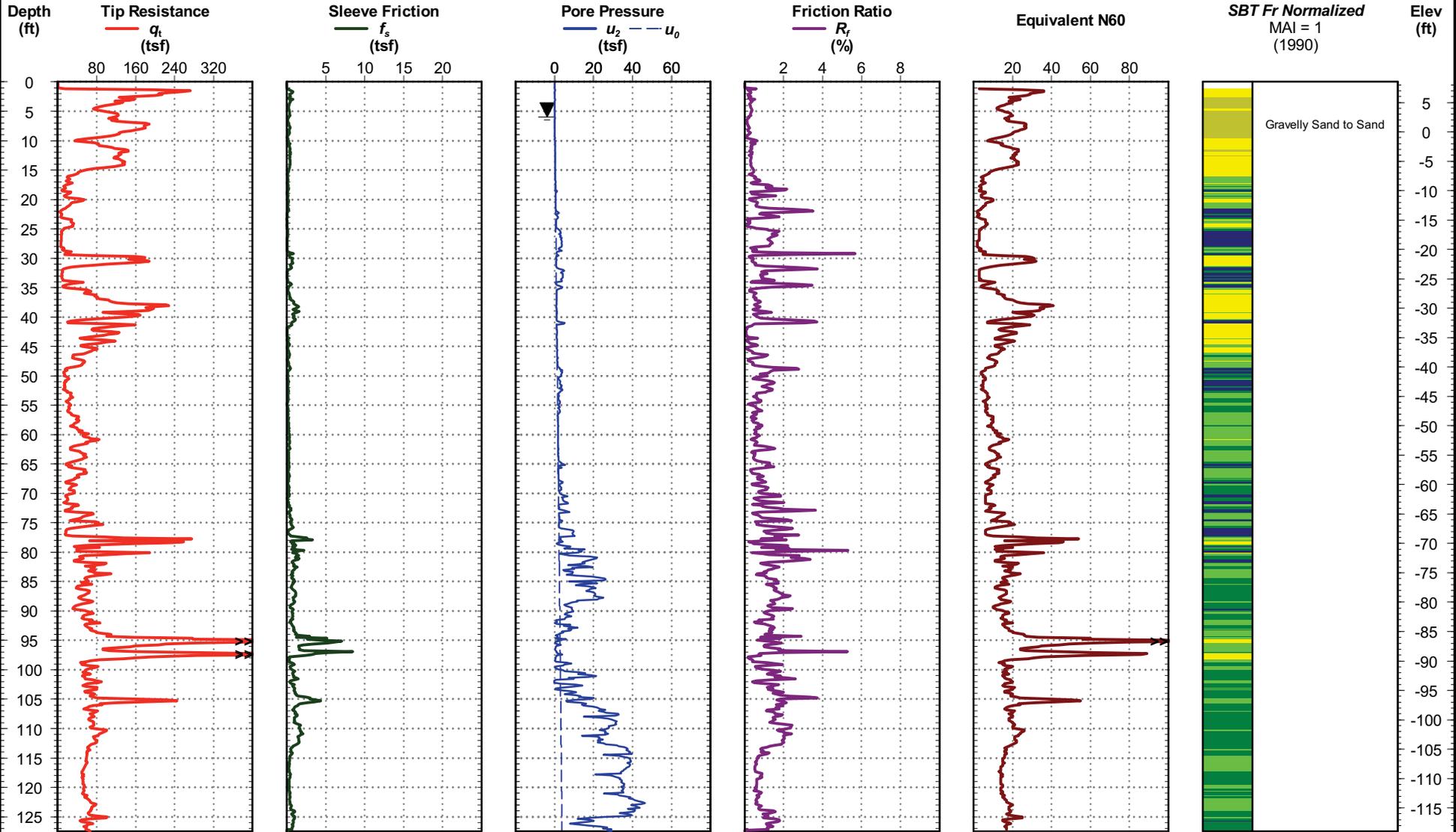




Date: Aug. 26, 2014  
Estimated Water Depth: 6 ft  
Rig/Operator: Conetec

Station: 13+72  
Offset: 7.0'-LT  
Elevation: 8.5

Total Depth: 127.5 ft  
Termination Criteria: Target Depth  
Cone Size:

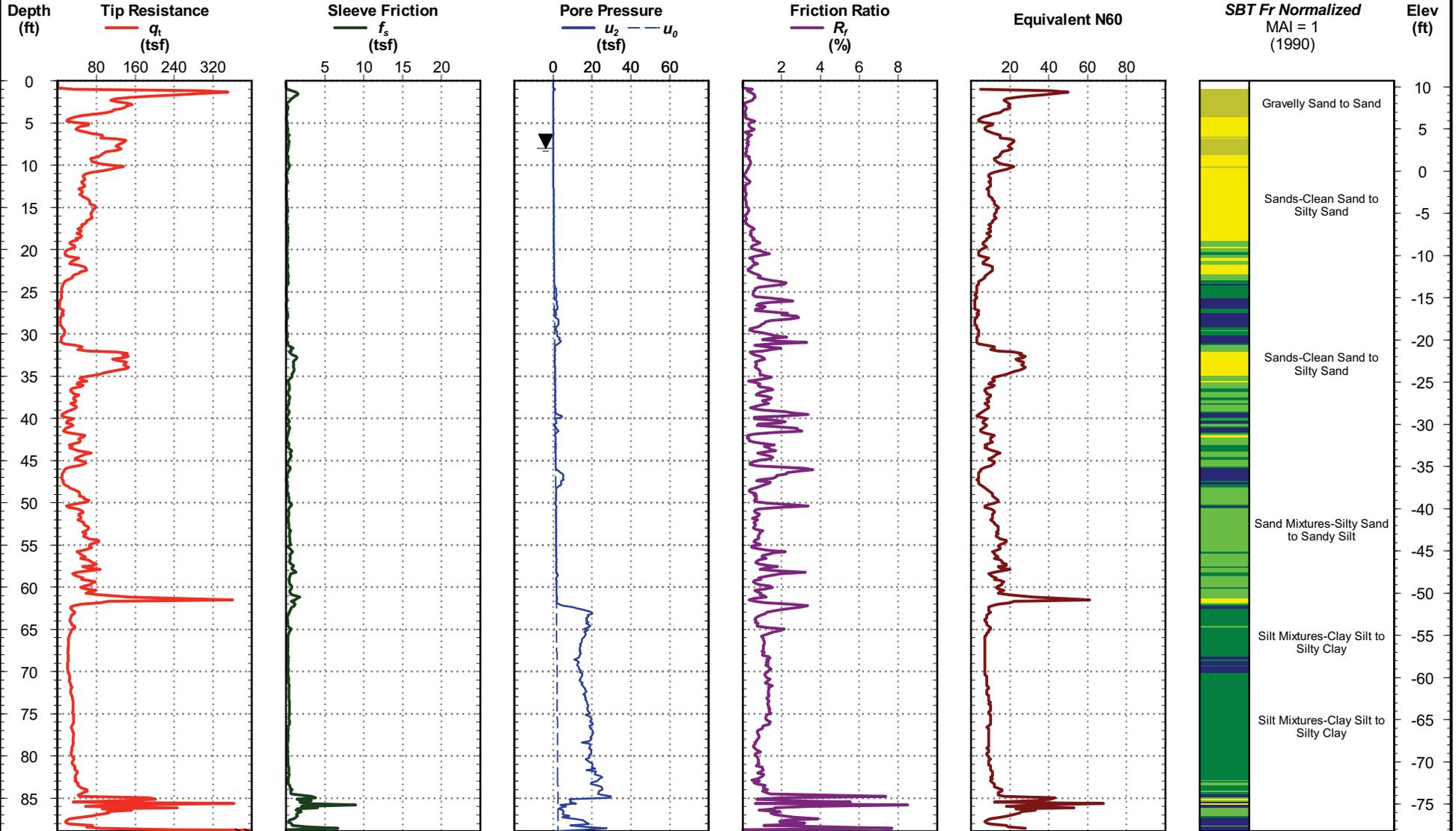


CPT REPORT - DYNAMIC G6396 - HARBOR RIVER SPT AND CPT.GPJ 11/1/16

Date: Aug. 25, 2014  
Estimated Water Depth: 8 ft  
Rig/Operator: Conetec

Station: 62+99  
Offset: 27.1'-RT  
Elevation: 10.7

Total Depth: 88.9 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size:

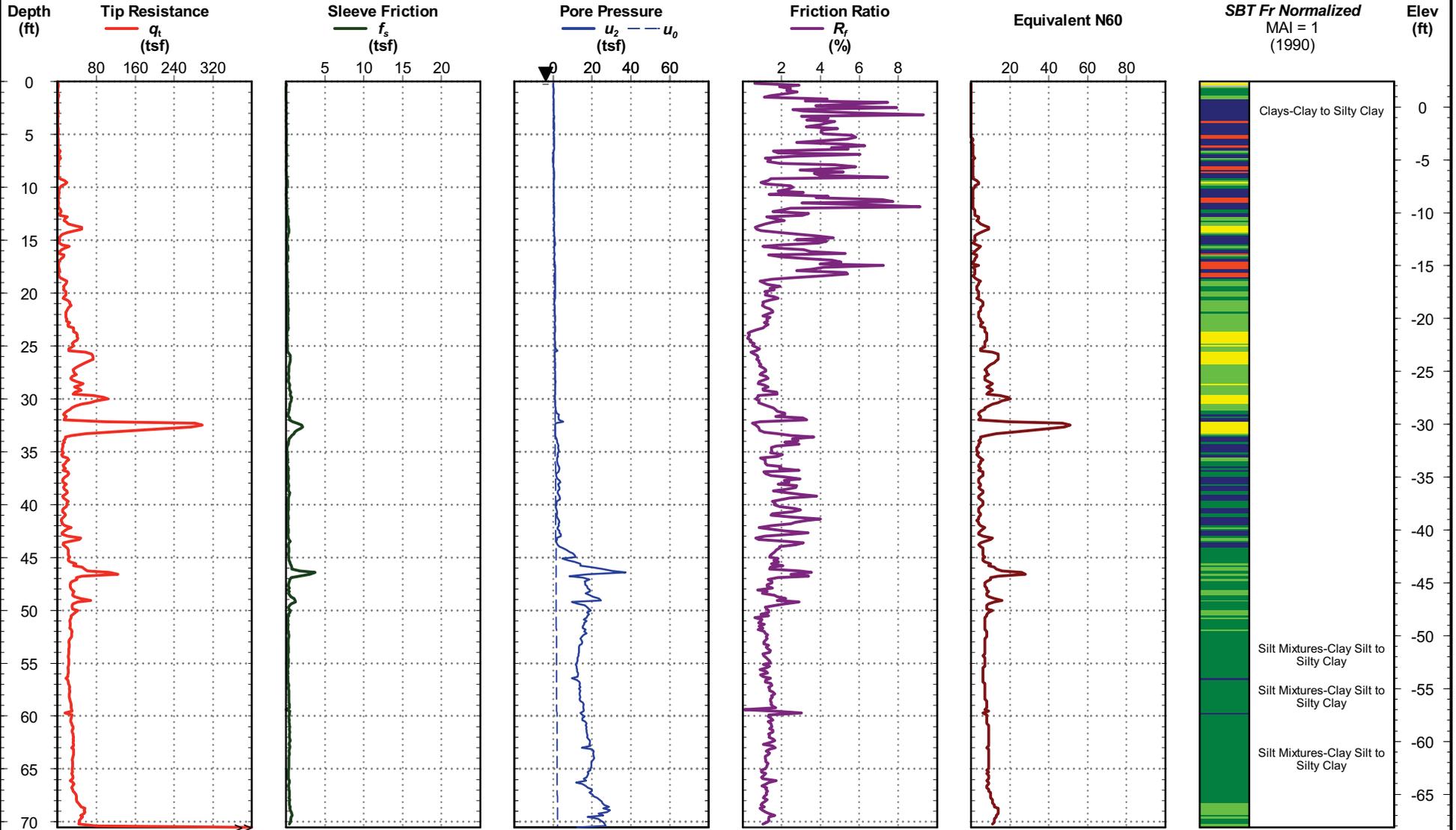


CPT REPORT - STANDARD G5396 - HARBOR RIVER SPT AND CPT GPJ 11/3/16

Date: Sep. 23, 2015  
Estimated Water Depth: 0 ft  
Rig/Operator: M.A.D.

Station: 42+42  
Offset: 96.4'-LT  
Elevation: 2.4

Total Depth: 70.5 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size:

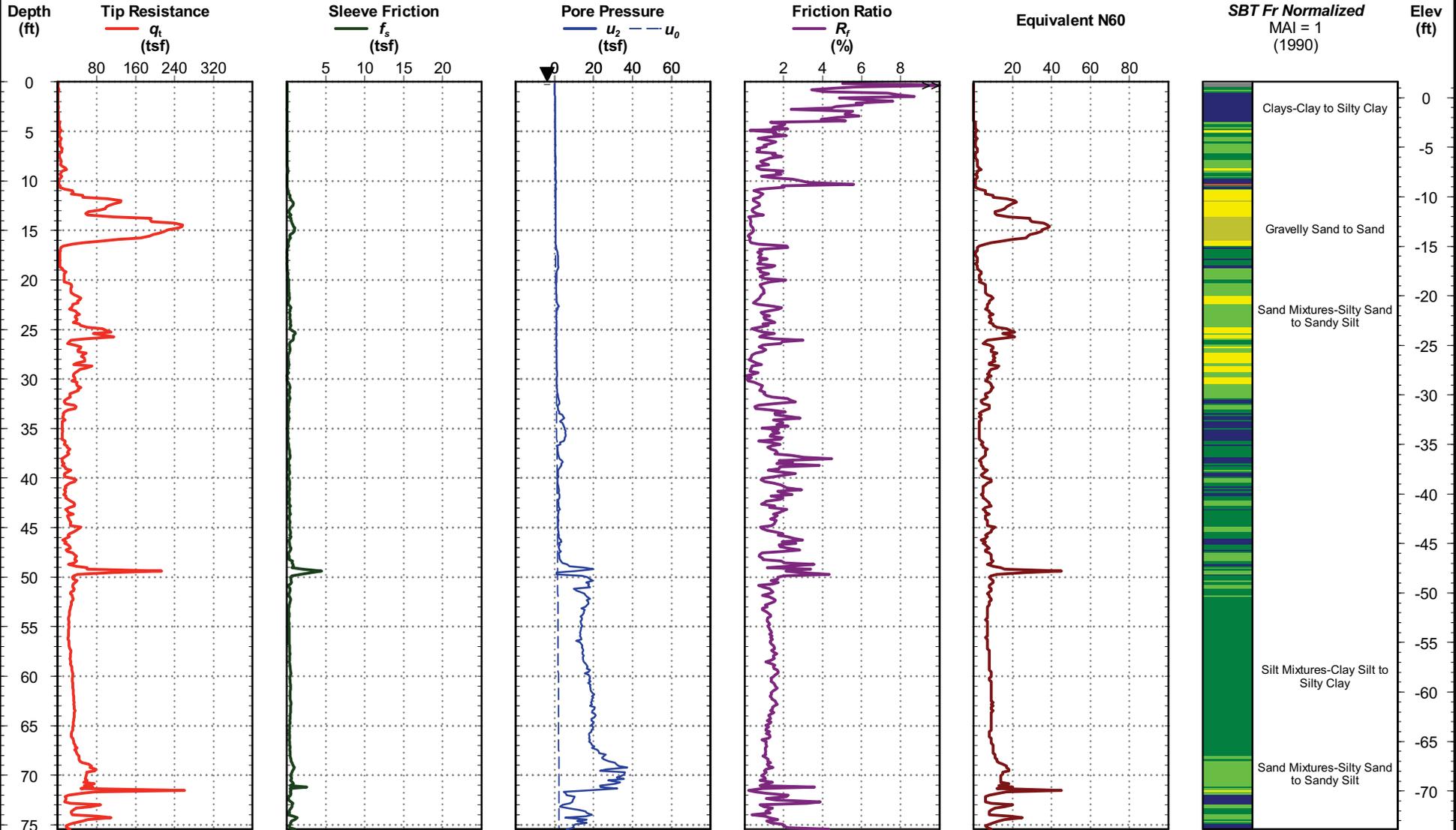


CPT REPORT - STANDARD G5396 - HARBOR RIVER SPT AND CPT.GPJ - 10/6/16

Date: Sep. 23, 2015  
Estimated Water Depth: 0 ft  
Rig/Operator: M.A.D.

Station: 49+36  
Offset: 76.2'-LT  
Elevation: 1.6

Total Depth: 75.5 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size:

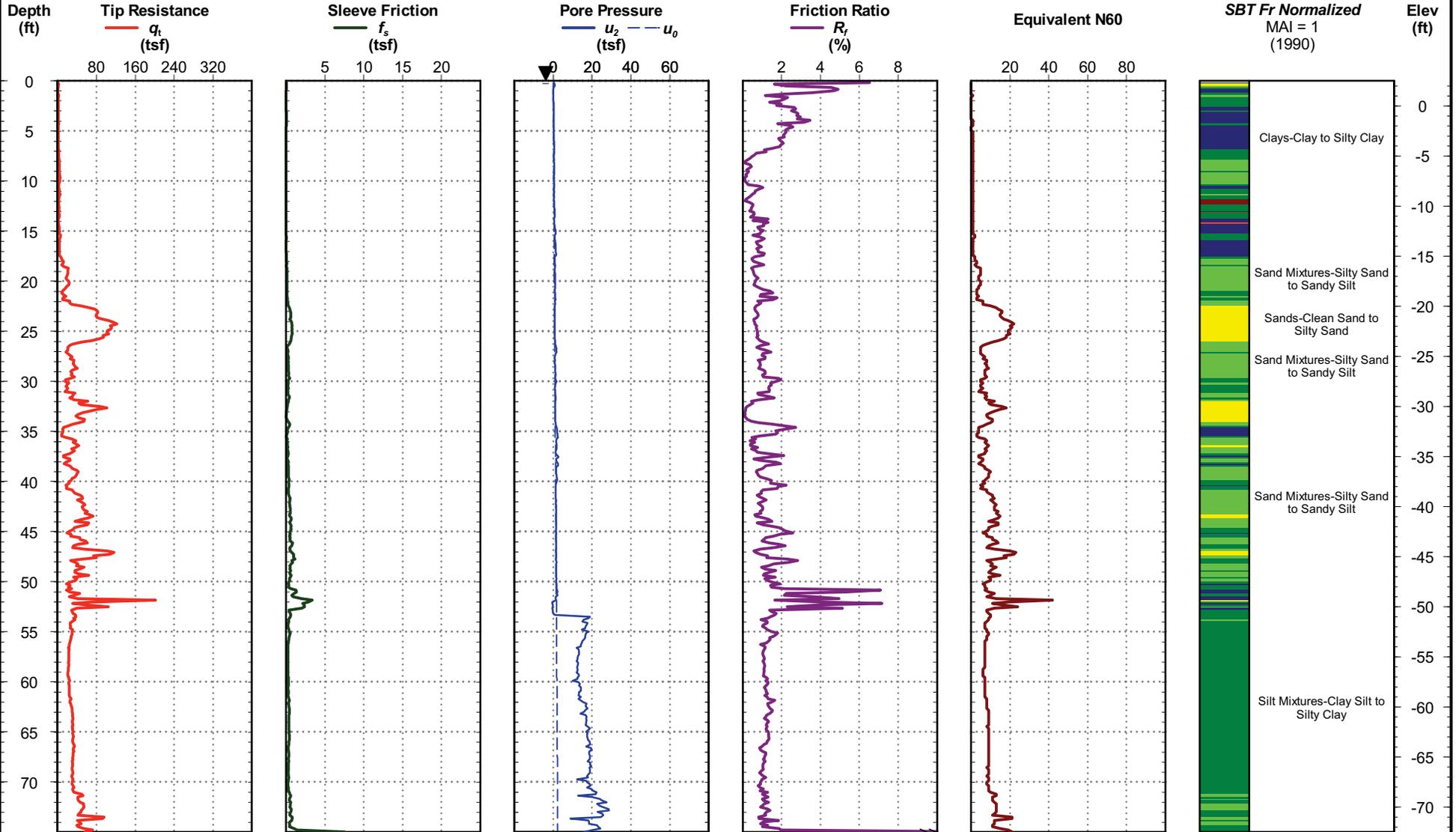


CPT REPORT - STANDARD G5396 - HARBOR RIVER SPT AND CPT TEST.GPJ 10/6/16

Date: Sep. 24, 2015  
Estimated Water Depth: 0 ft  
Rig/Operator: M.A.D.

Station: 60+88  
Offset: 78.7'-LT  
Elevation: 2.5

Total Depth: 75.0 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size:

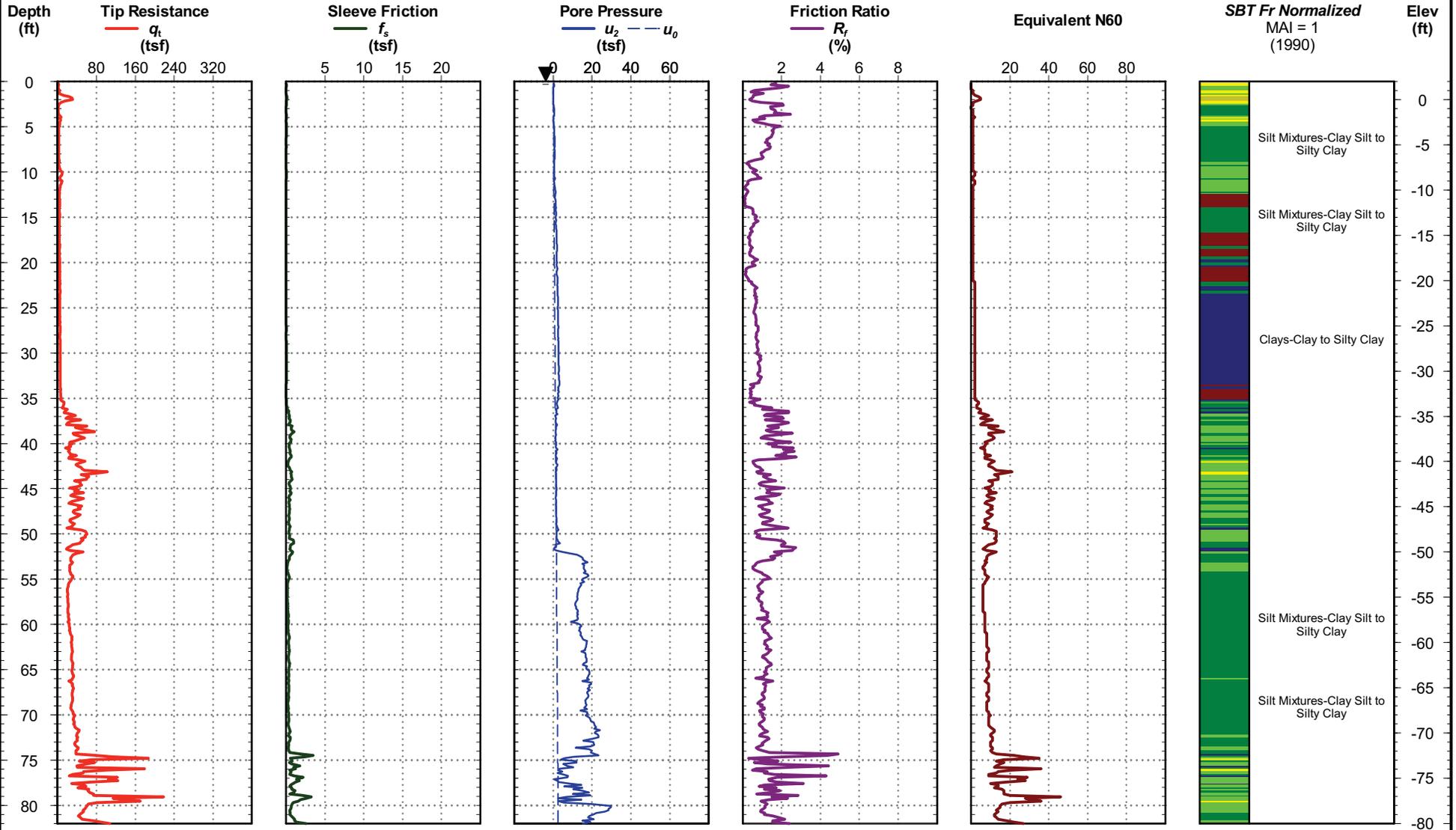


CPT REPORT - STANDARD G5396 - HARBOR RIVER SPT AND CPT GPJ 10/6/16

Date: Sep. 24, 2015  
Estimated Water Depth: 0 ft  
Rig/Operator: M.A.D.

Station: 69+12  
Offset: 41.6'-LT  
Elevation: 2.0

Total Depth: 82.0 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size:



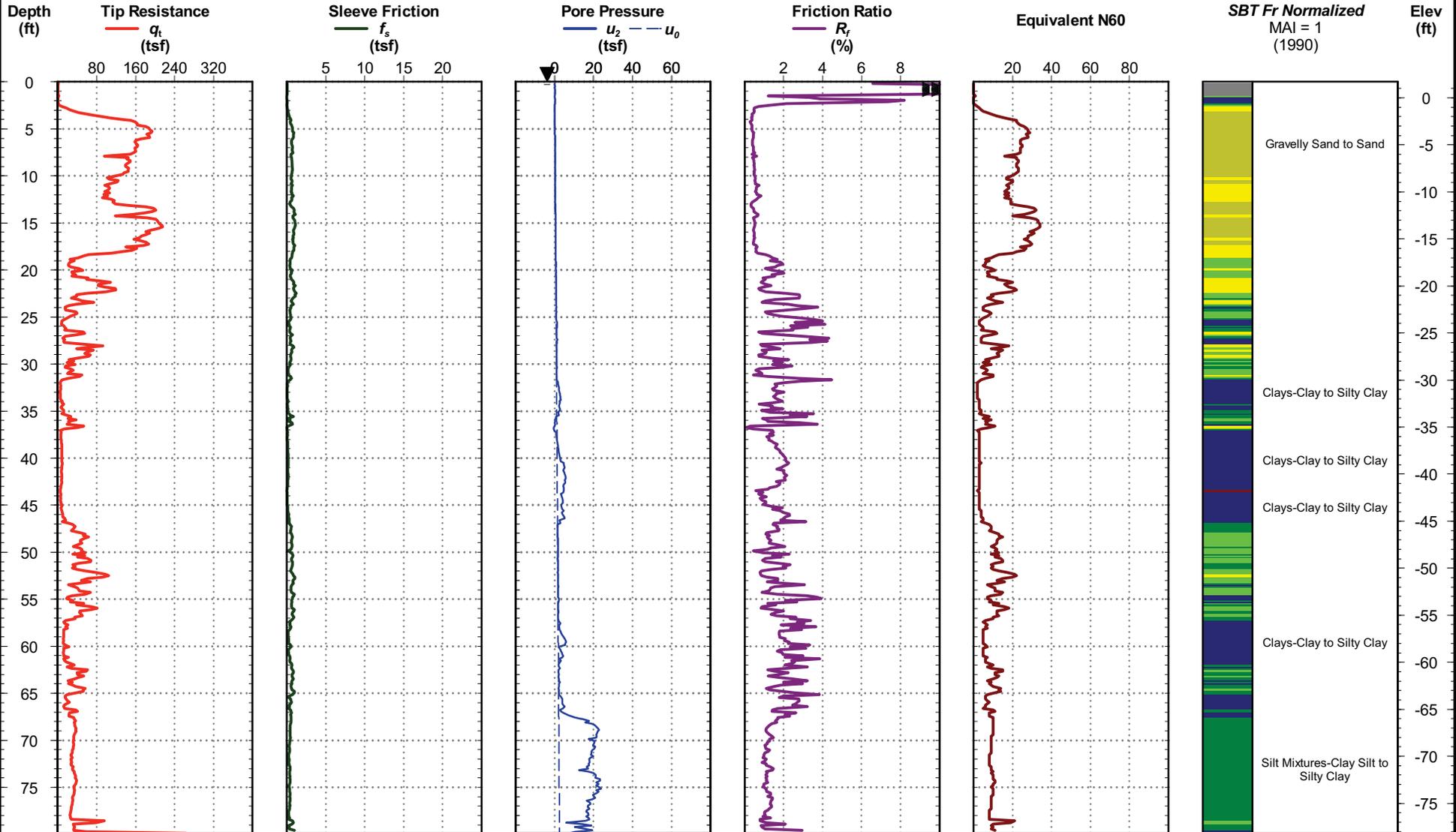
CPT REPORT - STANDARD G5396 - HARBOR RIVER SPT AND CPT GPJ 10/6/16



Date: Sep. 22, 2015  
Estimated Water Depth: 0 ft  
Rig/Operator: M.A.D.

Station: 100+84  
Offset: 1.9'-LT  
Elevation: 1.7

Total Depth: 79.9 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size:

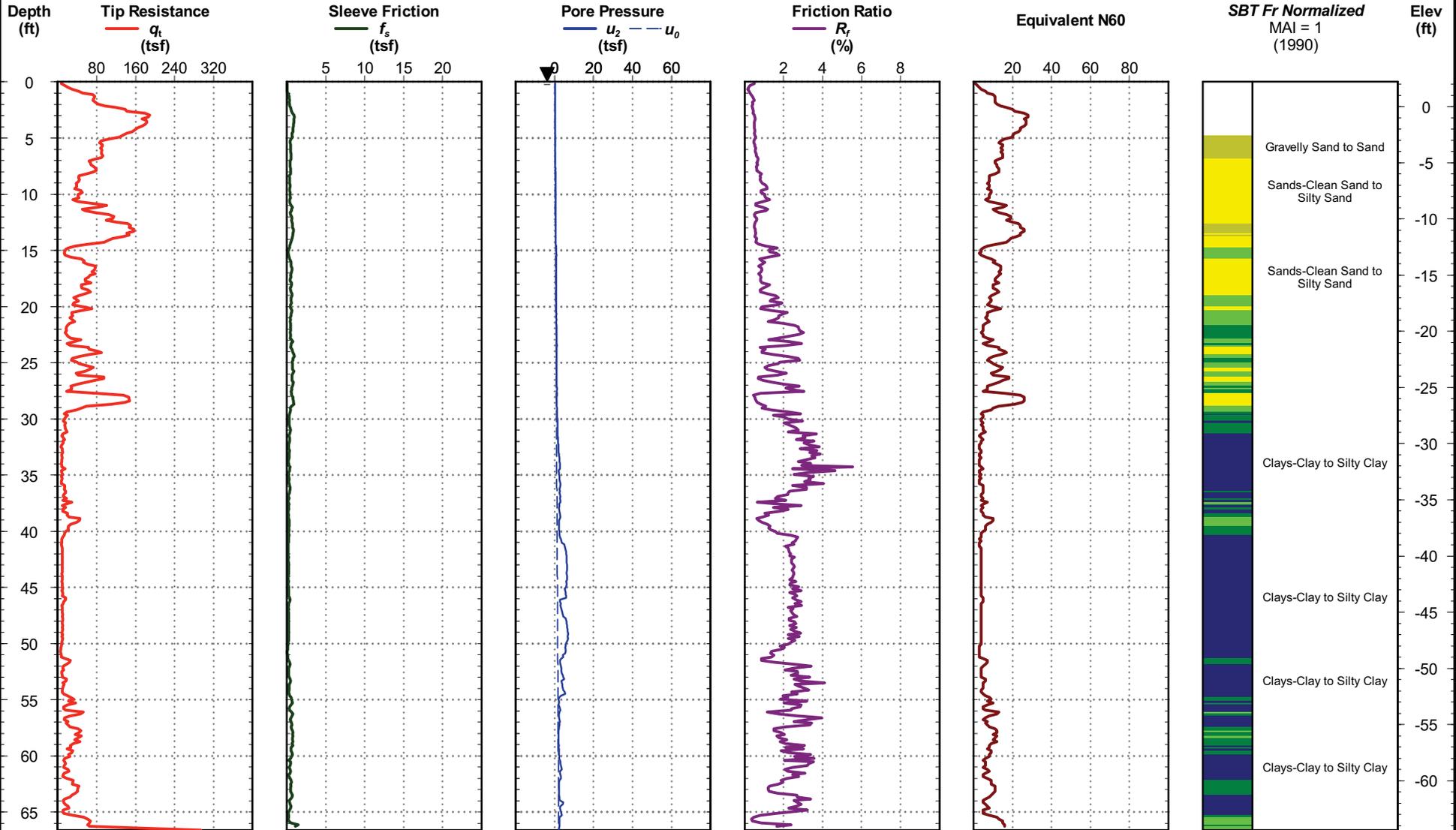


CPT REPORT - STANDARD G5396 - HARBOR RIVER SPT AND CPT GPJ 10/6/16

Date: Sep. 22, 2015  
Estimated Water Depth: 0 ft  
Rig/Operator: M.A.D.

Station: 103+87  
Offset: 15.3'-RT  
Elevation: 2.2

Total Depth: 66.6 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size:

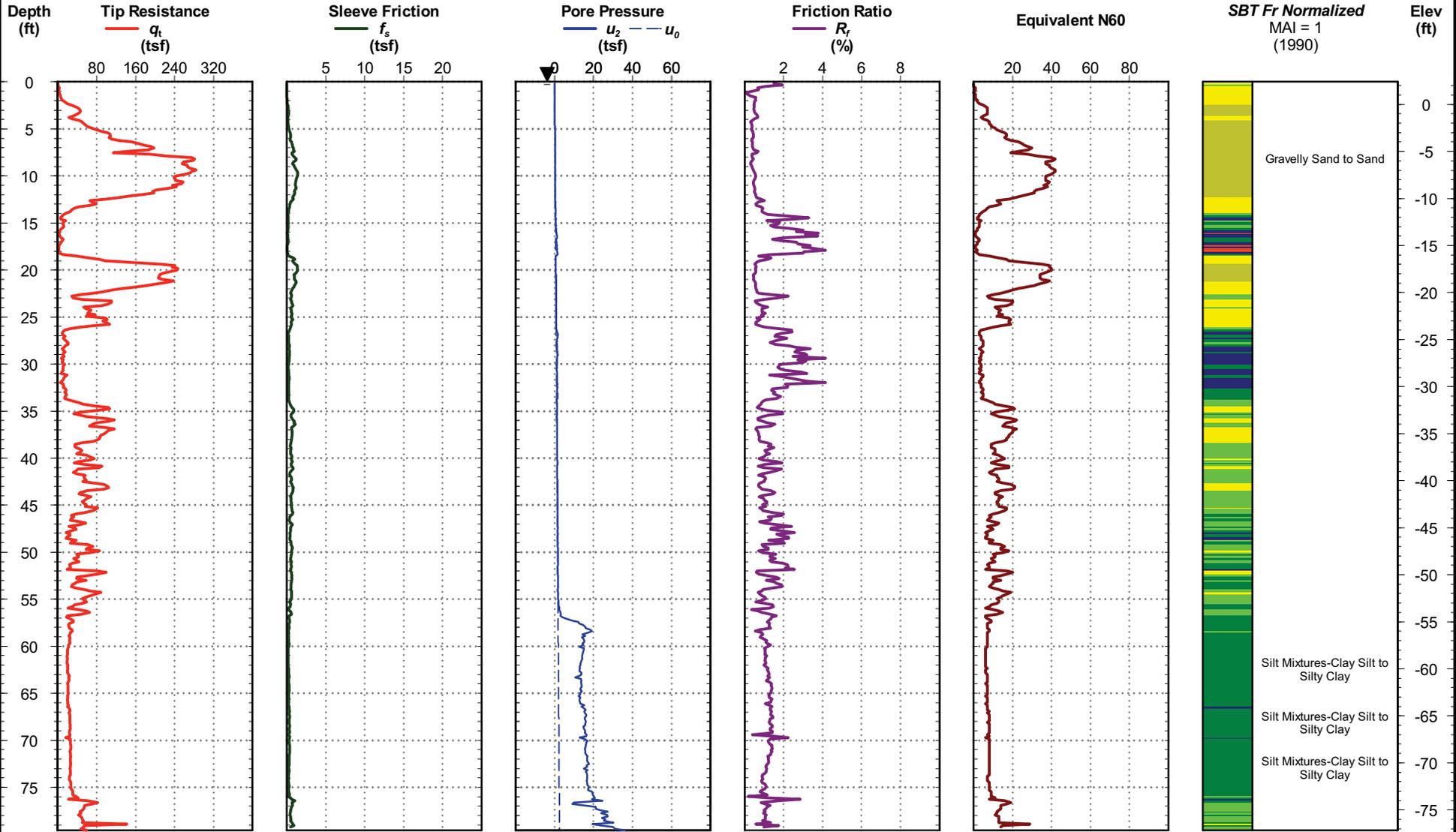


CPT REPORT - STANDARD G5396 - HARBOR RIVER SPT AND CPT TEST.GPJ 10/6/16

Date: Sep. 22, 2015  
Estimated Water Depth: 0 ft  
Rig/Operator: M.A.D.

Station: 116+53  
Offset: 42.4'-LT  
Elevation: 2.4

Total Depth: 79.6 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size:

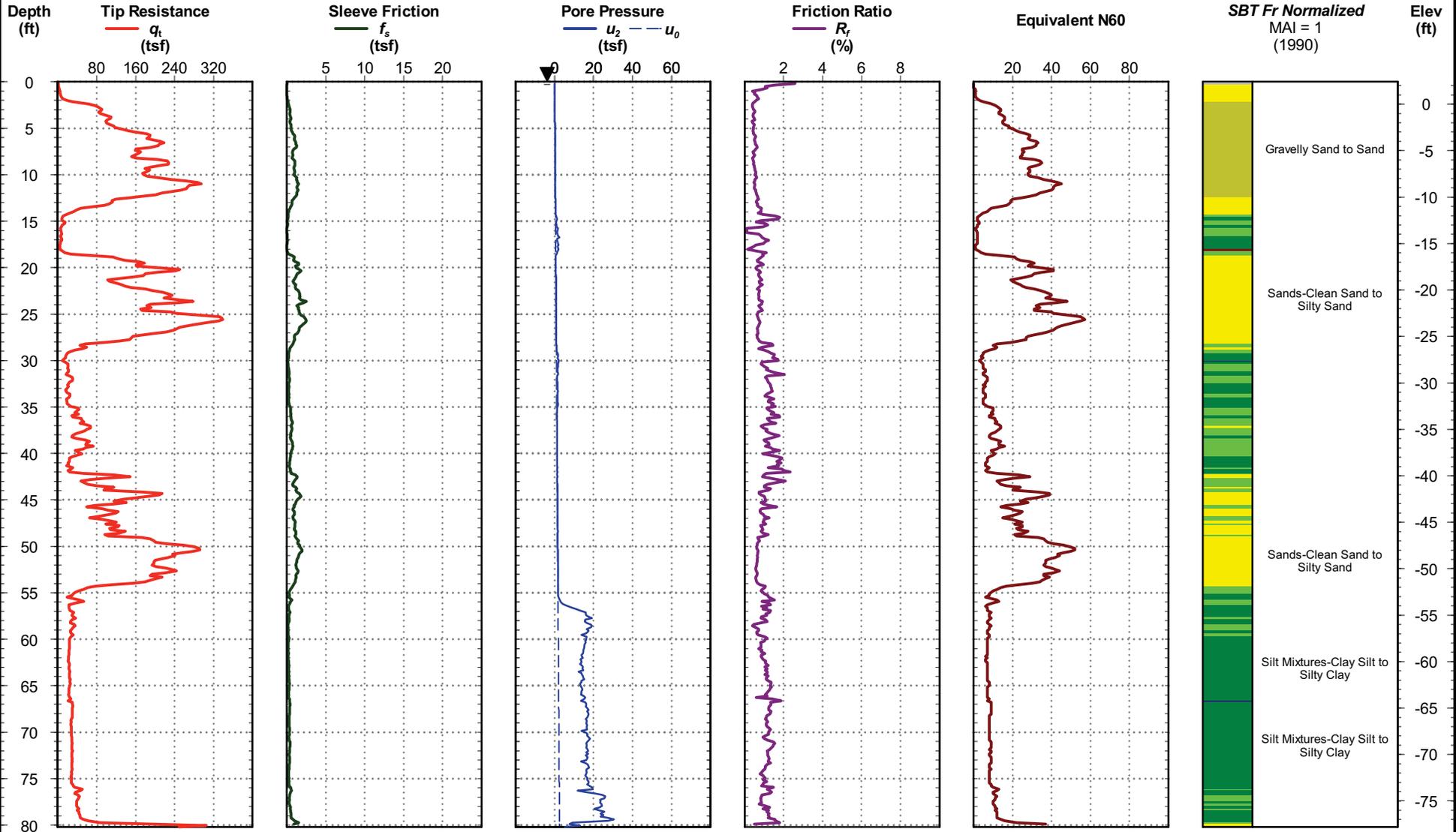


CPT REPORT - STANDARD G5396 - HARBOR RIVER SPT AND CPT.GPJ 10/6/16

Date: Sep. 23, 2015  
Estimated Water Depth: 0 ft  
Rig/Operator: M.A.D.

Station: 120+07  
Offset: 49.3'-LT  
Elevation: 2.4

Total Depth: 80.2 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size:

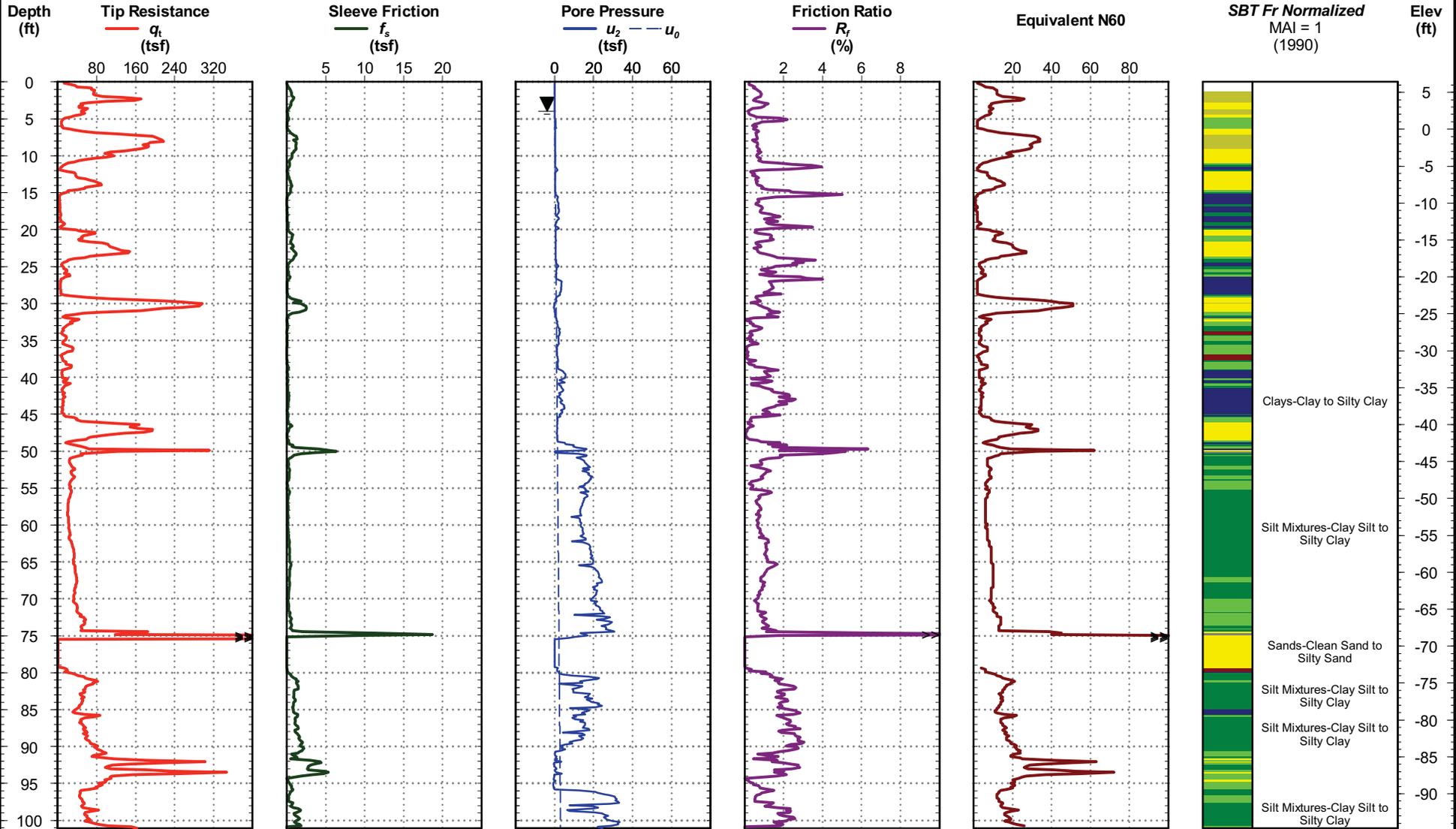


CPT REPORT - STANDARD G5396 - HARBOR RIVER SPT AND CPT.GPJ 10/6/16

Date: Nov. 18, 2015  
Estimated Water Depth: 4 ft  
Rig/Operator: Conetec

Station: 40+89  
Offset: 292.5'-RT  
Elevation: 6.4

Total Depth: 101.1 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size:



CPT REPORT - STANDARD G5396 - HARBOR RIVER SPT AND CPT.GPJ 11/3/16

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US 21 (SEA ISLAND PKWY.) BRIDGE REPLACEMENT OVER  
HARBOR RIVER  
GEOTECHNICAL BASE LINE REPORT

**APPENDIX**

SECTION 5

GEOPHYSICAL TEST RESULTS



**HARBOR RIVER**

**BOREHOLE GEOPHYSICS**

**BEAUFORT, SOUTH CAROLINA**

**BOREHOLE SB-1**

**August 24, 2016**  
**Report 16248-01 rev 0**

**HARBOR RIVER**  
**BOREHOLE GEOPHYSICS**  
**BEAUFORT, SOUTH CAROLINA**  
**BOREHOLE SB-1**

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Project 16248

**August 24, 2016**  
**Report 16248-01 rev 0**



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## **APPENDICES**

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**APPENDIX B      ELOG, MECHANICAL CALIPER, AND NATURAL GAMMA LOGS**

**APPENDIX C      GEOPHYSICAL LOGGING SYSTEMS - NIST TRACEABLE  
CALIBRATION RECORDS**

## **INTRODUCTION**

Borehole geophysical measurements were collected in one (1) boring at Harbor River in Beaufort, South Carolina. Data acquisition was performed on July 18<sup>th</sup>, 2016 by Jonathan Jordan of **GEOVision**. Data analysis and report preparation were performed by Emily Feldman and Victor Gonzalez and reviewed by John Diehl of **GEOVision**. The work was performed for F&ME Consultants, Inc. with Mike Miller serving as the point of contact.

This report describes the field measurements, data analysis, and results of this work.

## **SCOPE OF WORK**

This report presents the results of borehole geophysical measurements collected on July 18<sup>th</sup>, 2016 as detailed in Table 1.

Robertson Geologging (RG) ELOG and 3-Arm Mechanical Caliper (CAL) probes were used to collect long and short normal resistivity, single point resistance, self-potential, and borehole diameter, respectively. Both probes also acquired natural gamma (NG). The probes acquire data at up to 0.05 foot sample rate.

Measurement procedures followed these ASTM standards:

- ASTM D5753-05 (Re-approved 2010), “Planning and Conducting Boring Geophysical Logging”
- ASTM D6274-98 (Re-approved 2004), “Conducting Boring Geophysical Logging – Gamma”

Data were combined and plotted as profiles of the preceding parameters versus depth.

# INSTRUMENTATION

## Suspension Velocity Instrumentation

Suspension velocity measurements were performed using the suspension PS logging system, manufactured by OYO Corporation, and their subsidiary, Robertson Geologging. This system directly determines the average velocity of a 3.3-foot high segment of the soil column surrounding the boring of interest by measuring the elapsed time between arrivals of a wave propagating upward through the soil column. The receivers that detect the wave, and the source that generates the wave, are moved as a unit in the boring producing relatively constant amplitude signals at all depths.

The suspension system probe consists of a combined reversible polarity solenoid horizontal shear-wave source ( $S_H$ ) and compressional-wave source (P), joined to two biaxial receivers by a flexible isolation cylinder, as shown in Figure 1. The separation of the two receivers is 3.3 feet, allowing average wave velocity in the region between the receivers to be determined by inversion of the wave travel time between the two receivers. The total length of the probe as used in these surveys is approximately 22 feet, with the center point of the receiver pair 12.5 feet above the bottom end of the probe.

The probe receives control signals from, and sends the digitized receiver signals to, instrumentation on the surface via an armored conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data using a sheave of known circumference fitted with a digital rotary encoder.

The entire probe is suspended in the boring by the cable, therefore, source motion is not coupled directly to the boring walls; rather, the source motion creates a horizontally propagating impulsive pressure wave in the fluid filling the boring and surrounding the source. This pressure wave is converted to P and  $S_H$ -waves in the surrounding soil and rock as it passes through the casing and grout annulus and impinges upon the wall of the boring. These waves propagate through the soil and rock surrounding the boring, in turn causing a pressure wave to be generated in the fluid

surrounding the receivers as the soil waves pass their location. Separation of the P and  $S_H$ -waves at the receivers is performed using the following steps:

1. Orientation of the horizontal receivers is maintained parallel to the axis of the source, maximizing the amplitude of the recorded  $S_H$  -wave signals.
2. At each depth,  $S_H$ -wave signals are recorded with the source actuated in opposite directions, producing  $S_H$ -wave signals of opposite polarity, providing a characteristic  $S_H$ -wave signature distinct from the P-wave signal.
3. The 6.3 foot separation of source and receiver 1 permits the P-wave signal to pass and damp significantly before the slower  $S_H$ -wave signal arrives at the receiver.
4. In saturated soils, the received P-wave signal is typically of much higher frequency than the received  $S_H$ -wave signal, permitting additional separation of the two signals by low pass filtering.
5. Direct arrival of the original pressure pulse in the fluid is not detected at the receivers because the wavelength of the pressure pulse in fluid is significantly greater than the dimension of the fluid annulus surrounding the probe (feet versus inches scale), preventing significant energy transmission through the fluid medium.

In operation, a distinct, repeatable pattern of impulses is generated at each depth as follows:

1. The source is fired in one direction producing dominantly horizontal shear with some vertical compression, and the signals from the horizontal receivers situated parallel to the axis of motion of the source are recorded.
2. The source is fired again in the opposite direction and the horizontal receiver signals are recorded.
3. The source is fired again and the vertical receiver signals are recorded. The repeated source pattern facilitates the picking of the P and  $S_H$ -wave arrivals; reversal of the source changes the polarity of the  $S_H$ -wave pattern but not the P-wave pattern.

The data from each receiver during each source activation is recorded as a different channel on the recording system. The Suspension PS system has six channels (two simultaneous recording channels), each with a 1024 sample record. The recorded data are displayed as six channels with a common time scale. Data are stored on disk for further processing.

Review of the displayed data on the recorder or computer screen allows the operator to set the gains, filters, delay time, pulse length (energy), and sample rate to optimize the quality of the data before recording. Verification of the calibration of the Suspension PS digital recorder is performed every twelve months using a NIST traceable frequency source and counter, as presented in Appendix C.

## Caliper / Natural Gamma Instrumentation

Caliper and natural gamma data were collected using a mechanical 3-arm caliper probe (CAL) manufactured by Robertson Geologging, Ltd. The probe is 6.82 feet long, and 1.5 inches in diameter. As configured, the probe can measure boring diameters between 1.6 and 12 inches.

This probe is useful in the following studies:

- Measurement of boring diameter and volume
- Location of hard and soft formations
- Location of fissures, caving, pinching and casing damage
- Bed boundary identification
- Strata correlation between borings

The probe receives control signals from, and sends the digitized measurement values to, a Robertson Micrologger II (MLII) on the surface via an armored cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth using a sheave of known circumference fitted with a digital rotary encoder. Probe and depth data are transmitted by USB link from the MLII unit to a laptop computer where it is displayed and stored.

The caliper consists of three arms, each with a toothed quadrant at their base, pivoted in the lower probe body. A toothed rack engages with each quadrant, constraining the arms to move together. Linear movement of the rack is coupled to opening and closing of the arms. Springs hold the arms open in the operating position. A motor drive retracts the arms, allowing the probe to be lowered into the boring. The rack is coupled to a potentiometer which converts movement into a voltage sensed by the probe's microprocessor.

Natural gamma measurements rely on small quantities of radioactive material contained in soil and rocks to emit gamma radiation as they decay. Trace amounts of uranium and thorium are present



in a few minerals. Feldspar, mica and clays will include traces of a radioactive isotope of potassium. The radiation is detected by scintillation - the production of a tiny flash of light when gamma rays strike a crystal of sodium iodide. The light is converted into an electrical pulse by a photomultiplier tube. Pulses above a threshold value of 60 KeV are counted by the probe's microprocessor. The measurement is useful because the radioactive elements are concentrated in certain soil and rock types, e.g., clay or shale, and depleted in others, e.g., sandstone or coal.

## **Elog / Natural Gamma Instrumentation**

Elog and natural gamma data were collected using an electric log probe (ELOG), manufactured by Robertson Geologging, Ltd. This probe measures Single Point Resistance (SPR), short normal (16 inch) resistivity, long normal (64 inch) resistivity, Spontaneous Potential (SP) and natural gamma. The ELGX probe is 8.20 feet long, and 1.73 inches in diameter. The addition of an insulated bridle cable makes the functional length of the tool 41 feet.

This probe is useful in the following studies:

- Bed boundary identification
- Strata correlation between borings
- Strata geometry and type (shale indication)

The probe receives control signals from, and sends the digitized measurement values to, a Robertson Micrologger II (MLII) on the surface via an armored cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth using a sheave of known circumference fitted with a digital rotary encoder. The probe and depth data are transmitted by USB link from the MLII unit to a laptop computer where it is displayed and stored.

The resistivity section of the probe operates by driving an alternating current into the formation from the central SPR/DRIVE electrode. The current returns via the logging cable armor. However, to ensure adequate penetration of the formation, a 10 meter (32.8 feet) insulated bridle cable is

attached between the probe and cablehead, making the functional length of the probe 41 feet. The bridle is comprised of 10 meters of insulated cable with a remote, or reference, electrode located at the top. Voltages are measured between the 16 inch and 64 inch electrodes and the remote earth connection at surface, as noted below:

- Single Point Resistance (SPR): The current flowing to the cable armor is measured along with the voltage at the SPR electrode. The voltage divided by current gives resistance.
- Spontaneous Potential (SP): This is the DC bias of the 16 inch electrode with respect to the voltage return at the surface (ground stake).

Data quality depends on good grounding at the surface. This is achieved with a metal stake driven into the ground near the borehole.

Natural gamma measurements rely on small quantities of radioactive material contained in soil and rocks to emit gamma radiation as they decay. Trace amounts of uranium and thorium are present in a few minerals. Feldspar, mica and clays will include traces of a radioactive isotope of potassium. The radiation is detected by scintillation - the production of a tiny flash of light when gamma rays strike a crystal of sodium iodide. The light is converted into an electrical pulse by a photomultiplier tube. Pulses above a threshold value of 60 KeV are counted by the probe's microprocessor. The measurement is useful because the radioactive elements are concentrated in certain soil and rock types, e.g., clay or shale, and depleted in others, e.g., sandstone or coal.

## **MEASUREMENT PROCEDURES**

### **Suspension Velocity Measurement Procedures**

Boring SB-1 was logged uncased from 80 feet below ground surface, and filled with water. Measurements followed the **GEOVision** Procedure for P-S Suspension Seismic Velocity Logging, revision 1.5. Prior to each logging run, the probe was positioned with the top of the probe even with a stationary reference point. The electronic depth counter was set to the distance between the mid-point of the receiver and the top of the probe, minus the height of the stationary reference point, if any, verified with a tape measure, and recorded on the field logs. The probe was lowered to the bottom of the boring, stopping at 1.6 foot intervals to collect data, as summarized in Table 2.

At each measurement depth the measurement sequence of two opposite horizontal records and one vertical record was performed, and the gains were adjusted as required. The data from each depth were viewed on the computer display, checked, and recorded on disk before moving to the next depth.

Upon completion of the measurements, the probe zero depth indication at the depth reference point was verified prior to removal from the boring.

### **Caliper / Natural Gamma Measurement Procedures**

Measurement procedures followed these ASTM standards:

- ASTM D5753-05 (Reapproved 2010), “Planning and Conducting Borehole Geophysical Logging”
- ASTM D6167-11, “Conducting Borehole Geophysical Logging – Mechanical - Caliper”
- ASTM D6274-10, “Conducting Borehole Geophysical Logging – Gamma”

The CAL probe does not require a fluid filled boring for proper operation. Prior to logging, measurement depths were referenced to ground level. This was done by placing the top of the probe even with a fixed reference point, such as top of casing or drill mud bucket. Then the electronic depth counter was set to the probe length minus the height of the reference point. Once verified with a tape measure, these calculations were recorded on a field log. Offset distances between probe tip and measurement points are corrected by the acquisition software. The probe was then lowered to the bottom of the boring, the caliper arms opened via software control, the software recorder turned on and data were acquired on ascent. The probe was returned to the surface at approximately 10-15 feet/minute, collecting data continuously at 0.05-foot spacing, as summarized in Table 2.

Prior to use, caliper tool operation was verified using **GEOVision** verification plate S/N 203. Plate S/N 203 is a circular aluminum plate with a series of four machined annular slots in the top surface for fitting the tips of the caliper arms. The slots have outside diameters from 2.1 to 8.0 inches. Methodically, the nose of the probe is centered through the central hole of the verification plate. The caliper probe arms are opened under program control, and a log recorded as the tips of the arms are sequentially placed in the four slots on the plate. The measured dimensions, as displayed on the computer screen, are recorded and compared to the verification plate known diameters.

If the verification records do not fall within  $\pm 0.05$  inches of the verification plate values, the caliper tool is re-adjusted using the four point verification plate and the verification log repeated. As with the verification, the tips of the caliper arms are placed in the holes marked with the known diameter. During re-adjustment, the value of the current point, as stamped on the jig, is entered via the control computer. The system counts for 15 seconds to make an average of the response. The procedure is repeated for the remaining openings. The computation and generation of the adjustment file is entirely automatic. The adjustment file is simply the set of coefficients of a quadratic curve which fits the four data points.

Natural gamma was not calibrated in the field, as it is a qualitative measurement, not a quantitative value, and is used only to assist in picking transitions between stratigraphic units, as described in ASTM D6274-10, “Conducting Borehole Geophysical Logging – Gamma”.

Upon completion of the measurements, the probe zero depth indication at the depth reference point was verified prior to removal from the boring.

Natural gamma was not calibrated in the field, as it is a qualitative measurement, not a quantitative value, and is used only to assist in picking transitions between stratigraphic units, as described in ASTM D6274-10, “Conducting Borehole Geophysical Logging – Gamma”.

Upon completion of the measurements, the probe zero depth indication at the depth reference point was verified prior to removal from the boring.

## **Elog / Natural Gamma Measurement Procedures**

Measurement procedures followed these ASTM standards:

- ASTM D5753-05 (Re-approved 2010), “Planning and Conducting Boring Geophysical Logging”
- ASTM D6274-10, “Conducting Boring Geophysical Logging – Gamma”

The ELOG probe requires a fluid filled boring for proper operation. Prior to logging, measurement depths were referenced to ground level. This was done by placing the top of the probe even with a fixed reference point, such as top of casing or drill mud bucket. Then the electronic depth counter was set to the probe length minus the height of the reference point. Once verified with a tape measure, these calculations were recorded on a field log. Offset distances between probe tip and measurement points are corrected by the acquisition software.

The probe is connected to the logging cable using a 32.8 foot long insulating cable section or “bridle”. The probe head was insulated by wrapping all exposed metal of the cable head and probe

with self-amalgamating insulation tape. The 32.8 foot insulating yoke was checked for any damage, and repaired with self-amalgamating insulation tape as needed. The functional length of the probe with the bridle cable is 41 feet.

Prior to logging, measurement depths were referenced to ground level. This was done by positioning the probe with the top of the yoke even with a fixed reference point, such as top of casing or drill mud bucket. Then the electronic depth counter was set to the probe and bridle length (41 feet) minus the height of the reference point. Once verified with a tape measure, these calculations were recorded on a field log. Offset distances between probe tip and measurement points are corrected by the acquisition software. The probe was then lowered to the bottom of the boring, the software recorder turned on and data were acquired on ascent.. The probe was then returned to the surface at approximately 10 feet/minute, collecting data continuously at 0.05 foot spacing, until the yoke electrode cleared the surface of the borehole fluid or the probe entered the surface casing, as summarized in Table 2.

The reference ground stake was driven firmly into the ground near the borehole and connected to the ground socket on the winch junction box.

This probe was not calibrated in the field, as it is used to provide qualitative measurements, not quantitative values, and is used only to assist in picking transitions between stratigraphic units, as described in ASTM D5753-05 (Reapproved 2010), Planning and Conducting Boring Geophysical Surveys. A functional test was performed prior to use by applying fixed resistance values across the probe electrodes, as well as a 100 millivolt signal across the SP electrodes, and recording the resultant output of the system.

Natural gamma was not calibrated in the field, as it is a qualitative measurement, not a quantitative value, and is used only to assist in picking transitions between stratigraphic units, as described in ASTM D6274-10, Conducting Boring Geophysical Logging - Gamma.

Upon completion of the measurements, the probe zero depth indication at the depth reference point was verified prior to removal from the boring.

## DATA ANALYSIS

### Suspension Velocity Analysis

Using the proprietary OYO program PSLOG.EXE version 1.0, the recorded digital waveforms were analyzed to locate the most prominent first minima, first maxima, or first break on the vertical axis records, indicating the arrival of P-wave energy. The difference in travel time between receiver 1 and receiver 2 (R1-R2) arrivals was used to calculate the P-wave velocity for that 1.0 meter segment of the soil column. When observable, P-wave arrivals on the horizontal axis records were used to verify the velocities determined from the vertical axis data. The time picks were then transferred into a Microsoft Excel® template (version 2003 SP2) to complete the velocity calculations based upon the arrival time picks made in PSLOG. The Microsoft Excel® analysis files are included on the data disk that accompanies this report.

The P-wave velocity over the 6.3-foot interval from source to receiver 1 (S-R1) was also picked using PSLOG, and calculated and plotted in Microsoft Excel®, for quality assurance of the velocity derived from the travel time between receivers. In this analysis, the depth values as recorded were increased by 4.8 feet to correspond to the mid-point of the 6.3-foot S-R1 interval. Travel times were obtained by picking the first break of the P-wave signal at receiver 1 and subtracting 4 milliseconds, the calculated and experimentally verified delay from source trigger pulse (beginning of record) to source impact. This delay corresponds to the duration of acceleration of the solenoid before impact.

As with the P-wave records, the recorded digital waveforms were analyzed to locate clear S<sub>H</sub>-wave pulses, as indicated by the presence of opposite polarity pulses on each pair of horizontal records. Ideally, the S<sub>H</sub>-wave signals from the 'normal' and 'reverse' source pulses are very nearly inverted images of each other. Digital Fast Fourier Transform – Inverse Fast Fourier Transform (FFT – IFFT) lowpass filtering was used to remove the higher frequency P-wave signal from the S<sub>H</sub>-wave signal. Different filter cutoffs were used to separate P- and S<sub>H</sub>-waves at different depths, ranging from 600 Hz in the slowest zones to 4000 Hz in the regions of highest velocity. At each depth, the



filter frequency was selected to be at least twice the fundamental frequency of the  $S_H$ -wave signal being filtered.

Generally, the first maxima were picked for the 'normal' signals and the first minima for the 'reverse' signals, although other points on the waveform were used if the first pulse was distorted. The absolute arrival time of the 'normal' and 'reverse' signals may vary by +/- 0.2 milliseconds, due to differences in the actuation time of the solenoid source caused by constant mechanical bias in the source or by boring inclination. This variation does not affect the R1-R2 velocity determinations, as the differential time is measured between arrivals of waves created by the same source actuation. The final velocity value is the average of the values obtained from the 'normal' and 'reverse' source actuations.

As with the P-wave data,  $S_H$ -wave velocity calculated from the travel time over the 6.3-foot interval from source to receiver 1 was calculated and plotted for verification of the velocity derived from the travel time between receivers. In this analysis, the depth values were increased by 4.8 feet to correspond to the mid-point of the 6.3-foot S-R1 interval. Travel times were obtained by picking the first break of the  $S_H$ -wave signal at the near receiver and subtracting 4 milliseconds, the calculated and experimentally verified delay from the beginning of the record at the source trigger pulse to source impact.

These data and analysis were reviewed by John Diehl as a component of **GEOVision's** in-house data validation program.

Figure 2 shows an example of R1 - R2 measurements on a sample filtered suspension record. In Figure 2, the time difference over the 3.3 foot interval of 1.88 milliseconds for the horizontal signals is equivalent to an  $S_H$ -wave velocity of 1745 feet/second. Whenever possible, time differences were determined from several phase points on the  $S_H$ -waveform records to verify the data obtained from the first arrival of the  $S_H$ -wave pulse. Figure 3 displays the same record before filtering of the  $S_H$ -waveform record with a 1400 Hz FFT - IFFT digital lowpass filter, illustrating

the presence of higher frequency P-wave energy at the beginning of the record, and distortion of the lower frequency  $S_H$ -wave by residual P-wave signal.

### **Caliper / Natural Gamma**

CAL and NG data do not require analysis; however depths to identifiable boring log features, such as distinct natural gamma transitions, were compared to verify consistent depth readings on all logs. Using WellCAD software version 5.1, CAL and NG data were combined with other line log data and converted to LAS 2.0 and PDF formats.

### **Elog / Natural Gamma Analysis**

ELOG and NG data do not require analysis; however depths to identifiable boring log features, such as distinct natural gamma transitions, were compared to verify consistent depth readings on all logs. Using WellCAD software version 5.1, ELOG and NG data were combined with other line log data and converted to LAS 2.0 and PDF formats.

## RESULTS

### Suspension Velocity Results

Suspension R1-R2 P- and S<sub>H</sub>-wave velocities for Boring SB-1 are plotted in Figure 5. The suspension velocity data presented in this figure are also presented in Table 3. The Microsoft Excel<sup>®</sup> analysis file is included in the electronic data that accompanies this report.

P- and S<sub>H</sub>-wave velocity data from R1-R2 analysis and quality assurance analysis of S-R1 data are plotted together in Figure A-1 to aid in visual comparison. It should be noted that R1-R2 data are an average velocity over a 3.3-foot segment of the soil column; S-R1 data are an average over 6.3 feet, creating a significant smoothing relative to the R1-R2 plots. The S-R1 velocity data displayed in this figure are also presented in Table A-1 and included in the Microsoft Excel<sup>®</sup> analysis file that accompanies this report. The Microsoft Excel<sup>®</sup> analysis file includes Poisson's Ratio calculations, tabulated data and plots.

### Caliper / Natural Gamma Results

Caliper (CAL) data are presented on combination line log plots with ELOG and NG data (Appendix B). All logs are scaled to the API 5-inch (1 inch = 20 feet) standard. Depths on all figures and tables are referenced to ground surface. LAS 2.0 data and Acrobat files of the plots are included in the boring specific sub-directories in the data directory that accompanies this report.

## **Elog / Natural Gamma Results**

ELOG data are presented on combination line log plots with CAL and NG data (Appendix B). All logs are scaled to the API 5-inch (1 inch = 20 feet) standard. Depths on all figures and tables are referenced to ground surface. LAS 2.0 data and Acrobat files of the plots are included in the boring specific sub-directories in the data directory that accompanies this report.

## SUMMARY

### Discussion of Suspension Velocity Results

Suspension PS velocity data are ideally collected in an uncased fluid filled boring, drilled with rotary mud (rotary wash) methods, as found in the case of this boring.

Suspension PS velocity data quality is judged based upon 5 criteria.

- Consistent data between receiver to receiver (R1 – R2) and source to receiver (S – R1) data.
- Consistency between data from adjacent depth intervals.
- Consistent relationship between P-wave and  $S_H$ -wave (excluding transition to saturated soils)
- Clarity of P-wave and  $S_H$ -wave onset, as well as damping of later oscillations.
- Consistency of profile between adjacent borings, if available.

Good correspondence between the shapes of the P- and  $S_H$ -wave velocity curves are observed for this data set. The raw data was of excellent quality, obviating the need for any filtering or other post processing. The velocities derived from S-R1 and R1-R2 data are in good agreement for this borehole, providing verification of the higher resolution R1-R2 data.

There is an interesting drop in both P- and S-wave velocities at about 294 feet below ground surface (bgs). The P-wave velocity drops below water velocity, indicating possibly a thin unsaturated zone. Low  $V_s$  velocities continue down to about 400 feet bgs.

### Discussion of Caliper / Natural Gamma Results

The caliper log for boring SB-1 shows fairly consistent 6" gauge below the casing to about 248', where the gauge narrows to 5", likely due to a change in bit size. The gauge narrows again to 4" at about 452' bgs. The caliper log terminated at 475' due to collapse of the hole. This was the final log to be run.

There were no significant variations in the Natural Gamma log, but notable correspondence between minor features, particularly the events at about 285' and 400'.

### **Discussion of Elog / Natural Gamma Results**

Elog data were acquired in this borehole to full depth, including long- and short-normal resistance, single-point resistance (SPR), and self-potential (SP). ELog data correlate well with other line logs, further assisting identification of lithologic variability with depth.

Natural Gamma data collected with this probe is not presented, as it is of lower vertical resolution than that collected with the CAL probe. However, the data correlates very well with the Caliper NG, and confirms the accuracy of the results.

## **Suspension Velocity Data Reliability**

P- and S<sub>H</sub>-wave velocity measurement using the Suspension Method gives average velocities over a 3.3-foot interval of depth. This high resolution results in the scatter of values shown in the graphs. Individual measurements are very reliable with estimated precision of +/- 5%. Standardized field procedures and quality assurance checks contribute to the reliability of these data.

## **Quality Assurance**

These borehole geophysical measurements were performed using industry-standard or better methods for measurements and analyses. All work was performed under **GEOVision** quality assurance procedures, which include:

- Use of NIST-traceable calibrations, where applicable, for field and laboratory instrumentation
- Use of standard field data logs
- Independent review of calculations and results by a registered professional engineer, geologist, or geophysicist.

Table 1. Boring locations and logging dates

| BORING DESIGNATION | DATES LOGGED | LOCATION <sup>(1)</sup> |             | ELEVATION (FEET) |
|--------------------|--------------|-------------------------|-------------|------------------|
|                    |              | NORTHING                | EASTING     |                  |
| SB-1               | 7/18/2016    | 209678.36               | 2164427.494 | 6.4              |

<sup>(1)</sup> Coordinates provided by F&ME

Table 2. Logging dates and depth ranges

| BORING NUMBER | TOOL AND RUN NUMBER | DEPTH RANGE (FEET)* | CASED OR UNCASED | SAMPLE INTERVAL (FEET) | DATE LOGGED |
|---------------|---------------------|---------------------|------------------|------------------------|-------------|
| SB-1          | SUSPENSION DOWN01   | 78.85 – 501.75      | UNCASED          | 1.6                    | 7/18/2016   |
| SB-1          | ELOG UP01           | 515.19 – 77.29      | UNCASED          | 0.05                   | 7/18/2016   |
| SB-1          | CALIPER UP01        | 474.69 – 46.69      | UNCASED          | 0.05                   | 7/18/2016   |



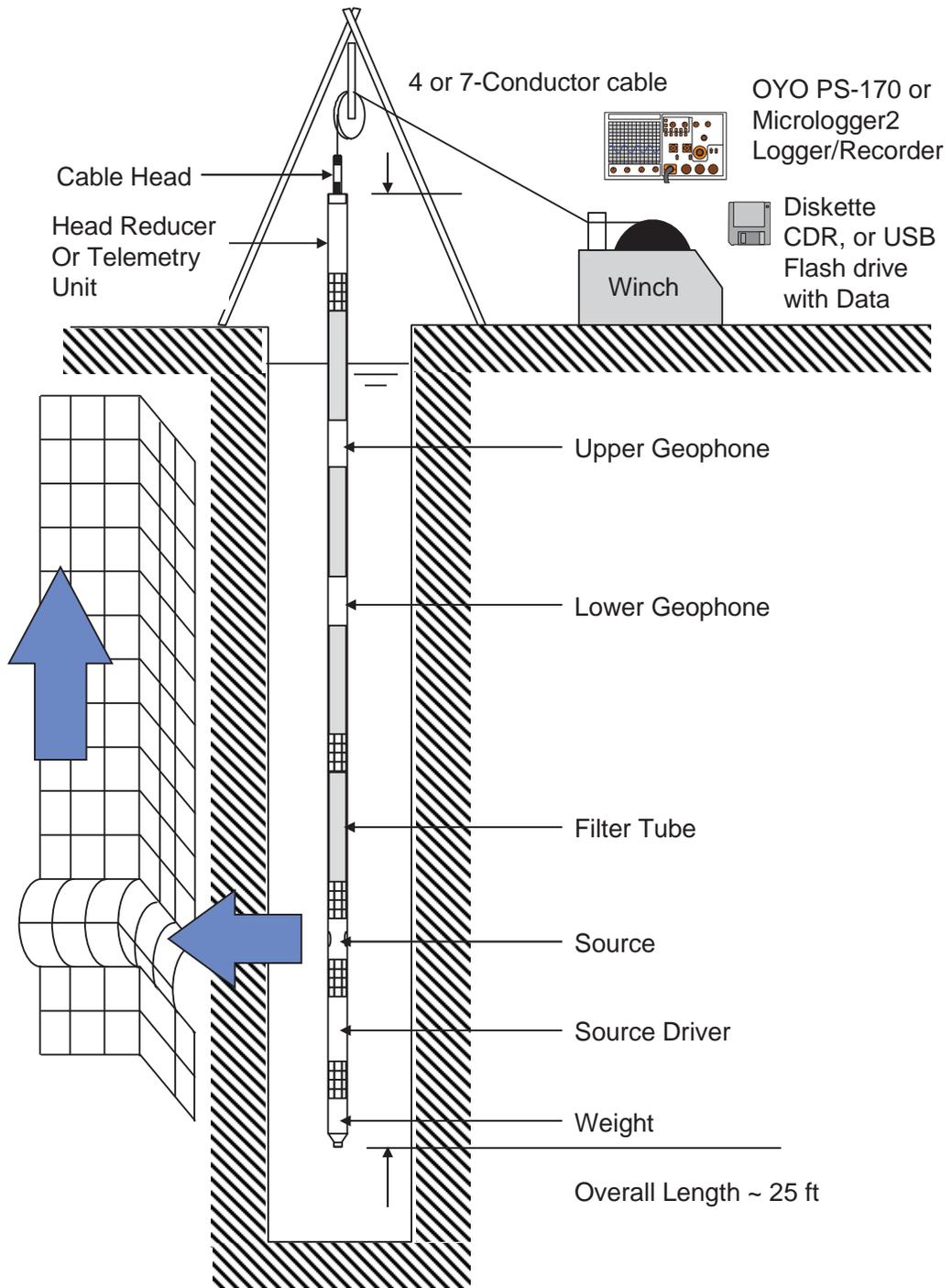


Figure 1: Concept illustration of P-S logging system

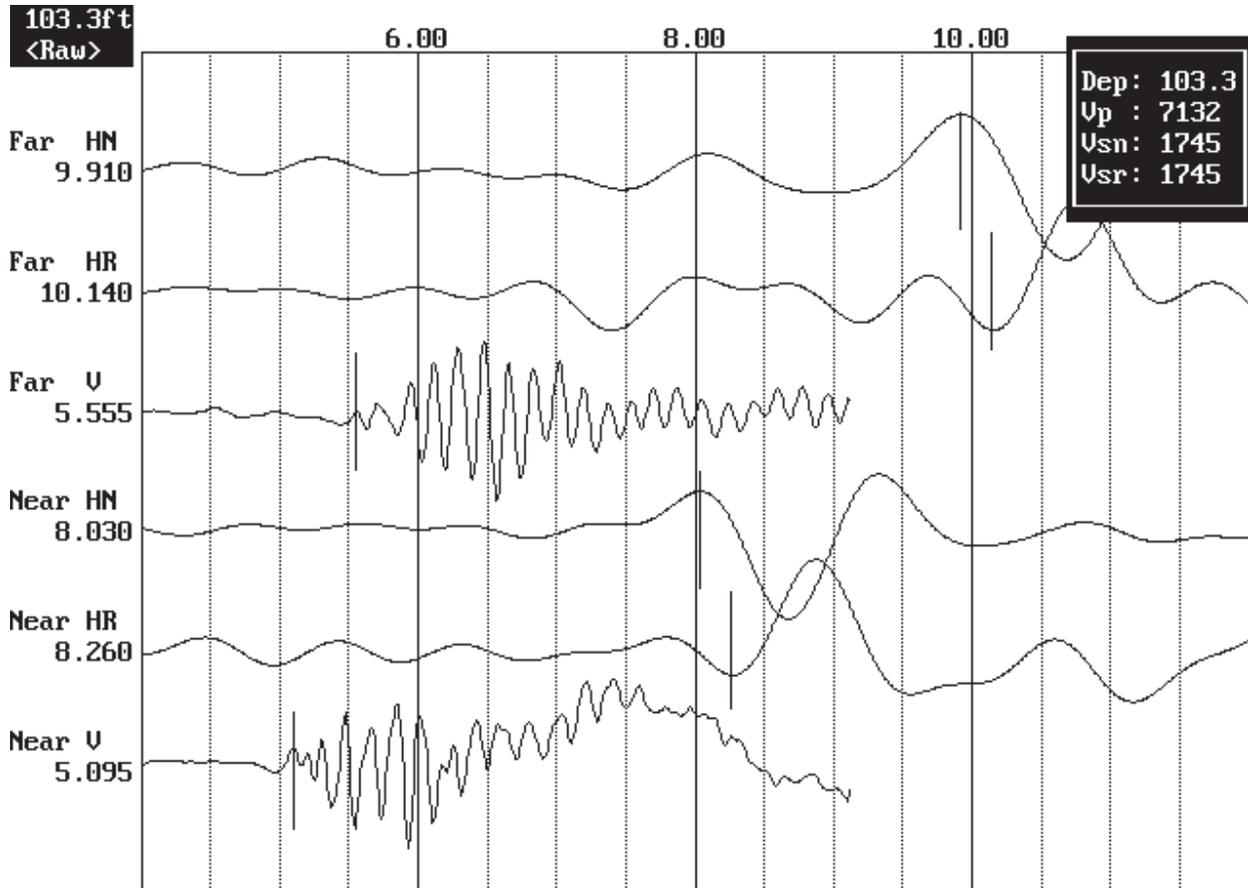


Figure 2: Example of filtered (1400 Hz lowpass) suspension record

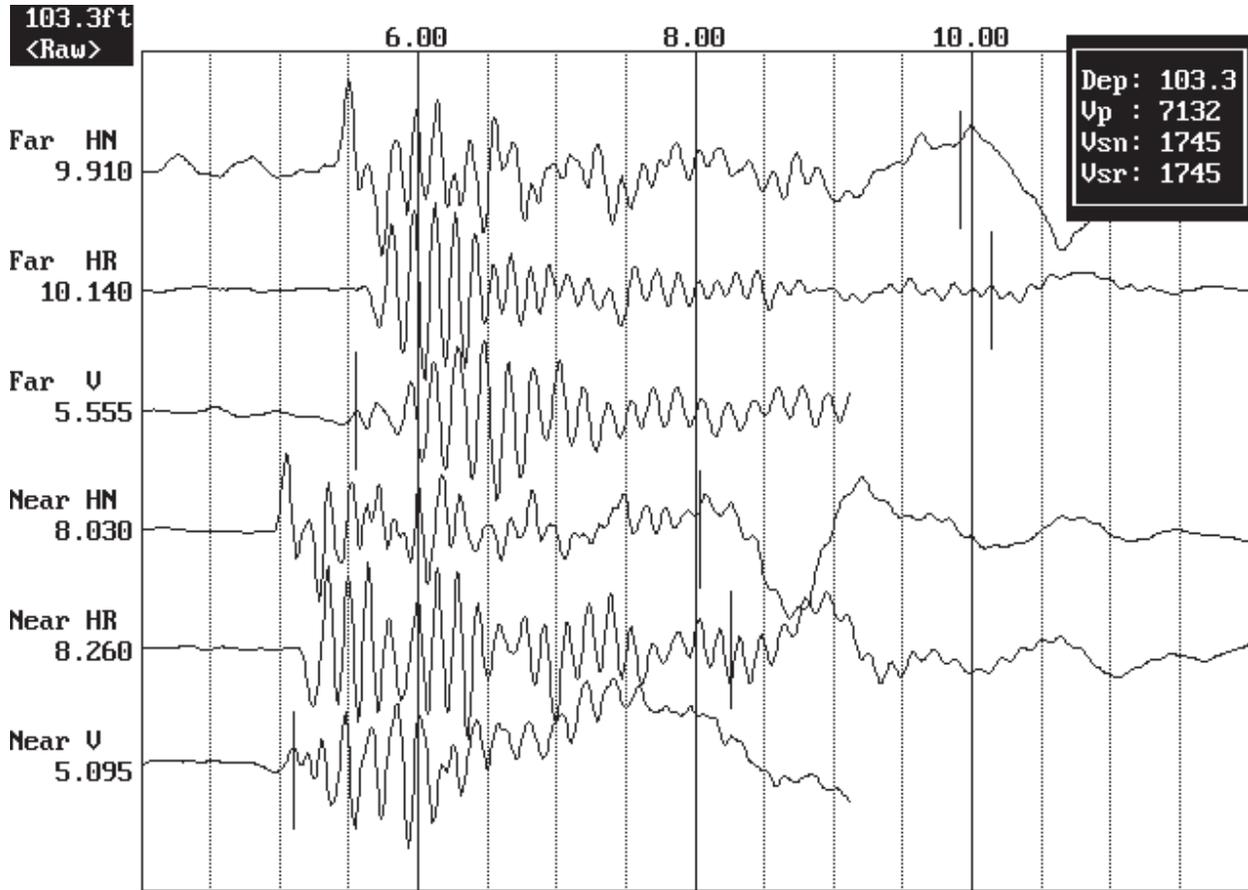


Figure 3. Example of unfiltered suspension record

### HARBOR RIVER BOREHOLE SB-1 Receiver to Receiver $V_s$ and $V_p$ Analysis

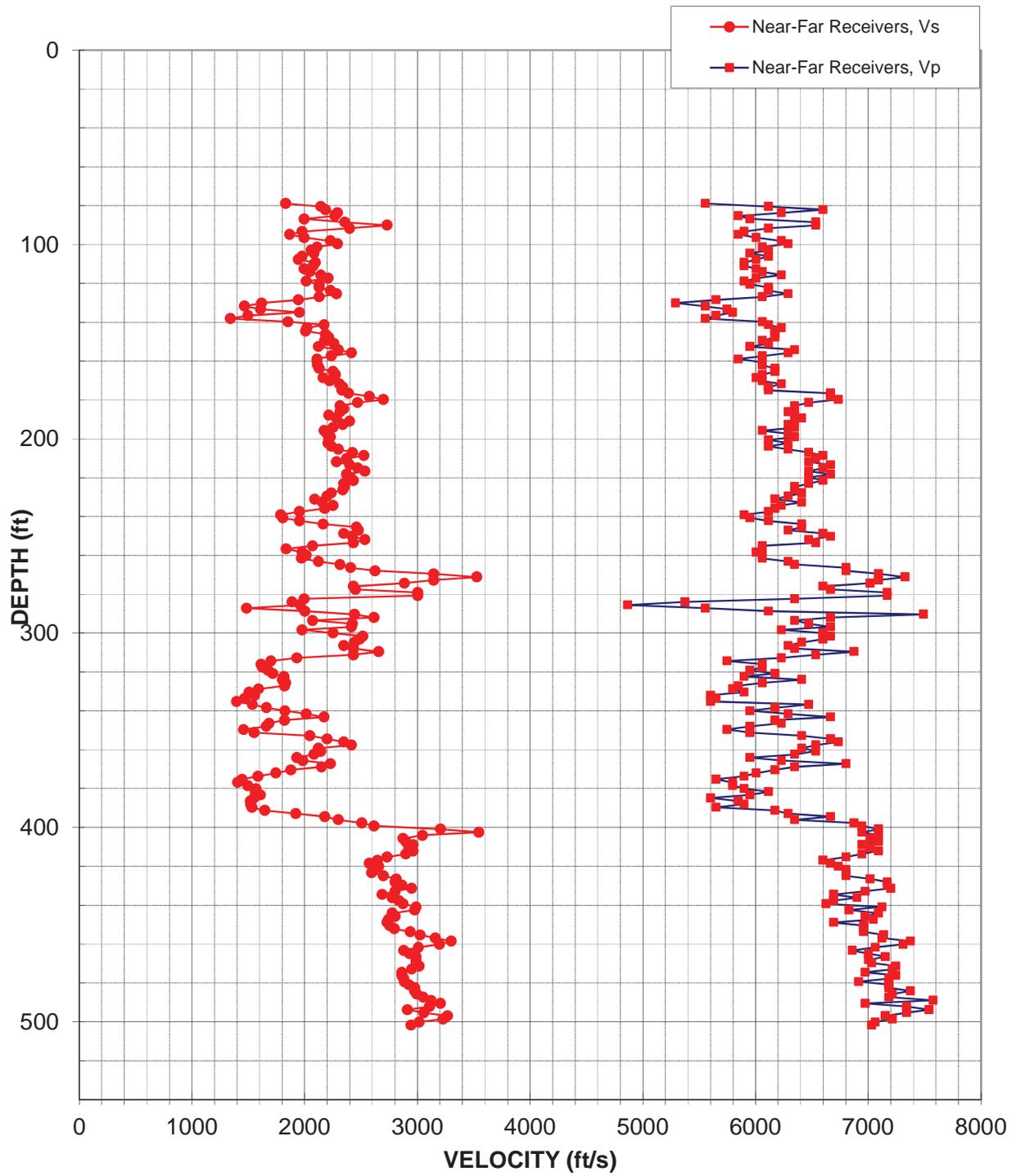


Figure 4: Boring SB-1, Suspension R1-R2 P- and  $S_H$ -wave velocities

Table 3. Boring SB-1, Suspension R1-R2 depths and P- and SH-wave velocities

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Receiver-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                      |                |                |                 | Metric Units                        |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio | Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (ft)                                | (ft/s)         | (ft/s)         |                 | (m)                                 | (m/s)          | (m/s)          |                 |
| 78.9                                | 1830           | 5560           | 0.44            | 24.0                                | 560            | 1690           | 0.44            |
| 80.5                                | 2140           | 6120           | 0.43            | 24.5                                | 650            | 1860           | 0.43            |
| 82.1                                | 2190           | 6600           | 0.44            | 25.0                                | 670            | 2010           | 0.44            |
| 83.7                                | 2290           | 6230           | 0.42            | 25.5                                | 700            | 1900           | 0.42            |
| 85.3                                | 2270           | 5850           | 0.41            | 26.0                                | 690            | 1780           | 0.41            |
| 86.9                                | 2000           | 5950           | 0.44            | 26.5                                | 610            | 1810           | 0.44            |
| 88.5                                | 2360           | 6540           | 0.43            | 27.0                                | 720            | 1990           | 0.43            |
| 90.1                                | 2730           | 6540           | 0.39            | 27.5                                | 830            | 1990           | 0.39            |
| 91.7                                | 2400           | 6120           | 0.41            | 27.9                                | 730            | 1860           | 0.41            |
| 93.3                                | 1980           | 5900           | 0.44            | 28.4                                | 600            | 1800           | 0.44            |
| 94.9                                | 1870           | 5850           | 0.44            | 28.9                                | 570            | 1780           | 0.44            |
| 96.5                                | 2000           | 6010           | 0.44            | 29.4                                | 610            | 1830           | 0.44            |
| 98.1                                | 2230           | 6230           | 0.43            | 29.9                                | 680            | 1900           | 0.43            |
| 99.7                                | 2290           | 6290           | 0.42            | 30.4                                | 700            | 1920           | 0.42            |
| 101.3                               | 2110           | 6060           | 0.43            | 30.9                                | 640            | 1850           | 0.43            |
| 102.9                               | 2060           | 6120           | 0.44            | 31.4                                | 630            | 1860           | 0.44            |
| 104.5                               | 2080           | 5950           | 0.43            | 31.8                                | 640            | 1810           | 0.43            |
| 106.1                               | 1980           | 6120           | 0.44            | 32.3                                | 600            | 1860           | 0.44            |
| 107.7                               | 1940           | 6010           | 0.44            | 32.8                                | 590            | 1830           | 0.44            |
| 109.3                               | 2100           | 5900           | 0.43            | 33.3                                | 640            | 1800           | 0.43            |
| 110.9                               | 2080           | 5900           | 0.43            | 33.8                                | 630            | 1800           | 0.43            |
| 112.5                               | 2000           | 6010           | 0.44            | 34.3                                | 610            | 1830           | 0.44            |
| 114.1                               | 2040           | 6060           | 0.44            | 34.8                                | 620            | 1850           | 0.44            |
| 115.7                               | 2140           | 6230           | 0.43            | 35.3                                | 650            | 1900           | 0.43            |
| 117.3                               | 2210           | 6010           | 0.42            | 35.8                                | 670            | 1830           | 0.42            |
| 118.9                               | 2010           | 5900           | 0.43            | 36.2                                | 610            | 1800           | 0.43            |
| 120.5                               | 2130           | 5950           | 0.43            | 36.7                                | 650            | 1810           | 0.43            |
| 122.1                               | 2130           | 6120           | 0.43            | 37.2                                | 650            | 1860           | 0.43            |
| 123.7                               | 2230           | 6120           | 0.42            | 37.7                                | 680            | 1860           | 0.42            |
| 125.3                               | 2280           | 6290           | 0.42            | 38.2                                | 700            | 1920           | 0.42            |
| 126.9                               | 2130           | 6060           | 0.43            | 38.7                                | 650            | 1850           | 0.43            |
| 128.5                               | 1940           | 5650           | 0.43            | 39.2                                | 590            | 1720           | 0.43            |
| 130.1                               | 1620           | 5290           | 0.45            | 39.7                                | 490            | 1610           | 0.45            |
| 131.7                               | 1470           | 5560           | 0.46            | 40.1                                | 450            | 1690           | 0.46            |
| 133.3                               | 1610           | 5750           | 0.46            | 40.6                                | 490            | 1750           | 0.46            |
| 134.9                               | 1960           | 5800           | 0.44            | 41.1                                | 600            | 1770           | 0.44            |
| 136.5                               | 1500           | 5650           | 0.46            | 41.6                                | 460            | 1720           | 0.46            |

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Receiver-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                      |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (ft)                                | (ft/s)         | (ft/s)         |                 |
| 138.1                               | 1340           | 5560           | 0.47            |
| 139.7                               | 1850           | 6060           | 0.45            |
| 141.3                               | 2170           | 6120           | 0.43            |
| 142.9                               | 2020           | 6230           | 0.44            |
| 144.5                               | 2010           | 6170           | 0.44            |
| 146.1                               | 2190           | 6170           | 0.43            |
| 147.7                               | 2210           | 6170           | 0.43            |
| 149.3                               | 2180           | 6060           | 0.43            |
| 150.9                               | 2260           | 6120           | 0.42            |
| 152.5                               | 2120           | 5950           | 0.43            |
| 154.1                               | 2300           | 6350           | 0.42            |
| 155.7                               | 2420           | 6290           | 0.41            |
| 157.3                               | 2240           | 6060           | 0.42            |
| 158.9                               | 2110           | 5850           | 0.43            |
| 160.5                               | 2110           | 6060           | 0.43            |
| 162.1                               | 2120           | 6060           | 0.43            |
| 163.8                               | 2130           | 6170           | 0.43            |
| 165.4                               | 2250           | 6170           | 0.42            |
| 167.0                               | 2280           | 6060           | 0.42            |
| 168.6                               | 2160           | 6010           | 0.43            |
| 170.2                               | 2220           | 6060           | 0.42            |
| 171.8                               | 2310           | 6230           | 0.42            |
| 173.4                               | 2340           | 6120           | 0.41            |
| 175.0                               | 2330           | 6120           | 0.42            |
| 176.6                               | 2390           | 6670           | 0.43            |
| 178.2                               | 2570           | 6670           | 0.41            |
| 179.8                               | 2700           | 6730           | 0.40            |
| 181.4                               | 2470           | 6470           | 0.41            |
| 183.0                               | 2310           | 6350           | 0.42            |
| 184.6                               | 2350           | 6350           | 0.42            |
| 186.2                               | 2310           | 6290           | 0.42            |
| 187.8                               | 2210           | 6350           | 0.43            |
| 189.4                               | 2280           | 6410           | 0.43            |
| 191.0                               | 2400           | 6350           | 0.42            |
| 192.6                               | 2340           | 6290           | 0.42            |
| 194.2                               | 2250           | 6350           | 0.43            |
| 195.8                               | 2170           | 6060           | 0.43            |
| 197.4                               | 2200           | 6290           | 0.43            |
| 199.0                               | 2230           | 6350           | 0.43            |
| 200.6                               | 2210           | 6120           | 0.42            |

| Metric Units                        |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (m)                                 | (m/s)          | (m/s)          |                 |
| 42.1                                | 410            | 1690           | 0.47            |
| 42.6                                | 560            | 1850           | 0.45            |
| 43.1                                | 660            | 1860           | 0.43            |
| 43.6                                | 620            | 1900           | 0.44            |
| 44.1                                | 610            | 1880           | 0.44            |
| 44.5                                | 670            | 1880           | 0.43            |
| 45.0                                | 680            | 1880           | 0.43            |
| 45.5                                | 660            | 1850           | 0.43            |
| 46.0                                | 690            | 1860           | 0.42            |
| 46.5                                | 650            | 1810           | 0.43            |
| 47.0                                | 700            | 1940           | 0.42            |
| 47.5                                | 740            | 1920           | 0.41            |
| 48.0                                | 680            | 1850           | 0.42            |
| 48.4                                | 640            | 1780           | 0.43            |
| 48.9                                | 640            | 1850           | 0.43            |
| 49.4                                | 650            | 1850           | 0.43            |
| 49.9                                | 650            | 1880           | 0.43            |
| 50.4                                | 690            | 1880           | 0.42            |
| 50.9                                | 690            | 1850           | 0.42            |
| 51.4                                | 660            | 1830           | 0.43            |
| 51.9                                | 680            | 1850           | 0.42            |
| 52.4                                | 700            | 1900           | 0.42            |
| 52.8                                | 710            | 1860           | 0.41            |
| 53.3                                | 710            | 1860           | 0.42            |
| 53.8                                | 730            | 2030           | 0.43            |
| 54.3                                | 780            | 2030           | 0.41            |
| 54.8                                | 820            | 2050           | 0.40            |
| 55.3                                | 750            | 1970           | 0.41            |
| 55.8                                | 710            | 1940           | 0.42            |
| 56.3                                | 720            | 1940           | 0.42            |
| 56.7                                | 710            | 1920           | 0.42            |
| 57.2                                | 680            | 1940           | 0.43            |
| 57.7                                | 700            | 1950           | 0.43            |
| 58.2                                | 730            | 1940           | 0.42            |
| 58.7                                | 710            | 1920           | 0.42            |
| 59.2                                | 690            | 1940           | 0.43            |
| 59.7                                | 660            | 1850           | 0.43            |
| 60.2                                | 670            | 1920           | 0.43            |
| 60.7                                | 680            | 1940           | 0.43            |
| 61.1                                | 680            | 1860           | 0.42            |

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Receiver-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                      |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (ft)                                | (ft/s)         | (ft/s)         |                 |
| 202.2                               | 2210           | 6290           | 0.43            |
| 203.8                               | 2240           | 6120           | 0.42            |
| 205.4                               | 2300           | 6290           | 0.42            |
| 207.0                               | 2420           | 6470           | 0.42            |
| 208.6                               | 2530           | 6600           | 0.41            |
| 210.2                               | 2370           | 6540           | 0.42            |
| 211.8                               | 2280           | 6470           | 0.43            |
| 213.4                               | 2400           | 6670           | 0.43            |
| 215.0                               | 2470           | 6600           | 0.42            |
| 216.6                               | 2530           | 6470           | 0.41            |
| 218.2                               | 2370           | 6670           | 0.43            |
| 219.8                               | 2410           | 6470           | 0.42            |
| 221.4                               | 2430           | 6600           | 0.42            |
| 223.0                               | 2350           | 6470           | 0.42            |
| 224.6                               | 2360           | 6350           | 0.42            |
| 226.2                               | 2340           | 6350           | 0.42            |
| 227.8                               | 2240           | 6410           | 0.43            |
| 229.4                               | 2200           | 6290           | 0.43            |
| 231.0                               | 2090           | 6170           | 0.44            |
| 232.6                               | 2160           | 6410           | 0.44            |
| 234.2                               | 2250           | 6230           | 0.42            |
| 235.8                               | 2180           | 6170           | 0.43            |
| 237.4                               | 1960           | 6120           | 0.44            |
| 239.0                               | 1790           | 5900           | 0.45            |
| 240.6                               | 1810           | 5950           | 0.45            |
| 242.2                               | 1960           | 6120           | 0.44            |
| 243.8                               | 2160           | 6410           | 0.44            |
| 245.4                               | 2460           | 6410           | 0.41            |
| 247.0                               | 2480           | 6290           | 0.41            |
| 248.7                               | 2350           | 6600           | 0.43            |
| 250.3                               | 2420           | 6670           | 0.42            |
| 251.9                               | 2530           | 6470           | 0.41            |
| 253.5                               | 2430           | 6540           | 0.42            |
| 255.1                               | 2070           | 6060           | 0.43            |
| 256.7                               | 1840           | 6060           | 0.45            |
| 258.3                               | 1980           | 6010           | 0.44            |
| 259.9                               | 2010           | 6060           | 0.44            |
| 261.5                               | 1970           | 6060           | 0.44            |
| 263.1                               | 2120           | 6290           | 0.44            |
| 264.7                               | 2310           | 6350           | 0.42            |

| Metric Units                        |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (m)                                 | (m/s)          | (m/s)          |                 |
| 61.6                                | 670            | 1920           | 0.43            |
| 62.1                                | 680            | 1860           | 0.42            |
| 62.6                                | 700            | 1920           | 0.42            |
| 63.1                                | 740            | 1970           | 0.42            |
| 63.6                                | 770            | 2010           | 0.41            |
| 64.1                                | 720            | 1990           | 0.42            |
| 64.6                                | 700            | 1970           | 0.43            |
| 65.0                                | 730            | 2030           | 0.43            |
| 65.5                                | 750            | 2010           | 0.42            |
| 66.0                                | 770            | 1970           | 0.41            |
| 66.5                                | 720            | 2030           | 0.43            |
| 67.0                                | 730            | 1970           | 0.42            |
| 67.5                                | 740            | 2010           | 0.42            |
| 68.0                                | 720            | 1970           | 0.42            |
| 68.5                                | 720            | 1940           | 0.42            |
| 69.0                                | 710            | 1940           | 0.42            |
| 69.4                                | 680            | 1950           | 0.43            |
| 69.9                                | 670            | 1920           | 0.43            |
| 70.4                                | 640            | 1880           | 0.44            |
| 70.9                                | 660            | 1950           | 0.44            |
| 71.4                                | 690            | 1900           | 0.42            |
| 71.9                                | 660            | 1880           | 0.43            |
| 72.4                                | 600            | 1860           | 0.44            |
| 72.9                                | 540            | 1800           | 0.45            |
| 73.3                                | 550            | 1810           | 0.45            |
| 73.8                                | 600            | 1860           | 0.44            |
| 74.3                                | 660            | 1950           | 0.44            |
| 74.8                                | 750            | 1950           | 0.41            |
| 75.3                                | 760            | 1920           | 0.41            |
| 75.8                                | 720            | 2010           | 0.43            |
| 76.3                                | 740            | 2030           | 0.42            |
| 76.8                                | 770            | 1970           | 0.41            |
| 77.3                                | 740            | 1990           | 0.42            |
| 77.7                                | 630            | 1850           | 0.43            |
| 78.2                                | 560            | 1850           | 0.45            |
| 78.7                                | 600            | 1830           | 0.44            |
| 79.2                                | 610            | 1850           | 0.44            |
| 79.7                                | 600            | 1850           | 0.44            |
| 80.2                                | 650            | 1920           | 0.44            |
| 80.7                                | 710            | 1940           | 0.42            |

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Receiver-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                      |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (ft)                                | (ft/s)         | (ft/s)         |                 |
| 266.3                               | 2410           | 6800           | 0.43            |
| 267.9                               | 2620           | 6800           | 0.41            |
| 269.5                               | 3140           | 7090           | 0.38            |
| 271.1                               | 3530           | 7330           | 0.35            |
| 272.7                               | 3140           | 7090           | 0.38            |
| 274.3                               | 2890           | 7020           | 0.40            |
| 275.9                               | 2430           | 6600           | 0.42            |
| 277.5                               | 2450           | 6670           | 0.42            |
| 279.1                               | 3000           | 7170           | 0.39            |
| 280.7                               | 3000           | 7170           | 0.39            |
| 282.3                               | 2000           | 6350           | 0.45            |
| 283.9                               | 1890           | 5380           | 0.43            |
| 285.5                               | 1960           | 4870           | 0.40            |
| 287.1                               | 1480           | 5560           | 0.46            |
| 288.7                               | 2000           | 6120           | 0.44            |
| 290.3                               | 2440           | 7490           | 0.44            |
| 291.9                               | 2610           | 6670           | 0.41            |
| 293.5                               | 2070           | 6350           | 0.44            |
| 295.1                               | 2420           | 6470           | 0.42            |
| 296.7                               | 2420           | 6670           | 0.42            |
| 298.3                               | 1980           | 6230           | 0.44            |
| 299.9                               | 2250           | 6600           | 0.43            |
| 301.5                               | 2520           | 6670           | 0.42            |
| 303.1                               | 2490           | 6600           | 0.42            |
| 304.7                               | 2440           | 6410           | 0.42            |
| 306.3                               | 2350           | 6290           | 0.42            |
| 307.9                               | 2430           | 6350           | 0.41            |
| 309.5                               | 2660           | 6870           | 0.41            |
| 311.1                               | 2430           | 6540           | 0.42            |
| 312.7                               | 1930           | 6230           | 0.45            |
| 314.3                               | 1700           | 5750           | 0.45            |
| 315.9                               | 1610           | 6060           | 0.46            |
| 317.5                               | 1630           | 6060           | 0.46            |
| 319.1                               | 1680           | 5950           | 0.46            |
| 320.7                               | 1720           | 6170           | 0.46            |
| 322.3                               | 1820           | 5900           | 0.45            |
| 323.9                               | 1800           | 6410           | 0.46            |
| 325.5                               | 1830           | 6060           | 0.45            |
| 327.1                               | 1820           | 5850           | 0.45            |
| 328.7                               | 1590           | 5800           | 0.46            |

| Metric Units                        |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (m)                                 | (m/s)          | (m/s)          |                 |
| 81.2                                | 730            | 2070           | 0.43            |
| 81.6                                | 800            | 2070           | 0.41            |
| 82.1                                | 960            | 2160           | 0.38            |
| 82.6                                | 1080           | 2230           | 0.35            |
| 83.1                                | 960            | 2160           | 0.38            |
| 83.6                                | 880            | 2140           | 0.40            |
| 84.1                                | 740            | 2010           | 0.42            |
| 84.6                                | 750            | 2030           | 0.42            |
| 85.1                                | 920            | 2180           | 0.39            |
| 85.6                                | 920            | 2180           | 0.39            |
| 86.0                                | 610            | 1940           | 0.45            |
| 86.5                                | 580            | 1640           | 0.43            |
| 87.0                                | 600            | 1480           | 0.40            |
| 87.5                                | 450            | 1690           | 0.46            |
| 88.0                                | 610            | 1860           | 0.44            |
| 88.5                                | 740            | 2280           | 0.44            |
| 89.0                                | 800            | 2030           | 0.41            |
| 89.5                                | 630            | 1940           | 0.44            |
| 89.9                                | 740            | 1970           | 0.42            |
| 90.4                                | 740            | 2030           | 0.42            |
| 90.9                                | 600            | 1900           | 0.44            |
| 91.4                                | 690            | 2010           | 0.43            |
| 91.9                                | 770            | 2030           | 0.42            |
| 92.4                                | 760            | 2010           | 0.42            |
| 92.9                                | 740            | 1950           | 0.42            |
| 93.4                                | 720            | 1920           | 0.42            |
| 93.9                                | 740            | 1940           | 0.41            |
| 94.3                                | 810            | 2090           | 0.41            |
| 94.8                                | 740            | 1990           | 0.42            |
| 95.3                                | 590            | 1900           | 0.45            |
| 95.8                                | 520            | 1750           | 0.45            |
| 96.3                                | 490            | 1850           | 0.46            |
| 96.8                                | 500            | 1850           | 0.46            |
| 97.3                                | 510            | 1810           | 0.46            |
| 97.8                                | 520            | 1880           | 0.46            |
| 98.2                                | 550            | 1800           | 0.45            |
| 98.7                                | 550            | 1950           | 0.46            |
| 99.2                                | 560            | 1850           | 0.45            |
| 99.7                                | 560            | 1780           | 0.45            |
| 100.2                               | 480            | 1770           | 0.46            |



**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Receiver-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                      |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (ft)                                | (ft/s)         | (ft/s)         |                 |
| 330.3                               | 1510           | 5900           | 0.47            |
| 331.9                               | 1560           | 5600           | 0.46            |
| 333.6                               | 1470           | 5650           | 0.46            |
| 335.2                               | 1390           | 5600           | 0.47            |
| 336.8                               | 1540           | 6470           | 0.47            |
| 338.4                               | 1660           | 6170           | 0.46            |
| 340.0                               | 1830           | 5950           | 0.45            |
| 341.6                               | 2010           | 6290           | 0.44            |
| 343.2                               | 2170           | 6670           | 0.44            |
| 344.8                               | 1820           | 6170           | 0.45            |
| 346.4                               | 1680           | 6230           | 0.46            |
| 348.0                               | 1660           | 5950           | 0.46            |
| 349.6                               | 1460           | 5750           | 0.47            |
| 351.2                               | 1550           | 5950           | 0.46            |
| 352.8                               | 2040           | 6410           | 0.44            |
| 354.4                               | 2200           | 6670           | 0.44            |
| 356.0                               | 2350           | 6730           | 0.43            |
| 357.6                               | 2420           | 6540           | 0.42            |
| 359.2                               | 2120           | 6410           | 0.44            |
| 360.8                               | 2140           | 6540           | 0.44            |
| 362.4                               | 2080           | 6350           | 0.44            |
| 364.0                               | 1930           | 5950           | 0.44            |
| 365.6                               | 1980           | 6230           | 0.44            |
| 367.2                               | 2230           | 6800           | 0.44            |
| 368.8                               | 2150           | 6350           | 0.44            |
| 370.4                               | 1880           | 6170           | 0.45            |
| 372.0                               | 1750           | 6010           | 0.45            |
| 373.6                               | 1590           | 5900           | 0.46            |
| 375.2                               | 1450           | 5650           | 0.46            |
| 376.8                               | 1410           | 5800           | 0.47            |
| 378.4                               | 1490           | 5800           | 0.46            |
| 380.0                               | 1570           | 5900           | 0.46            |
| 381.6                               | 1560           | 6120           | 0.47            |
| 383.2                               | 1610           | 5950           | 0.46            |
| 384.8                               | 1550           | 5600           | 0.46            |
| 386.4                               | 1520           | 5850           | 0.46            |
| 388.0                               | 1520           | 5900           | 0.46            |
| 389.6                               | 1530           | 5650           | 0.46            |
| 391.2                               | 1650           | 6170           | 0.46            |
| 392.8                               | 1920           | 6290           | 0.45            |

| Metric Units                        |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (m)                                 | (m/s)          | (m/s)          |                 |
| 100.7                               | 460            | 1800           | 0.47            |
| 101.2                               | 470            | 1710           | 0.46            |
| 101.7                               | 450            | 1720           | 0.46            |
| 102.2                               | 430            | 1710           | 0.47            |
| 102.6                               | 470            | 1970           | 0.47            |
| 103.1                               | 510            | 1880           | 0.46            |
| 103.6                               | 560            | 1810           | 0.45            |
| 104.1                               | 610            | 1920           | 0.44            |
| 104.6                               | 660            | 2030           | 0.44            |
| 105.1                               | 560            | 1880           | 0.45            |
| 105.6                               | 510            | 1900           | 0.46            |
| 106.1                               | 510            | 1810           | 0.46            |
| 106.5                               | 440            | 1750           | 0.47            |
| 107.0                               | 470            | 1810           | 0.46            |
| 107.5                               | 620            | 1950           | 0.44            |
| 108.0                               | 670            | 2030           | 0.44            |
| 108.5                               | 720            | 2050           | 0.43            |
| 109.0                               | 740            | 1990           | 0.42            |
| 109.5                               | 650            | 1950           | 0.44            |
| 110.0                               | 650            | 1990           | 0.44            |
| 110.5                               | 640            | 1940           | 0.44            |
| 110.9                               | 590            | 1810           | 0.44            |
| 111.4                               | 600            | 1900           | 0.44            |
| 111.9                               | 680            | 2070           | 0.44            |
| 112.4                               | 660            | 1940           | 0.44            |
| 112.9                               | 570            | 1880           | 0.45            |
| 113.4                               | 530            | 1830           | 0.45            |
| 113.9                               | 480            | 1800           | 0.46            |
| 114.4                               | 440            | 1720           | 0.46            |
| 114.8                               | 430            | 1770           | 0.47            |
| 115.3                               | 460            | 1770           | 0.46            |
| 115.8                               | 480            | 1800           | 0.46            |
| 116.3                               | 480            | 1860           | 0.47            |
| 116.8                               | 490            | 1810           | 0.46            |
| 117.3                               | 470            | 1710           | 0.46            |
| 117.8                               | 460            | 1780           | 0.46            |
| 118.3                               | 460            | 1800           | 0.46            |
| 118.8                               | 470            | 1720           | 0.46            |
| 119.2                               | 500            | 1880           | 0.46            |
| 119.7                               | 590            | 1920           | 0.45            |

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Receiver-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                      |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (ft)                                | (ft/s)         | (ft/s)         |                 |
| 394.4                               | 2180           | 6670           | 0.44            |
| 396.0                               | 2300           | 6350           | 0.42            |
| 397.6                               | 2510           | 6870           | 0.42            |
| 399.2                               | 2610           | 6940           | 0.42            |
| 400.8                               | 3210           | 7090           | 0.37            |
| 402.4                               | 3550           | 6940           | 0.32            |
| 404.0                               | 3040           | 7090           | 0.39            |
| 405.6                               | 2870           | 7020           | 0.40            |
| 407.2                               | 2900           | 7090           | 0.40            |
| 408.8                               | 2960           | 6940           | 0.39            |
| 410.4                               | 2920           | 7020           | 0.39            |
| 412.0                               | 2960           | 7090           | 0.39            |
| 413.6                               | 2900           | 6940           | 0.39            |
| 415.2                               | 2730           | 6800           | 0.40            |
| 416.8                               | 2650           | 6600           | 0.40            |
| 418.5                               | 2570           | 6670           | 0.41            |
| 420.1                               | 2660           | 6730           | 0.41            |
| 421.7                               | 2610           | 6800           | 0.41            |
| 423.3                               | 2590           | 6800           | 0.41            |
| 424.9                               | 2700           | 6800           | 0.41            |
| 426.5                               | 2810           | 7020           | 0.40            |
| 428.1                               | 2800           | 7170           | 0.41            |
| 429.7                               | 2860           | 7170           | 0.41            |
| 431.3                               | 2950           | 7200           | 0.40            |
| 432.9                               | 2800           | 6970           | 0.40            |
| 434.5                               | 2690           | 6690           | 0.40            |
| 436.1                               | 2780           | 6900           | 0.40            |
| 437.7                               | 2840           | 6690           | 0.39            |
| 439.3                               | 2870           | 6630           | 0.38            |
| 440.9                               | 2990           | 7120           | 0.39            |
| 442.5                               | 2980           | 6830           | 0.38            |
| 444.1                               | 2780           | 7090           | 0.41            |
| 445.7                               | 2800           | 6970           | 0.40            |
| 447.3                               | 2740           | 7050           | 0.41            |
| 448.9                               | 2730           | 6690           | 0.40            |
| 450.5                               | 2750           | 6960           | 0.41            |
| 452.1                               | 2800           | 6960           | 0.40            |
| 453.7                               | 2940           | 6960           | 0.39            |
| 455.3                               | 3020           | 7140           | 0.39            |
| 456.9                               | 3160           | 7120           | 0.38            |

| Metric Units                        |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (m)                                 | (m/s)          | (m/s)          |                 |
| 120.2                               | 660            | 2030           | 0.44            |
| 120.7                               | 700            | 1940           | 0.42            |
| 121.2                               | 760            | 2090           | 0.42            |
| 121.7                               | 800            | 2120           | 0.42            |
| 122.2                               | 980            | 2160           | 0.37            |
| 122.7                               | 1080           | 2120           | 0.32            |
| 123.1                               | 930            | 2160           | 0.39            |
| 123.6                               | 880            | 2140           | 0.40            |
| 124.1                               | 880            | 2160           | 0.40            |
| 124.6                               | 900            | 2120           | 0.39            |
| 125.1                               | 890            | 2140           | 0.39            |
| 125.6                               | 900            | 2160           | 0.39            |
| 126.1                               | 880            | 2120           | 0.39            |
| 126.6                               | 830            | 2070           | 0.40            |
| 127.1                               | 810            | 2010           | 0.40            |
| 127.5                               | 780            | 2030           | 0.41            |
| 128.0                               | 810            | 2050           | 0.41            |
| 128.5                               | 800            | 2070           | 0.41            |
| 129.0                               | 790            | 2070           | 0.41            |
| 129.5                               | 820            | 2070           | 0.41            |
| 130.0                               | 860            | 2140           | 0.40            |
| 130.5                               | 850            | 2180           | 0.41            |
| 131.0                               | 870            | 2180           | 0.41            |
| 131.5                               | 900            | 2190           | 0.40            |
| 131.9                               | 850            | 2130           | 0.40            |
| 132.4                               | 820            | 2040           | 0.40            |
| 132.9                               | 850            | 2100           | 0.40            |
| 133.4                               | 860            | 2040           | 0.39            |
| 133.9                               | 880            | 2020           | 0.38            |
| 134.4                               | 910            | 2170           | 0.39            |
| 134.9                               | 910            | 2080           | 0.38            |
| 135.4                               | 850            | 2160           | 0.41            |
| 135.8                               | 850            | 2130           | 0.40            |
| 136.3                               | 840            | 2150           | 0.41            |
| 136.8                               | 830            | 2040           | 0.40            |
| 137.3                               | 840            | 2120           | 0.41            |
| 137.8                               | 850            | 2120           | 0.40            |
| 138.3                               | 900            | 2120           | 0.39            |
| 138.8                               | 920            | 2180           | 0.39            |
| 139.3                               | 960            | 2170           | 0.38            |

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Receiver-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                      |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (ft)                                | (ft/s)         | (ft/s)         |                 |
| 458.5                               | 3300           | 7370           | 0.37            |
| 460.1                               | 3200           | 7310           | 0.38            |
| 461.7                               | 3010           | 7060           | 0.39            |
| 463.3                               | 2880           | 6860           | 0.39            |
| 464.9                               | 2930           | 7000           | 0.39            |
| 466.5                               | 2990           | 7150           | 0.39            |
| 468.1                               | 2990           | 7000           | 0.39            |
| 469.7                               | 2990           | 7030           | 0.39            |
| 471.3                               | 3020           | 7250           | 0.40            |
| 472.9                               | 2950           | 7220           | 0.40            |
| 474.5                               | 2860           | 6970           | 0.40            |
| 476.1                               | 2860           | 7250           | 0.41            |
| 477.7                               | 2880           | 7180           | 0.40            |
| 479.3                               | 2890           | 6920           | 0.39            |
| 480.9                               | 2920           | 7180           | 0.40            |
| 482.5                               | 2980           | 7180           | 0.40            |
| 484.1                               | 2980           | 7370           | 0.40            |
| 485.7                               | 3000           | 7220           | 0.40            |
| 487.3                               | 3050           | 7180           | 0.39            |
| 488.9                               | 3120           | 7580           | 0.40            |
| 490.5                               | 3210           | 6970           | 0.37            |
| 492.1                               | 3110           | 7340           | 0.39            |
| 493.7                               | 2910           | 7540           | 0.41            |
| 495.3                               | 3060           | 7340           | 0.40            |
| 496.9                               | 3270           | 7150           | 0.37            |
| 498.5                               | 3230           | 7220           | 0.37            |
| 500.1                               | 3020           | 7060           | 0.39            |
| 501.8                               | 2940           | 7030           | 0.39            |

| Metric Units                        |                |                |                 |
|-------------------------------------|----------------|----------------|-----------------|
| Depth at Midpoint Between Receivers | Velocity       |                | Poisson's Ratio |
|                                     | V <sub>s</sub> | V <sub>p</sub> |                 |
| (m)                                 | (m/s)          | (m/s)          |                 |
| 139.8                               | 1010           | 2250           | 0.37            |
| 140.2                               | 970            | 2230           | 0.38            |
| 140.7                               | 920            | 2150           | 0.39            |
| 141.2                               | 880            | 2090           | 0.39            |
| 141.7                               | 890            | 2130           | 0.39            |
| 142.2                               | 910            | 2180           | 0.39            |
| 142.7                               | 910            | 2130           | 0.39            |
| 143.2                               | 910            | 2140           | 0.39            |
| 143.7                               | 920            | 2210           | 0.40            |
| 144.1                               | 900            | 2200           | 0.40            |
| 144.6                               | 870            | 2130           | 0.40            |
| 145.1                               | 870            | 2210           | 0.41            |
| 145.6                               | 880            | 2190           | 0.40            |
| 146.1                               | 880            | 2110           | 0.39            |
| 146.6                               | 890            | 2190           | 0.40            |
| 147.1                               | 910            | 2190           | 0.40            |
| 147.6                               | 910            | 2250           | 0.40            |
| 148.1                               | 910            | 2200           | 0.40            |
| 148.5                               | 930            | 2190           | 0.39            |
| 149.0                               | 950            | 2310           | 0.40            |
| 149.5                               | 980            | 2130           | 0.37            |
| 150.0                               | 950            | 2240           | 0.39            |
| 150.5                               | 890            | 2300           | 0.41            |
| 151.0                               | 930            | 2240           | 0.40            |
| 151.5                               | 1000           | 2180           | 0.37            |
| 152.0                               | 980            | 2200           | 0.37            |
| 152.4                               | 920            | 2150           | 0.39            |
| 152.9                               | 900            | 2140           | 0.39            |

## **APPENDIX A**

# **SUSPENSION VELOCITY MEASUREMENT QUALITY ASSURANCE SUSPENSION SOURCE TO RECEIVER ANALYSIS RESULTS**

# HARBOR RIVER BOREHOLE SB-1

## Source to Receiver and Receiver to Receiver Analysis

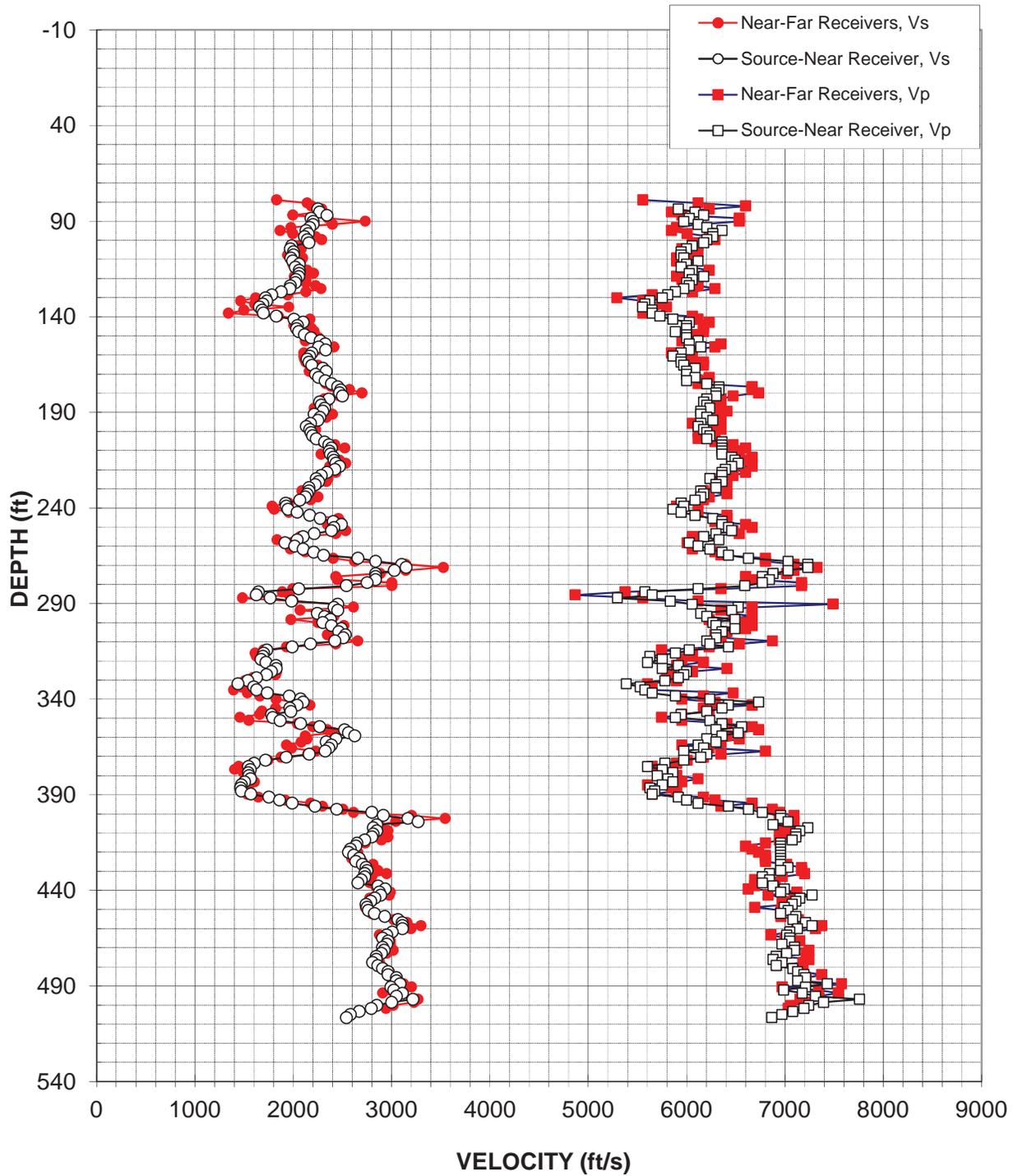


Figure A-1: Boring SB-1, Suspension S-R1 P- and S<sub>H</sub>-wave velocities

Table A-1. Boring SB-1, S - R1 quality assurance analysis P- and SH-wave data

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Source-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                                           |                |                |                    | Metric Units                                             |                |                |                    |
|----------------------------------------------------------|----------------|----------------|--------------------|----------------------------------------------------------|----------------|----------------|--------------------|
| Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio | Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio |
|                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |
| (ft)                                                     | (ft/s)         | (ft/s)         |                    | (m)                                                      | (m/s)          | (m/s)          |                    |
| 83.7                                                     | 2250           | 5920           | 0.42               | 25.5                                                     | 690            | 1800           | 0.42               |
| 85.3                                                     | 2270           | 6090           | 0.42               | 26.0                                                     | 690            | 1860           | 0.42               |
| 86.9                                                     | 2340           | 6180           | 0.42               | 26.5                                                     | 710            | 1880           | 0.42               |
| 88.5                                                     | 2180           | 6030           | 0.42               | 27.0                                                     | 670            | 1840           | 0.42               |
| 90.1                                                     | 2210           | 5970           | 0.42               | 27.5                                                     | 670            | 1820           | 0.42               |
| 91.7                                                     | 2200           | 6120           | 0.43               | 27.9                                                     | 670            | 1860           | 0.43               |
| 93.3                                                     | 2170           | 6210           | 0.43               | 28.4                                                     | 660            | 1890           | 0.43               |
| 94.9                                                     | 2130           | 6360           | 0.44               | 28.9                                                     | 650            | 1940           | 0.44               |
| 96.5                                                     | 2150           | 6270           | 0.43               | 29.4                                                     | 660            | 1910           | 0.43               |
| 98.1                                                     | 2120           | 6270           | 0.44               | 29.9                                                     | 650            | 1910           | 0.44               |
| 99.7                                                     | 2150           | 6210           | 0.43               | 30.4                                                     | 650            | 1890           | 0.43               |
| 101.3                                                    | 2160           | 6180           | 0.43               | 30.9                                                     | 660            | 1880           | 0.43               |
| 102.9                                                    | 1980           | 6060           | 0.44               | 31.4                                                     | 600            | 1850           | 0.44               |
| 104.5                                                    | 1970           | 6000           | 0.44               | 31.9                                                     | 600            | 1830           | 0.44               |
| 106.1                                                    | 2000           | 5940           | 0.44               | 32.3                                                     | 610            | 1810           | 0.44               |
| 107.7                                                    | 2000           | 5940           | 0.44               | 32.8                                                     | 610            | 1810           | 0.44               |
| 109.3                                                    | 1980           | 5970           | 0.44               | 33.3                                                     | 600            | 1820           | 0.44               |
| 110.9                                                    | 2000           | 6120           | 0.44               | 33.8                                                     | 610            | 1860           | 0.44               |
| 112.5                                                    | 2060           | 6000           | 0.43               | 34.3                                                     | 630            | 1830           | 0.43               |
| 114.1                                                    | 2020           | 5940           | 0.43               | 34.8                                                     | 620            | 1810           | 0.43               |
| 115.7                                                    | 2060           | 6060           | 0.43               | 35.3                                                     | 630            | 1850           | 0.43               |
| 117.3                                                    | 2060           | 6030           | 0.43               | 35.8                                                     | 630            | 1840           | 0.43               |
| 118.9                                                    | 2060           | 6180           | 0.44               | 36.2                                                     | 630            | 1880           | 0.44               |
| 120.5                                                    | 2030           | 6060           | 0.44               | 36.7                                                     | 620            | 1850           | 0.44               |
| 122.1                                                    | 2020           | 6000           | 0.44               | 37.2                                                     | 620            | 1830           | 0.44               |
| 123.7                                                    | 1970           | 6030           | 0.44               | 37.7                                                     | 600            | 1840           | 0.44               |
| 125.3                                                    | 1970           | 5970           | 0.44               | 38.2                                                     | 600            | 1820           | 0.44               |
| 126.9                                                    | 1880           | 5890           | 0.44               | 38.7                                                     | 570            | 1790           | 0.44               |
| 128.5                                                    | 1780           | 5810           | 0.45               | 39.2                                                     | 540            | 1770           | 0.45               |
| 130.1                                                    | 1720           | 5750           | 0.45               | 39.7                                                     | 520            | 1750           | 0.45               |
| 131.7                                                    | 1730           | 5630           | 0.45               | 40.2                                                     | 530            | 1720           | 0.45               |
| 133.3                                                    | 1690           | 5580           | 0.45               | 40.6                                                     | 520            | 1700           | 0.45               |
| 134.9                                                    | 1660           | 5550           | 0.45               | 41.1                                                     | 510            | 1690           | 0.45               |
| 136.5                                                    | 1680           | 5650           | 0.45               | 41.6                                                     | 510            | 1720           | 0.45               |
| 138.1                                                    | 1700           | 5650           | 0.45               | 42.1                                                     | 520            | 1720           | 0.45               |
| 139.7                                                    | 1830           | 5730           | 0.44               | 42.6                                                     | 560            | 1750           | 0.44               |
| 141.3                                                    | 2010           | 5860           | 0.43               | 43.1                                                     | 610            | 1790           | 0.43               |
| 143.0                                                    | 2100           | 6030           | 0.43               | 43.6                                                     | 640            | 1840           | 0.43               |
| 144.6                                                    | 2050           | 6000           | 0.43               | 44.1                                                     | 620            | 1830           | 0.43               |

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Source-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                                           |                |                |                    | Metric Units                                             |                |                |                    |
|----------------------------------------------------------|----------------|----------------|--------------------|----------------------------------------------------------|----------------|----------------|--------------------|
| Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio | Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio |
|                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |
| (ft)                                                     | (ft/s)         | (ft/s)         |                    | (m)                                                      | (m/s)          | (m/s)          |                    |
| 146.2                                                    | 2040           | 6000           | 0.43               | 44.5                                                     | 620            | 1830           | 0.43               |
| 147.8                                                    | 2060           | 5890           | 0.43               | 45.0                                                     | 630            | 1790           | 0.43               |
| 149.4                                                    | 2120           | 6000           | 0.43               | 45.5                                                     | 650            | 1830           | 0.43               |
| 151.0                                                    | 2180           | 6000           | 0.42               | 46.0                                                     | 670            | 1830           | 0.42               |
| 152.6                                                    | 2280           | 6120           | 0.42               | 46.5                                                     | 690            | 1860           | 0.42               |
| 154.2                                                    | 2330           | 6030           | 0.41               | 47.0                                                     | 710            | 1840           | 0.41               |
| 155.8                                                    | 2260           | 6150           | 0.42               | 47.5                                                     | 690            | 1870           | 0.42               |
| 157.4                                                    | 2330           | 6030           | 0.41               | 48.0                                                     | 710            | 1840           | 0.41               |
| 159.0                                                    | 2190           | 5940           | 0.42               | 48.5                                                     | 670            | 1810           | 0.42               |
| 160.6                                                    | 2170           | 5860           | 0.42               | 48.9                                                     | 660            | 1790           | 0.42               |
| 162.2                                                    | 2140           | 5940           | 0.43               | 49.4                                                     | 650            | 1810           | 0.43               |
| 163.8                                                    | 2160           | 5940           | 0.42               | 49.9                                                     | 660            | 1810           | 0.42               |
| 165.4                                                    | 2190           | 5970           | 0.42               | 50.4                                                     | 670            | 1820           | 0.42               |
| 167.0                                                    | 2300           | 6090           | 0.42               | 50.9                                                     | 700            | 1860           | 0.42               |
| 168.6                                                    | 2340           | 6000           | 0.41               | 51.4                                                     | 710            | 1830           | 0.41               |
| 170.2                                                    | 2230           | 6000           | 0.42               | 51.9                                                     | 680            | 1830           | 0.42               |
| 171.8                                                    | 2260           | 6090           | 0.42               | 52.4                                                     | 690            | 1860           | 0.42               |
| 173.4                                                    | 2330           | 6000           | 0.41               | 52.8                                                     | 710            | 1830           | 0.41               |
| 175.0                                                    | 2390           | 6210           | 0.41               | 53.3                                                     | 730            | 1890           | 0.41               |
| 176.6                                                    | 2450           | 6330           | 0.41               | 53.8                                                     | 750            | 1930           | 0.41               |
| 178.2                                                    | 2480           | 6330           | 0.41               | 54.3                                                     | 760            | 1930           | 0.41               |
| 179.8                                                    | 2470           | 6300           | 0.41               | 54.8                                                     | 750            | 1920           | 0.41               |
| 181.4                                                    | 2500           | 6300           | 0.41               | 55.3                                                     | 760            | 1920           | 0.41               |
| 183.0                                                    | 2360           | 6210           | 0.42               | 55.8                                                     | 720            | 1890           | 0.42               |
| 184.6                                                    | 2270           | 6180           | 0.42               | 56.3                                                     | 690            | 1880           | 0.42               |
| 186.2                                                    | 2290           | 6210           | 0.42               | 56.8                                                     | 700            | 1890           | 0.42               |
| 187.8                                                    | 2320           | 6240           | 0.42               | 57.2                                                     | 710            | 1900           | 0.42               |
| 189.4                                                    | 2300           | 6150           | 0.42               | 57.7                                                     | 700            | 1870           | 0.42               |
| 191.0                                                    | 2210           | 6150           | 0.43               | 58.2                                                     | 670            | 1870           | 0.43               |
| 192.6                                                    | 2270           | 6210           | 0.42               | 58.7                                                     | 690            | 1890           | 0.42               |
| 194.2                                                    | 2250           | 6270           | 0.43               | 59.2                                                     | 690            | 1910           | 0.43               |
| 195.8                                                    | 2180           | 6150           | 0.43               | 59.7                                                     | 660            | 1870           | 0.43               |
| 197.4                                                    | 2130           | 6120           | 0.43               | 60.2                                                     | 650            | 1860           | 0.43               |
| 199.0                                                    | 2170           | 6180           | 0.43               | 60.7                                                     | 660            | 1880           | 0.43               |
| 200.6                                                    | 2180           | 6210           | 0.43               | 61.1                                                     | 670            | 1890           | 0.43               |
| 202.2                                                    | 2200           | 6240           | 0.43               | 61.6                                                     | 670            | 1900           | 0.43               |
| 203.8                                                    | 2240           | 6210           | 0.43               | 62.1                                                     | 680            | 1890           | 0.43               |
| 205.4                                                    | 2320           | 6360           | 0.42               | 62.6                                                     | 710            | 1940           | 0.42               |
| 207.0                                                    | 2360           | 6360           | 0.42               | 63.1                                                     | 720            | 1940           | 0.42               |
| 208.6                                                    | 2390           | 6360           | 0.42               | 63.6                                                     | 730            | 1940           | 0.42               |

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Source-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                                           |                |                |                    | Metric Units                                             |                |                |                    |
|----------------------------------------------------------|----------------|----------------|--------------------|----------------------------------------------------------|----------------|----------------|--------------------|
| Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio | Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio |
|                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |
| (ft)                                                     | (ft/s)         | (ft/s)         |                    | (m)                                                      | (m/s)          | (m/s)          |                    |
| 210.2                                                    | 2370           | 6360           | 0.42               | 64.1                                                     | 720            | 1940           | 0.42               |
| 211.8                                                    | 2380           | 6360           | 0.42               | 64.6                                                     | 730            | 1940           | 0.42               |
| 213.4                                                    | 2410           | 6460           | 0.42               | 65.1                                                     | 730            | 1970           | 0.42               |
| 215.0                                                    | 2420           | 6490           | 0.42               | 65.5                                                     | 740            | 1980           | 0.42               |
| 216.6                                                    | 2430           | 6530           | 0.42               | 66.0                                                     | 740            | 1990           | 0.42               |
| 218.2                                                    | 2470           | 6460           | 0.41               | 66.5                                                     | 750            | 1970           | 0.41               |
| 219.8                                                    | 2430           | 6390           | 0.42               | 67.0                                                     | 740            | 1950           | 0.42               |
| 221.4                                                    | 2340           | 6360           | 0.42               | 67.5                                                     | 710            | 1940           | 0.42               |
| 223.0                                                    | 2290           | 6360           | 0.43               | 68.0                                                     | 700            | 1940           | 0.43               |
| 224.6                                                    | 2240           | 6240           | 0.43               | 68.5                                                     | 680            | 1900           | 0.43               |
| 226.3                                                    | 2260           | 6360           | 0.43               | 69.0                                                     | 690            | 1940           | 0.43               |
| 227.9                                                    | 2220           | 6300           | 0.43               | 69.4                                                     | 680            | 1920           | 0.43               |
| 229.5                                                    | 2160           | 6300           | 0.43               | 69.9                                                     | 660            | 1920           | 0.43               |
| 231.1                                                    | 2160           | 6150           | 0.43               | 70.4                                                     | 660            | 1870           | 0.43               |
| 232.7                                                    | 2140           | 6180           | 0.43               | 70.9                                                     | 650            | 1880           | 0.43               |
| 234.3                                                    | 2120           | 6150           | 0.43               | 71.4                                                     | 650            | 1870           | 0.43               |
| 235.9                                                    | 2070           | 6090           | 0.43               | 71.9                                                     | 630            | 1860           | 0.43               |
| 237.5                                                    | 1920           | 5940           | 0.44               | 72.4                                                     | 590            | 1810           | 0.44               |
| 239.1                                                    | 1930           | 5970           | 0.44               | 72.9                                                     | 590            | 1820           | 0.44               |
| 240.7                                                    | 1950           | 5860           | 0.44               | 73.4                                                     | 590            | 1790           | 0.44               |
| 242.3                                                    | 2040           | 5940           | 0.43               | 73.8                                                     | 620            | 1810           | 0.43               |
| 243.9                                                    | 2170           | 6090           | 0.43               | 74.3                                                     | 660            | 1860           | 0.43               |
| 245.5                                                    | 2270           | 6270           | 0.42               | 74.8                                                     | 690            | 1910           | 0.42               |
| 247.1                                                    | 2410           | 6360           | 0.42               | 75.3                                                     | 730            | 1940           | 0.42               |
| 248.7                                                    | 2490           | 6360           | 0.41               | 75.8                                                     | 760            | 1940           | 0.41               |
| 250.3                                                    | 2420           | 6430           | 0.42               | 76.3                                                     | 740            | 1960           | 0.42               |
| 251.9                                                    | 2390           | 6460           | 0.42               | 76.8                                                     | 730            | 1970           | 0.42               |
| 253.5                                                    | 2210           | 6300           | 0.43               | 77.3                                                     | 670            | 1920           | 0.43               |
| 255.1                                                    | 2100           | 6180           | 0.43               | 77.7                                                     | 640            | 1880           | 0.43               |
| 256.7                                                    | 2040           | 6330           | 0.44               | 78.2                                                     | 620            | 1930           | 0.44               |
| 258.3                                                    | 1920           | 6030           | 0.44               | 78.7                                                     | 580            | 1840           | 0.44               |
| 259.9                                                    | 2020           | 6120           | 0.44               | 79.2                                                     | 610            | 1860           | 0.44               |
| 261.5                                                    | 2100           | 6240           | 0.44               | 79.7                                                     | 640            | 1900           | 0.44               |
| 263.1                                                    | 2210           | 6360           | 0.43               | 80.2                                                     | 670            | 1940           | 0.43               |
| 264.7                                                    | 2310           | 6430           | 0.43               | 80.7                                                     | 700            | 1960           | 0.43               |
| 266.3                                                    | 2660           | 6630           | 0.40               | 81.2                                                     | 810            | 2020           | 0.40               |
| 267.9                                                    | 2840           | 7030           | 0.40               | 81.7                                                     | 870            | 2140           | 0.40               |
| 269.5                                                    | 3100           | 7230           | 0.39               | 82.1                                                     | 950            | 2210           | 0.39               |
| 271.1                                                    | 3150           | 7230           | 0.38               | 82.6                                                     | 960            | 2210           | 0.38               |
| 272.7                                                    | 3030           | 7030           | 0.39               | 83.1                                                     | 920            | 2140           | 0.39               |



**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Source-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                                           |                |                |                    | Metric Units                                             |                |                |                    |
|----------------------------------------------------------|----------------|----------------|--------------------|----------------------------------------------------------|----------------|----------------|--------------------|
| Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio | Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio |
|                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |
| (ft)                                                     | (ft/s)         | (ft/s)         |                    | (m)                                                      | (m/s)          | (m/s)          |                    |
| 274.3                                                    | 2840           | 6880           | 0.40               | 83.6                                                     | 870            | 2100           | 0.40               |
| 275.9                                                    | 2840           | 6770           | 0.39               | 84.1                                                     | 870            | 2060           | 0.39               |
| 277.5                                                    | 2840           | 6840           | 0.40               | 84.6                                                     | 870            | 2090           | 0.40               |
| 279.1                                                    | 2750           | 6770           | 0.40               | 85.1                                                     | 840            | 2060           | 0.40               |
| 280.7                                                    | 2540           | 6590           | 0.41               | 85.6                                                     | 770            | 2010           | 0.41               |
| 282.3                                                    | 2060           | 6120           | 0.44               | 86.1                                                     | 630            | 1860           | 0.44               |
| 283.9                                                    | 1650           | 5580           | 0.45               | 86.5                                                     | 500            | 1700           | 0.45               |
| 285.5                                                    | 1630           | 5650           | 0.45               | 87.0                                                     | 500            | 1720           | 0.45               |
| 287.1                                                    | 1770           | 5300           | 0.44               | 87.5                                                     | 540            | 1610           | 0.44               |
| 288.7                                                    | 1980           | 5830           | 0.43               | 88.0                                                     | 600            | 1780           | 0.43               |
| 290.3                                                    | 2450           | 6060           | 0.40               | 88.5                                                     | 750            | 1850           | 0.40               |
| 291.9                                                    | 2420           | 6530           | 0.42               | 89.0                                                     | 740            | 1990           | 0.42               |
| 293.5                                                    | 2450           | 6460           | 0.42               | 89.5                                                     | 750            | 1970           | 0.42               |
| 295.1                                                    | 2240           | 6150           | 0.42               | 90.0                                                     | 680            | 1870           | 0.42               |
| 296.7                                                    | 2320           | 6210           | 0.42               | 90.4                                                     | 710            | 1890           | 0.42               |
| 298.3                                                    | 2380           | 6490           | 0.42               | 90.9                                                     | 730            | 1980           | 0.42               |
| 299.9                                                    | 2300           | 6270           | 0.42               | 91.4                                                     | 700            | 1910           | 0.42               |
| 301.5                                                    | 2390           | 6300           | 0.42               | 91.9                                                     | 730            | 1920           | 0.42               |
| 303.1                                                    | 2490           | 6490           | 0.41               | 92.4                                                     | 760            | 1980           | 0.41               |
| 304.7                                                    | 2460           | 6360           | 0.41               | 92.9                                                     | 750            | 1940           | 0.41               |
| 306.3                                                    | 2530           | 6300           | 0.40               | 93.4                                                     | 770            | 1920           | 0.40               |
| 307.9                                                    | 2510           | 6300           | 0.41               | 93.9                                                     | 770            | 1920           | 0.41               |
| 309.5                                                    | 2430           | 6210           | 0.41               | 94.4                                                     | 740            | 1890           | 0.41               |
| 311.2                                                    | 2180           | 6240           | 0.43               | 94.8                                                     | 660            | 1900           | 0.43               |
| 312.8                                                    | 1990           | 6430           | 0.45               | 95.3                                                     | 610            | 1960           | 0.45               |
| 314.4                                                    | 1730           | 6030           | 0.45               | 95.8                                                     | 530            | 1840           | 0.45               |
| 316.0                                                    | 1700           | 5890           | 0.45               | 96.3                                                     | 520            | 1790           | 0.45               |
| 317.6                                                    | 1690           | 5630           | 0.45               | 96.8                                                     | 520            | 1720           | 0.45               |
| 319.2                                                    | 1670           | 5750           | 0.45               | 97.3                                                     | 510            | 1750           | 0.45               |
| 320.8                                                    | 1720           | 5600           | 0.45               | 97.8                                                     | 530            | 1710           | 0.45               |
| 322.4                                                    | 1820           | 5920           | 0.45               | 98.3                                                     | 560            | 1800           | 0.45               |
| 324.0                                                    | 1830           | 5750           | 0.44               | 98.7                                                     | 560            | 1750           | 0.44               |
| 325.6                                                    | 1780           | 6000           | 0.45               | 99.2                                                     | 540            | 1830           | 0.45               |
| 327.2                                                    | 1730           | 5970           | 0.45               | 99.7                                                     | 530            | 1820           | 0.45               |
| 328.8                                                    | 1630           | 5920           | 0.46               | 100.2                                                    | 500            | 1800           | 0.46               |
| 330.4                                                    | 1540           | 5780           | 0.46               | 100.7                                                    | 470            | 1760           | 0.46               |
| 332.0                                                    | 1440           | 5390           | 0.46               | 101.2                                                    | 440            | 1640           | 0.46               |
| 333.6                                                    | 1600           | 5530           | 0.45               | 101.7                                                    | 490            | 1690           | 0.45               |
| 335.2                                                    | 1630           | 5580           | 0.45               | 102.2                                                    | 500            | 1700           | 0.45               |
| 336.8                                                    | 1740           | 5650           | 0.45               | 102.7                                                    | 530            | 1720           | 0.45               |

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Source-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                                           |                |                |                    | Metric Units                                             |                |                |                    |
|----------------------------------------------------------|----------------|----------------|--------------------|----------------------------------------------------------|----------------|----------------|--------------------|
| Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio | Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio |
|                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |
| (ft)                                                     | (ft/s)         | (ft/s)         |                    | (m)                                                      | (m/s)          | (m/s)          |                    |
| 338.4                                                    | 1960           | 5890           | 0.44               | 103.1                                                    | 600            | 1790           | 0.44               |
| 340.0                                                    | 2080           | 6240           | 0.44               | 103.6                                                    | 630            | 1900           | 0.44               |
| 341.6                                                    | 2100           | 6730           | 0.45               | 104.1                                                    | 640            | 2050           | 0.45               |
| 343.2                                                    | 2040           | 6430           | 0.44               | 104.6                                                    | 620            | 1960           | 0.44               |
| 344.8                                                    | 1970           | 6360           | 0.45               | 105.1                                                    | 600            | 1940           | 0.45               |
| 346.4                                                    | 1980           | 6210           | 0.44               | 105.6                                                    | 600            | 1890           | 0.44               |
| 348.0                                                    | 1780           | 5940           | 0.45               | 106.1                                                    | 540            | 1810           | 0.45               |
| 349.6                                                    | 1790           | 5890           | 0.45               | 106.6                                                    | 550            | 1790           | 0.45               |
| 351.2                                                    | 1870           | 6240           | 0.45               | 107.0                                                    | 570            | 1900           | 0.45               |
| 352.8                                                    | 2080           | 6360           | 0.44               | 107.5                                                    | 630            | 1940           | 0.44               |
| 354.4                                                    | 2270           | 6560           | 0.43               | 108.0                                                    | 690            | 2000           | 0.43               |
| 356.0                                                    | 2520           | 6300           | 0.40               | 108.5                                                    | 770            | 1920           | 0.40               |
| 357.6                                                    | 2560           | 6530           | 0.41               | 109.0                                                    | 780            | 1990           | 0.41               |
| 359.2                                                    | 2630           | 6360           | 0.40               | 109.5                                                    | 800            | 1940           | 0.40               |
| 360.8                                                    | 2430           | 6210           | 0.41               | 110.0                                                    | 740            | 1890           | 0.41               |
| 362.4                                                    | 2340           | 6300           | 0.42               | 110.5                                                    | 710            | 1920           | 0.42               |
| 364.0                                                    | 2390           | 6120           | 0.41               | 111.0                                                    | 730            | 1860           | 0.41               |
| 365.6                                                    | 2360           | 6180           | 0.41               | 111.4                                                    | 720            | 1880           | 0.41               |
| 367.2                                                    | 2330           | 5970           | 0.41               | 111.9                                                    | 710            | 1820           | 0.41               |
| 368.8                                                    | 2160           | 6210           | 0.43               | 112.4                                                    | 660            | 1890           | 0.43               |
| 370.4                                                    | 1930           | 6150           | 0.45               | 112.9                                                    | 590            | 1870           | 0.45               |
| 372.0                                                    | 1720           | 5970           | 0.45               | 113.4                                                    | 520            | 1820           | 0.45               |
| 373.6                                                    | 1600           | 5780           | 0.46               | 113.9                                                    | 490            | 1760           | 0.46               |
| 375.2                                                    | 1550           | 5600           | 0.46               | 114.4                                                    | 470            | 1710           | 0.46               |
| 376.8                                                    | 1560           | 5750           | 0.46               | 114.9                                                    | 480            | 1750           | 0.46               |
| 378.4                                                    | 1540           | 5860           | 0.46               | 115.3                                                    | 470            | 1790           | 0.46               |
| 380.0                                                    | 1550           | 5700           | 0.46               | 115.8                                                    | 470            | 1740           | 0.46               |
| 381.6                                                    | 1570           | 5810           | 0.46               | 116.3                                                    | 480            | 1770           | 0.46               |
| 383.2                                                    | 1510           | 5860           | 0.46               | 116.8                                                    | 460            | 1790           | 0.46               |
| 384.8                                                    | 1470           | 5750           | 0.46               | 117.3                                                    | 450            | 1750           | 0.46               |
| 386.4                                                    | 1470           | 5630           | 0.46               | 117.8                                                    | 450            | 1720           | 0.46               |
| 388.0                                                    | 1470           | 5680           | 0.46               | 118.3                                                    | 450            | 1730           | 0.46               |
| 389.6                                                    | 1570           | 5650           | 0.46               | 118.8                                                    | 480            | 1720           | 0.46               |
| 391.2                                                    | 1750           | 5920           | 0.45               | 119.3                                                    | 530            | 1800           | 0.45               |
| 392.8                                                    | 1860           | 6000           | 0.45               | 119.7                                                    | 570            | 1830           | 0.45               |
| 394.4                                                    | 1990           | 6120           | 0.44               | 120.2                                                    | 610            | 1860           | 0.44               |
| 396.1                                                    | 2220           | 6430           | 0.43               | 120.7                                                    | 680            | 1960           | 0.43               |
| 397.7                                                    | 2440           | 6630           | 0.42               | 121.2                                                    | 740            | 2020           | 0.42               |
| 399.3                                                    | 2800           | 6770           | 0.40               | 121.7                                                    | 850            | 2060           | 0.40               |
| 400.9                                                    | 2920           | 6960           | 0.39               | 122.2                                                    | 890            | 2120           | 0.39               |

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Source-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                                           |                |                |                    | Metric Units                                             |                |                |                    |
|----------------------------------------------------------|----------------|----------------|--------------------|----------------------------------------------------------|----------------|----------------|--------------------|
| Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio | Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio |
|                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |
| (ft)                                                     | (ft/s)         | (ft/s)         |                    | (m)                                                      | (m/s)          | (m/s)          |                    |
| 402.5                                                    | 3170           | 6960           | 0.37               | 122.7                                                    | 960            | 2120           | 0.37               |
| 404.1                                                    | 3270           | 7030           | 0.36               | 123.2                                                    | 1000           | 2140           | 0.36               |
| 405.7                                                    | 2850           | 6880           | 0.40               | 123.6                                                    | 870            | 2100           | 0.40               |
| 407.3                                                    | 2810           | 7230           | 0.41               | 124.1                                                    | 860            | 2210           | 0.41               |
| 408.9                                                    | 2850           | 7150           | 0.41               | 124.6                                                    | 870            | 2180           | 0.41               |
| 410.5                                                    | 2810           | 7110           | 0.41               | 125.1                                                    | 860            | 2170           | 0.41               |
| 412.1                                                    | 2800           | 7110           | 0.41               | 125.6                                                    | 850            | 2170           | 0.41               |
| 413.7                                                    | 2730           | 7070           | 0.41               | 126.1                                                    | 830            | 2160           | 0.41               |
| 415.3                                                    | 2650           | 6960           | 0.42               | 126.6                                                    | 810            | 2120           | 0.42               |
| 416.9                                                    | 2640           | 6960           | 0.42               | 127.1                                                    | 800            | 2120           | 0.42               |
| 418.5                                                    | 2580           | 6960           | 0.42               | 127.6                                                    | 790            | 2120           | 0.42               |
| 420.1                                                    | 2560           | 6960           | 0.42               | 128.0                                                    | 780            | 2120           | 0.42               |
| 421.7                                                    | 2620           | 6960           | 0.42               | 128.5                                                    | 800            | 2120           | 0.42               |
| 423.3                                                    | 2670           | 6960           | 0.41               | 129.0                                                    | 810            | 2120           | 0.41               |
| 424.9                                                    | 2640           | 6960           | 0.42               | 129.5                                                    | 800            | 2120           | 0.42               |
| 426.5                                                    | 2710           | 6960           | 0.41               | 130.0                                                    | 820            | 2120           | 0.41               |
| 428.1                                                    | 2740           | 7030           | 0.41               | 130.5                                                    | 840            | 2140           | 0.41               |
| 429.7                                                    | 2750           | 6960           | 0.41               | 131.0                                                    | 840            | 2120           | 0.41               |
| 431.3                                                    | 2730           | 6840           | 0.41               | 131.5                                                    | 830            | 2090           | 0.41               |
| 432.9                                                    | 2730           | 6770           | 0.40               | 131.9                                                    | 830            | 2060           | 0.40               |
| 434.5                                                    | 2690           | 6840           | 0.41               | 132.4                                                    | 820            | 2090           | 0.41               |
| 436.1                                                    | 2660           | 6770           | 0.41               | 132.9                                                    | 810            | 2060           | 0.41               |
| 437.7                                                    | 2860           | 6880           | 0.40               | 133.4                                                    | 870            | 2100           | 0.40               |
| 439.3                                                    | 2940           | 6990           | 0.39               | 133.9                                                    | 900            | 2130           | 0.39               |
| 440.9                                                    | 2880           | 6960           | 0.40               | 134.4                                                    | 880            | 2120           | 0.40               |
| 442.5                                                    | 2890           | 7280           | 0.41               | 134.9                                                    | 880            | 2220           | 0.41               |
| 444.1                                                    | 2830           | 7150           | 0.41               | 135.4                                                    | 860            | 2180           | 0.41               |
| 445.7                                                    | 2790           | 7110           | 0.41               | 135.9                                                    | 850            | 2170           | 0.41               |
| 447.3                                                    | 2740           | 7070           | 0.41               | 136.3                                                    | 840            | 2160           | 0.41               |
| 448.9                                                    | 2750           | 6990           | 0.41               | 136.8                                                    | 840            | 2130           | 0.41               |
| 450.5                                                    | 2760           | 7030           | 0.41               | 137.3                                                    | 840            | 2140           | 0.41               |
| 452.1                                                    | 2830           | 6960           | 0.40               | 137.8                                                    | 860            | 2120           | 0.40               |
| 453.7                                                    | 2930           | 7110           | 0.40               | 138.3                                                    | 890            | 2170           | 0.40               |
| 455.3                                                    | 3070           | 7080           | 0.38               | 138.8                                                    | 930            | 2160           | 0.38               |
| 456.9                                                    | 3110           | 7210           | 0.39               | 139.3                                                    | 950            | 2200           | 0.39               |
| 458.5                                                    | 3110           | 7280           | 0.39               | 139.8                                                    | 950            | 2220           | 0.39               |
| 460.1                                                    | 3110           | 7130           | 0.38               | 140.2                                                    | 950            | 2170           | 0.38               |
| 461.7                                                    | 3010           | 7050           | 0.39               | 140.7                                                    | 920            | 2150           | 0.39               |
| 463.3                                                    | 2950           | 7020           | 0.39               | 141.2                                                    | 900            | 2140           | 0.39               |
| 464.9                                                    | 2910           | 7050           | 0.40               | 141.7                                                    | 890            | 2150           | 0.40               |

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio  
Based on Source-to-Receiver Travel Time Data - Borehole SB-1**

| American Units                                           |                |                |                    |
|----------------------------------------------------------|----------------|----------------|--------------------|
| Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio |
|                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |
| (ft)                                                     | (ft/s)         | (ft/s)         |                    |
| 466.5                                                    | 2960           | 7050           | 0.39               |
| 468.1                                                    | 2950           | 6970           | 0.39               |
| 469.7                                                    | 2910           | 7100           | 0.40               |
| 471.3                                                    | 2920           | 7100           | 0.40               |
| 472.9                                                    | 2900           | 7020           | 0.40               |
| 474.5                                                    | 2850           | 6910           | 0.40               |
| 476.1                                                    | 2840           | 6880           | 0.40               |
| 477.7                                                    | 2810           | 6970           | 0.40               |
| 479.3                                                    | 2860           | 6910           | 0.40               |
| 481.0                                                    | 2910           | 7080           | 0.40               |
| 482.6                                                    | 2960           | 7130           | 0.40               |
| 484.2                                                    | 2960           | 7190           | 0.40               |
| 485.8                                                    | 3050           | 7210           | 0.39               |
| 487.4                                                    | 3050           | 7130           | 0.39               |
| 489.0                                                    | 3090           | 7430           | 0.40               |
| 490.6                                                    | 2990           | 7210           | 0.40               |
| 492.2                                                    | 3020           | 6990           | 0.38               |
| 493.8                                                    | 3110           | 7180           | 0.38               |
| 495.4                                                    | 3050           | 7310           | 0.39               |
| 497.0                                                    | 3220           | 7760           | 0.40               |
| 498.6                                                    | 3000           | 7390           | 0.40               |
| 500.2                                                    | 2850           | 7240           | 0.41               |
| 501.8                                                    | 2790           | 7190           | 0.41               |
| 503.4                                                    | 2670           | 7080           | 0.42               |
| 505.0                                                    | 2580           | 6970           | 0.42               |
| 506.6                                                    | 2540           | 6870           | 0.42               |

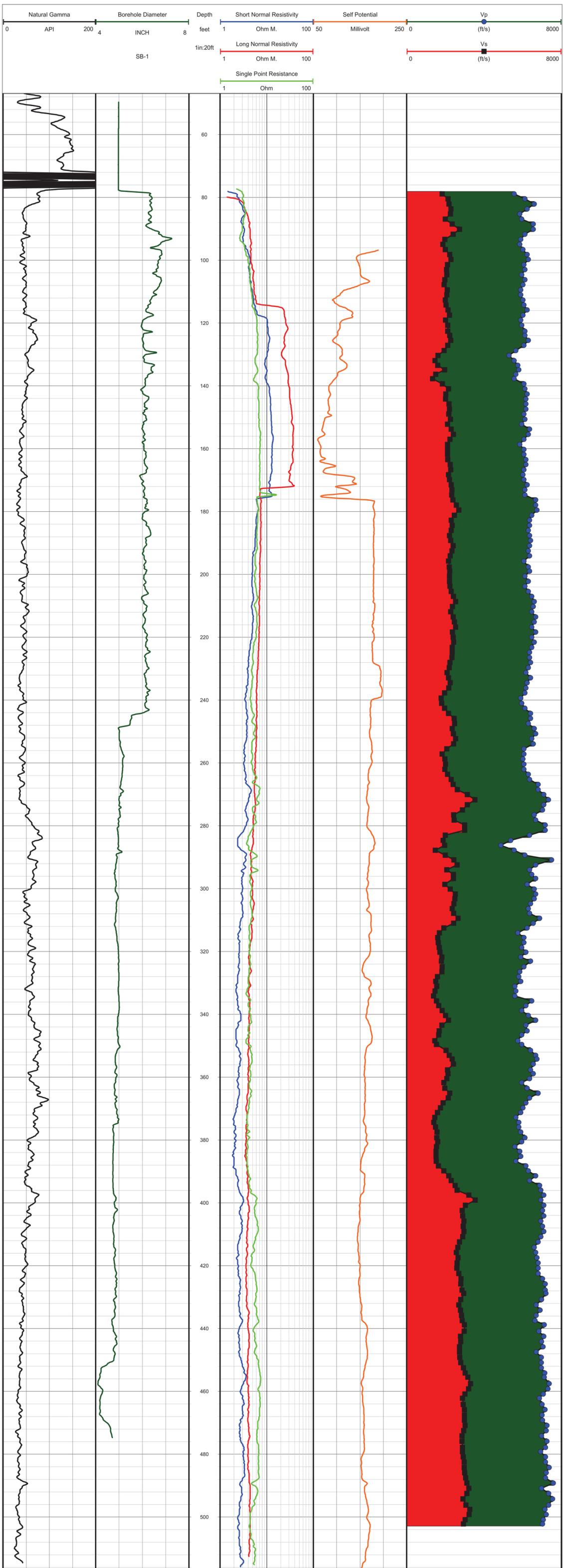
| Metric Units                                             |                |                |                    |
|----------------------------------------------------------|----------------|----------------|--------------------|
| Depth at Midpoint<br>Between Source<br>and Near Receiver | Velocity       |                | Poisson's<br>Ratio |
|                                                          | V <sub>s</sub> | V <sub>p</sub> |                    |
| (m)                                                      | (m/s)          | (m/s)          |                    |
| 142.2                                                    | 900            | 2150           | 0.39               |
| 142.7                                                    | 900            | 2120           | 0.39               |
| 143.2                                                    | 890            | 2160           | 0.40               |
| 143.7                                                    | 890            | 2160           | 0.40               |
| 144.2                                                    | 880            | 2140           | 0.40               |
| 144.6                                                    | 870            | 2110           | 0.40               |
| 145.1                                                    | 870            | 2100           | 0.40               |
| 145.6                                                    | 860            | 2120           | 0.40               |
| 146.1                                                    | 870            | 2110           | 0.40               |
| 146.6                                                    | 890            | 2160           | 0.40               |
| 147.1                                                    | 900            | 2170           | 0.40               |
| 147.6                                                    | 900            | 2190           | 0.40               |
| 148.1                                                    | 930            | 2200           | 0.39               |
| 148.5                                                    | 930            | 2170           | 0.39               |
| 149.0                                                    | 940            | 2260           | 0.40               |
| 149.5                                                    | 910            | 2200           | 0.40               |
| 150.0                                                    | 920            | 2130           | 0.38               |
| 150.5                                                    | 950            | 2190           | 0.38               |
| 151.0                                                    | 930            | 2230           | 0.39               |
| 151.5                                                    | 980            | 2360           | 0.40               |
| 152.0                                                    | 910            | 2250           | 0.40               |
| 152.5                                                    | 870            | 2210           | 0.41               |
| 152.9                                                    | 850            | 2190           | 0.41               |
| 153.4                                                    | 810            | 2160           | 0.42               |
| 153.9                                                    | 790            | 2120           | 0.42               |
| 154.4                                                    | 770            | 2090           | 0.42               |

**APPENDIX B**

**ELOG, MECHANICAL CALIPER, AND  
NATURAL GAMMA LOGS**

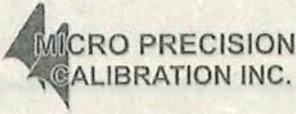


|                 |  |                    |  |                       |  |
|-----------------|--|--------------------|--|-----------------------|--|
| COMPANY F&ME    |  | WELL ID SB-1       |  | STATE SC              |  |
| FIELD           |  | COUNTRY USA        |  |                       |  |
| LOCATION        |  | LAT                |  | LONG                  |  |
| ELEVATION       |  | NA                 |  | K.B.                  |  |
| OTHER SERVICES  |  | ELOG               |  | CAL                   |  |
|                 |  | NG                 |  | PSL                   |  |
| CO F&ME         |  | PERMANENT DATUM    |  | LOG MEAS FROM         |  |
| WELL SB-1       |  | NA                 |  | TOC                   |  |
| FLD             |  | ELEVATION          |  | D.F.                  |  |
| CTY             |  | NA                 |  | G.L.                  |  |
| STE SC          |  | LOG MEAS FROM      |  | DRILLING MEAS FROM NA |  |
| API No          |  | DATE               |  | FLUID IN-HOLE MUD     |  |
|                 |  | July 18, 2016      |  | July 18, 2016         |  |
|                 |  | RUN No             |  | 1                     |  |
|                 |  | ELOG NG            |  | PSL                   |  |
|                 |  | 518                |  | 518                   |  |
|                 |  | DEPTH-LOGGER       |  | CAL NG                |  |
|                 |  | 516                |  | 515                   |  |
|                 |  | LOG DEPEST         |  | LEVEL                 |  |
|                 |  | 79                 |  | 476                   |  |
|                 |  | OPERATING RIG TIME |  | LOG SHALLOW           |  |
|                 |  | RECORDED BY        |  | 79                    |  |
|                 |  | WITNESSED BY       |  | 50                    |  |
|                 |  | JJ                 |  | JJ                    |  |
|                 |  | JJ                 |  | JJ                    |  |
| BOREHOLE RECORD |  | CASING RECORD      |  |                       |  |
| NO              |  | NO                 |  | NO                    |  |
| BIT             |  | FROM               |  | SIZE                  |  |
|                 |  |                    |  | WGT.                  |  |
|                 |  |                    |  | FROM                  |  |
|                 |  |                    |  | TO                    |  |



**APPENDIX C**

**BORING GEOPHYSICAL LOGGING  
SYSTEMS - NIST TRACEABLE  
CALIBRATION RECORDS**



MICRO PRECISION CALIBRATION, INC  
 2165 N. Glassell St.,  
 Orange, CA 92865  
 714-901-5659

## Certificate of Calibration

Date: Jul 14, 2016

Cert No. 222200812421163

**Customer:**

GEOVISION  
 1124 OLYMPIC DRIVE  
 CORONA CA 92881

Work Order #: N/A

MPC Control #: BG9698  
 Asset ID: 15014  
 Gage Type: LOGGER  
 Manufacturer: OYO  
 Model Number: 03331-0000  
 Size: N/A  
 Temp/RH: 72.0°F / 54.0%

Serial Number: 15014  
 Department: N/A  
 Performed By: TYLER MCKEEN  
 Received Condition: IN TOLERANCE  
 Returned Condition: IN TOLERANCE  
 Cal. Date: July 14, 2016  
 Cal. Interval: 12 MONTHS  
 Cal. Due Date: July 14, 2017

**Calibration Notes:**

See attached data sheet for calculations. ( 1 Page )

Calibrated IAW customer supplied data form Rev 2.1  
 Frequency measurement uncertainty = 0.0005 Hz  
 Unit calibrated with Laptop Panasonic Model CF-29,s/n: 4FKSA41798  
 Calibrated To 4:1 Accuracy Ratio

**Standards Used to Calibrate Equipment**

| I.D.   | Description.       | Model  | Serial     | Manufacturer    | Cal. Due Date | Traceability #  |
|--------|--------------------|--------|------------|-----------------|---------------|-----------------|
| BD7715 | UNIVERSAL COUNTER  | 53131A | 3416A05377 | HEWLETT PACKARD | Aug 26, 2016  | 222008122635161 |
| T1100  | UNIVERSAL COUNTER  | 53131A | 3546A09912 | HEWLETT PACKARD | Feb 2, 2017   | 222008122827657 |
| AM4000 | WAVEFORM GENERATOR | 33250A | MY40000703 | AGILENT         | Jul 8, 2017   | 222200812420653 |

**Procedures Used in this Event**

| Procedure Name    | Description                                                 |
|-------------------|-------------------------------------------------------------|
| GEOVISION SEISMIC | Suspension PS Seismic Logger/Recorder Calibration Procedure |

Calibrating Technician:

TYLER MCKEEN

QC Approval:

JIM WILLIAMS

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA's Publication and NIST Technical Note 1297, 1994 Edition. Services rendered comply with ISO 17025:2005, ANSI/NC SL Z540-1, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

All standards are traceable to SI through the National Institute of Standards and Technology (NIST) and/or recognized national or international standards laboratories. Services rendered include proper manufacturer's service instruction and are warranted for no less than thirty (30) days. This report may not be reproduced in part or in a whole without the prior written approval of the issuing MPC lab.



BG 9698 15014



SUSPENSION PS SEISMIC LOGGER/RECORDER CALIBRATION DATA FORM

INSTRUMENT DATA

|                         |                        |                   |                        |
|-------------------------|------------------------|-------------------|------------------------|
| System mfg.:            | <u>0/0</u>             | Model no.:        | <u>3331</u>            |
| Serial no.:             | <u>15014</u>           | Calibration date: | <u>07/14/2016</u>      |
| By:                     | <u>Emily Feldman</u>   | Due date:         | <u>07/14/2017</u>      |
| Counter mfg.:           | <u>Hewlett Packard</u> | Model no.:        | <u>53/31A</u>          |
| Serial no.:             | <u>3546A09912</u>      | Calibration date: | <u>02/02/16</u>        |
| By:                     | <u>Micro Precision</u> | Due date:         | <u>02/02/17</u>        |
| Signal generator mfg.:  | <u>Agilent</u>         | Model no.:        | <u>07 33250A</u>       |
| Serial no.:             | <u>MY40000703</u>      | Calibration date: | <u>07/08/16</u>        |
| By:                     | <u>Micro Precision</u> | Due date:         | <u>07/08/17</u>        |
| Laptop controller mfg.: | <u>Panasonic</u>       | Model no.:        | <u>CF-29 Toughbook</u> |
| Serial no.:             | <u>4FKSA41798</u>      | Calibration date: | <u>N/A</u>             |

SYSTEM SETTINGS:

Gain: x10

Filter: open

Range: 200 - 5 MS

Delay: 4 msec

Stack (1 std): 1

System date = correct date and time: yes, 12:25, 7/14/16

PROCEDURE:

Set sine wave frequency to target frequency with amplitude of approximately 0.25 volt peak  
 Note actual frequency on data form.  
 Set sample period and record data file to disk. Note file name on data form.  
 Pick duration of 9 cycles using PSLOG.EXE program, note duration on data form, and save as .sps file. Calculate average frequency for each channel pair and note on data form.  
 Average frequency must be within +/- 1% of actual frequency at all data points.

Maximum error ((AVG-ACT)/ACT\*100)% As found 0.22% As left 0.22%

| Target Frequency (Hz) | Actual Frequency (Hz) | Sample Period (microS) | File Name | Time for 9 cycles Hn (msec) | Average Frequency Hn (Hz) | Time for 9 cycles Hr (msec) | Average Frequency Hr (Hz) | Time for 9 cycles V (msec) | Average Frequency V (Hz) |
|-----------------------|-----------------------|------------------------|-----------|-----------------------------|---------------------------|-----------------------------|---------------------------|----------------------------|--------------------------|
| 50.00                 | 50.00                 | 200                    | Cal2-001  | 180                         | 50.00                     | 180                         | 50.00                     | 179.8                      | 50.05                    |
| 100.0                 | 100.0                 | 100                    | 002       | 89.9                        | 99.9                      | 89.9                        | 99.9                      | 90.2                       | 99.9                     |
| 200.0                 | 200.0                 | 50                     | 003       | 44.95                       | 200.2                     | 45                          | 200.0                     | 45                         | 200.0                    |
| 500.0                 | 500.0                 | 20                     | 004       | 18.02                       | 499.5                     | 18.0                        | 499.5                     | 17.98                      | 500.6                    |
| 1000                  | 1000                  | 10                     | 005       | 9.01                        | 998.9                     | 8.98                        | 1002.2                    | 9                          | 1000                     |
| 2000                  | 2,000                 | 5                      | 006       | 4.505                       | 1998                      | 4.50                        | 2000                      | 4.495                      | 2002                     |

Calibrated by: Tyler McKean 7/14/16

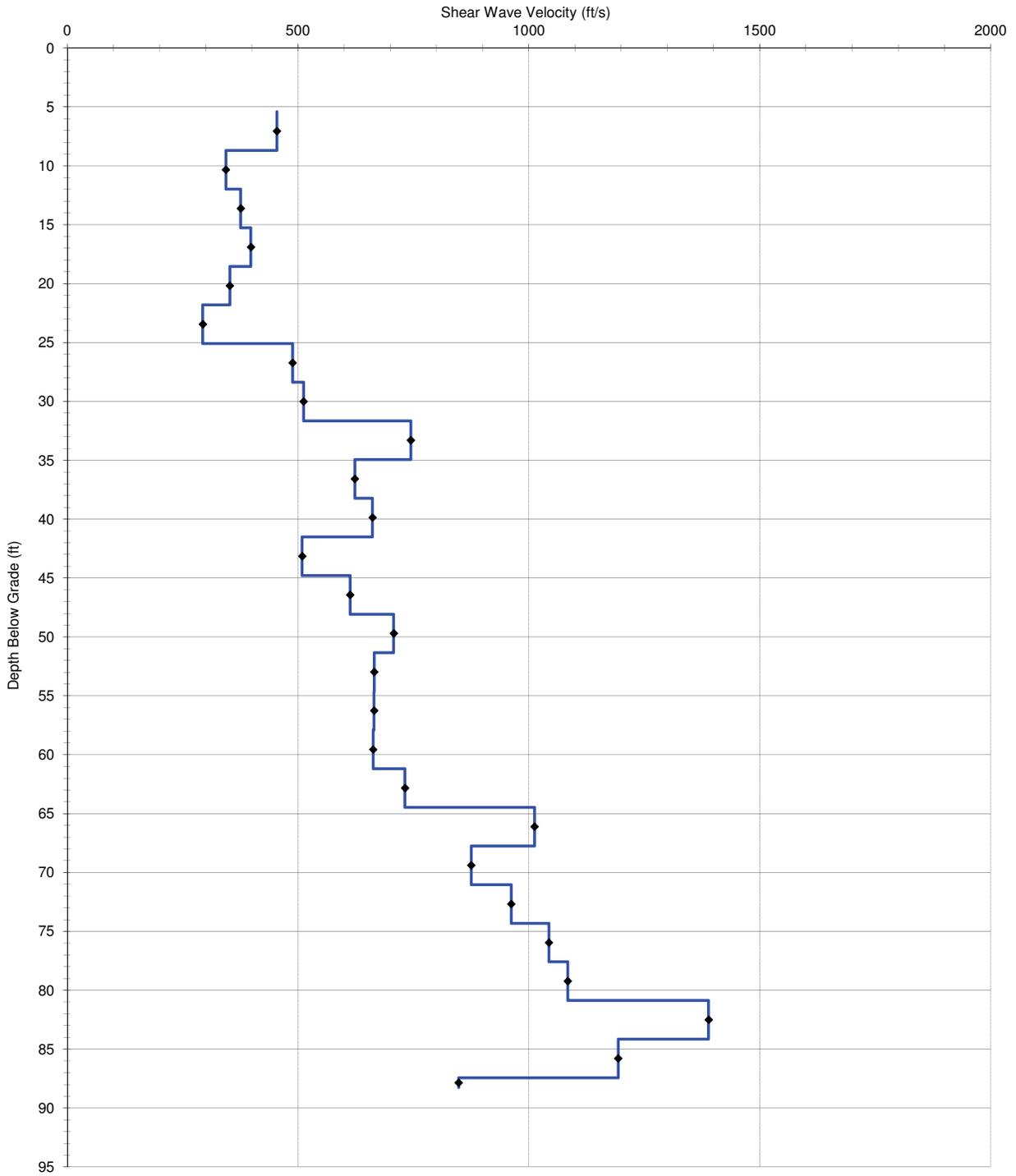
Name Date Signature

Witnessed by: Emily Feldman 7/14/16

Name Date Signature



Shear Wave Velocity- SCPT-2  
US 21 Replacement Bridge Over Harbor River  
14-54074  
August 25<sup>th</sup>, 2014





# ConeTec Shear Wave Velocity Data Reduction Sheet

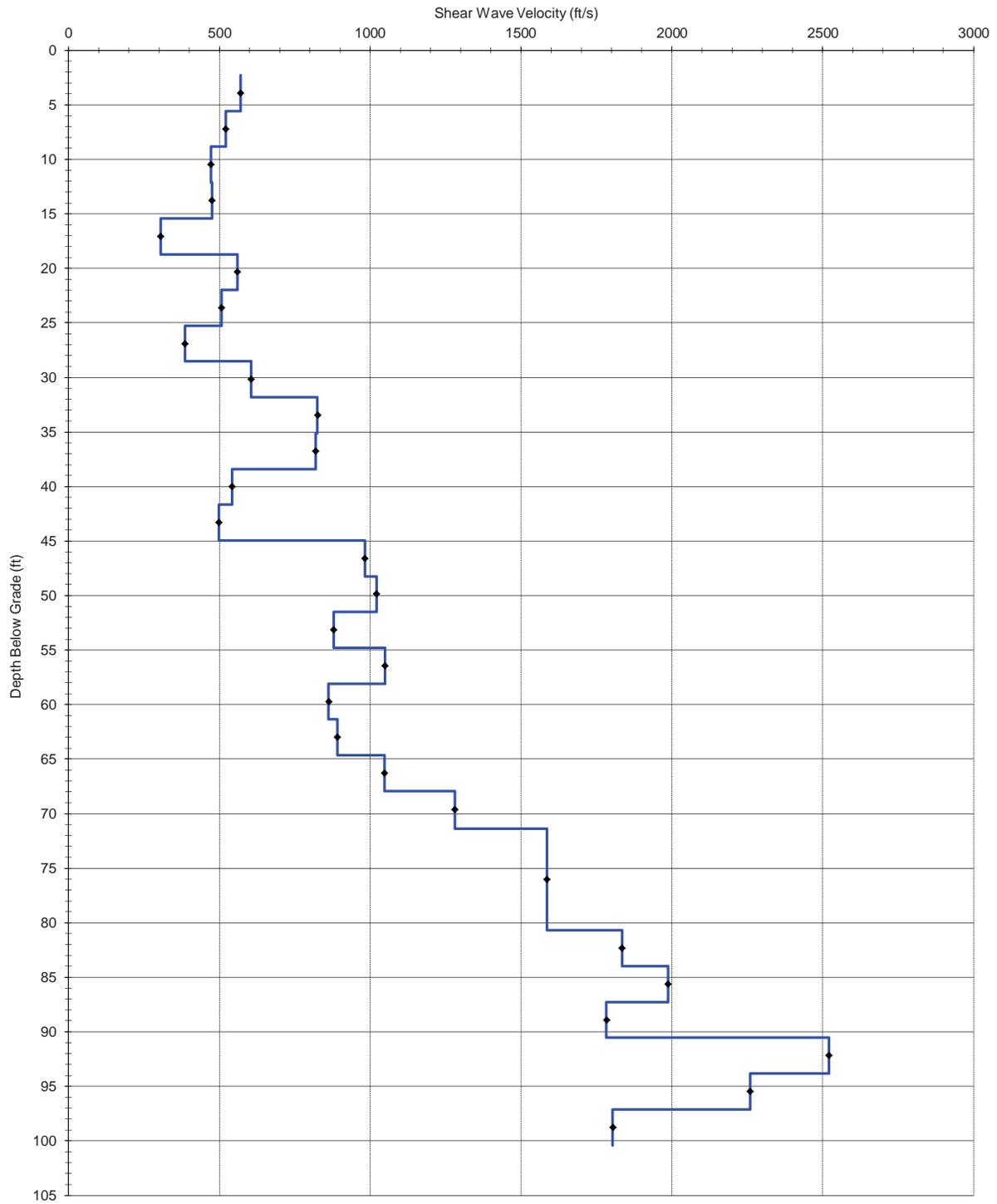
Hole: SCPT-2  
Location: US 21 Replacement Bridge Over Harbor River  
Cone: AD184  
Date: 25-Aug-14  
Source: Beam

|               |        |
|---------------|--------|
| Source Depth  | 0.00 m |
| Source Offset | 2.15 m |

| Tip Depth (m) | Geophone Depth(m) | Travel Path (m) | Interval time (ms) | Velocity (m/s) | Velocity (ft/s) | Interval Depth (m) | Interval Depth (ft) |
|---------------|-------------------|-----------------|--------------------|----------------|-----------------|--------------------|---------------------|
| 0.00          |                   |                 |                    |                |                 |                    |                     |
| 1.85          | 1.65              | 2.71            |                    |                |                 |                    |                     |
| 2.85          | 2.65              | 3.41            | 5.07               | 138.5          | 454.4           | 2.15               | 7.05                |
| 3.85          | 3.65              | 4.24            | 7.86               | 104.8          | 343.7           | 3.15               | 10.33               |
| 4.85          | 4.65              | 5.12            | 7.74               | 114.6          | 375.9           | 4.15               | 13.61               |
| 5.85          | 5.65              | 6.05            | 7.61               | 121.3          | 397.9           | 5.15               | 16.90               |
| 6.85          | 6.65              | 6.99            | 8.78               | 107.5          | 352.5           | 6.15               | 20.18               |
| 7.85          | 7.65              | 7.95            | 10.69              | 89.5           | 293.8           | 7.15               | 23.46               |
| 8.85          | 8.65              | 8.91            | 6.50               | 148.8          | 488.2           | 8.15               | 26.74               |
| 9.85          | 9.65              | 9.89            | 6.24               | 156.1          | 512.0           | 9.15               | 30.02               |
| 10.85         | 10.65             | 10.86           | 4.31               | 226.9          | 744.3           | 10.15              | 33.30               |
| 11.85         | 11.65             | 11.85           | 5.17               | 189.9          | 623.0           | 11.15              | 36.58               |
| 12.85         | 12.65             | 12.83           | 4.89               | 201.5          | 661.2           | 12.15              | 39.86               |
| 13.85         | 13.65             | 13.82           | 6.36               | 155.1          | 509.0           | 13.15              | 43.14               |
| 14.85         | 14.65             | 14.81           | 5.29               | 186.9          | 613.1           | 14.15              | 46.42               |
| 15.85         | 15.65             | 15.80           | 4.59               | 215.6          | 707.2           | 15.15              | 49.70               |
| 16.85         | 16.65             | 16.79           | 4.89               | 202.8          | 665.4           | 16.15              | 52.98               |
| 17.85         | 17.65             | 17.78           | 4.90               | 202.6          | 664.7           | 17.15              | 56.27               |
| 18.85         | 18.65             | 18.77           | 4.92               | 202.0          | 662.7           | 18.15              | 59.55               |
| 19.85         | 19.65             | 19.77           | 4.46               | 223.0          | 731.6           | 19.15              | 62.83               |
| 20.85         | 20.65             | 20.76           | 3.22               | 308.6          | 1012.3          | 20.15              | 66.11               |
| 21.85         | 21.65             | 21.76           | 3.73               | 266.7          | 875.1           | 21.15              | 69.39               |
| 22.85         | 22.65             | 22.75           | 3.39               | 293.2          | 962.0           | 22.15              | 72.67               |
| 23.85         | 23.65             | 23.75           | 3.13               | 318.1          | 1043.5          | 23.15              | 75.95               |
| 24.85         | 24.65             | 24.74           | 3.01               | 330.4          | 1084.0          | 24.15              | 79.23               |
| 25.85         | 25.65             | 25.74           | 2.35               | 423.4          | 1389.2          | 25.15              | 82.51               |
| 26.85         | 26.65             | 26.74           | 2.74               | 363.8          | 1193.5          | 26.15              | 85.79               |
| 27.10         | 26.90             | 26.99           | 0.96               | 258.5          | 848.0           | 26.78              | 87.84               |



Shear Wave Velocity- SCPT-11  
US 21 Replacement Bridge Over Harbor River  
15-54107  
November 18<sup>th</sup>, 2015





Job No: 15-54107  
Client: F&ME  
Project: Harbor River  
Sounding ID: SCPT-11  
Date: 11/18/2015

Seismic Source: Beam  
Source Offset (ft): 4.75  
Source Depth (ft): 0.00  
Geophone Offset (ft): 0.66

### SCPT<sub>u</sub> SHEAR WAVE VELOCITY TEST RESULTS - Vs

| Tip Depth (ft) | Geophone Depth (ft) | Ray Path (ft) | Ray Path Difference (ft) | Travel Time Interval (ms) | Interval Velocity (ft/s) |
|----------------|---------------------|---------------|--------------------------|---------------------------|--------------------------|
| 2.95           | 2.30                | 5.28          |                          |                           |                          |
| 6.23           | 5.58                | 7.33          | 2.05                     | 3.59                      | 571                      |
| 9.51           | 8.86                | 10.05         | 2.73                     | 5.23                      | 521                      |
| 12.80          | 12.14               | 13.04         | 2.98                     | 6.32                      | 472                      |
| 16.08          | 15.42               | 16.13         | 3.10                     | 6.52                      | 475                      |
| 19.36          | 18.70               | 19.29         | 3.16                     | 10.35                     | 305                      |
| 22.64          | 21.98               | 22.49         | 3.19                     | 5.71                      | 559                      |
| 25.92          | 25.26               | 25.71         | 3.22                     | 6.34                      | 507                      |
| 29.20          | 28.54               | 28.94         | 3.23                     | 8.38                      | 386                      |
| 32.48          | 31.82               | 32.18         | 3.24                     | 5.36                      | 605                      |
| 35.76          | 35.10               | 35.42         | 3.25                     | 3.94                      | 825                      |
| 39.04          | 38.39               | 38.68         | 3.25                     | 3.97                      | 820                      |
| 42.32          | 41.67               | 41.94         | 3.26                     | 6.00                      | 543                      |
| 45.60          | 44.95               | 45.20         | 3.26                     | 6.55                      | 498                      |
| 48.88          | 48.23               | 48.46         | 3.26                     | 3.32                      | 982                      |
| 52.17          | 51.51               | 51.73         | 3.27                     | 3.20                      | 1020                     |
| 55.45          | 54.79               | 55.00         | 3.27                     | 3.72                      | 879                      |
| 58.73          | 58.07               | 58.26         | 3.27                     | 3.12                      | 1049                     |
| 62.01          | 61.35               | 61.53         | 3.27                     | 3.79                      | 862                      |
| 65.29          | 64.63               | 64.81         | 3.27                     | 3.67                      | 892                      |
| 68.57          | 67.91               | 68.08         | 3.27                     | 3.12                      | 1047                     |
| 72.01          | 71.36               | 71.52         | 3.44                     | 2.69                      | 1280                     |
| 81.36          | 80.71               | 80.85         | 9.33                     | 5.89                      | 1585                     |
| 84.65          | 83.99               | 84.12         | 3.28                     | 1.79                      | 1834                     |
| 87.93          | 87.27               | 87.40         | 3.28                     | 1.65                      | 1987                     |
| 91.21          | 90.55               | 90.68         | 3.28                     | 1.84                      | 1783                     |
| 94.49          | 93.83               | 93.95         | 3.28                     | 1.30                      | 2520                     |
| 97.77          | 97.11               | 97.23         | 3.28                     | 1.45                      | 2260                     |
| 101.05         | 100.39              | 100.51        | 3.28                     | 1.82                      | 1804                     |

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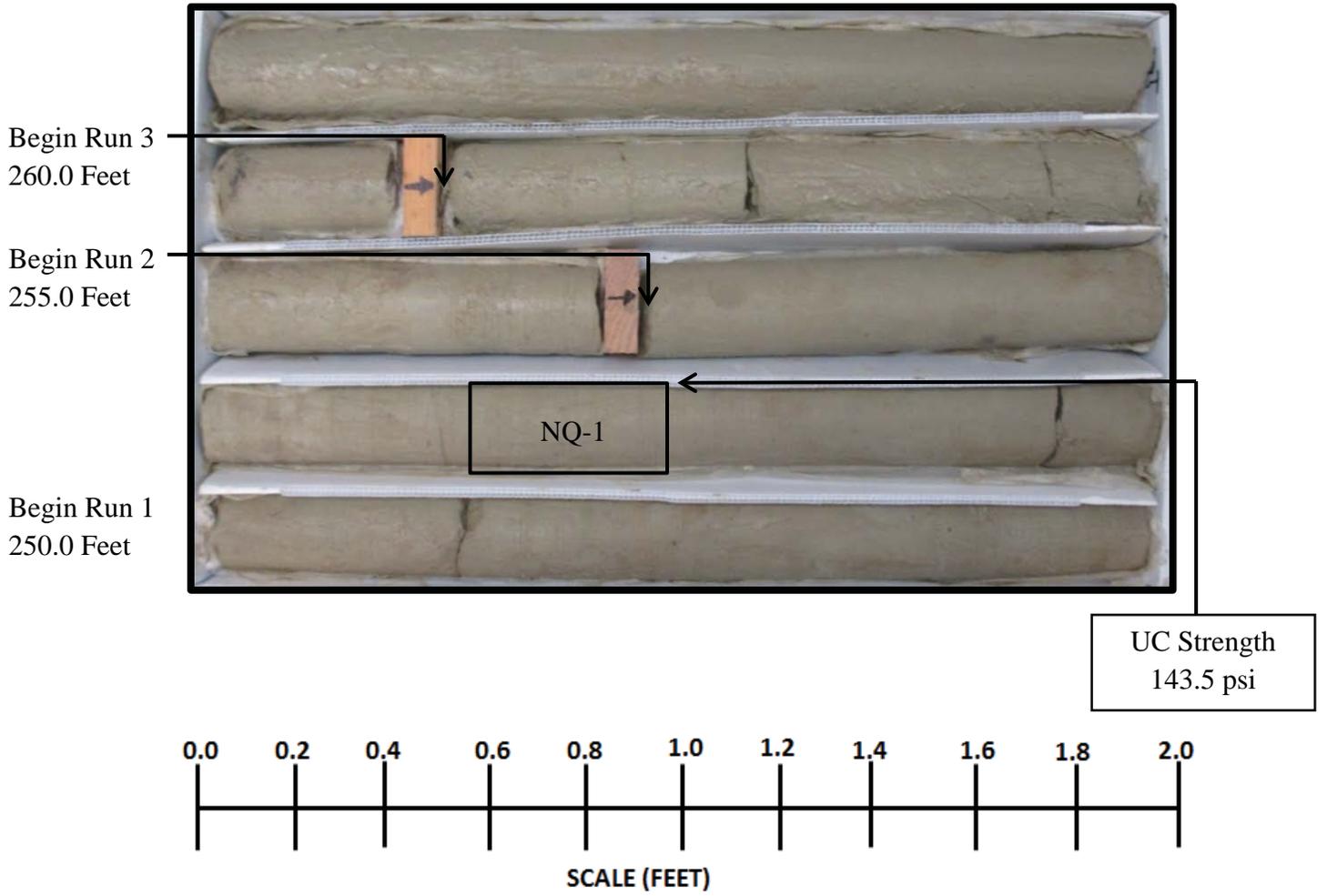
US 21 (SEA ISLAND PKWY.) BRIDGE REPLACEMENT OVER  
HARBOR RIVER  
GEOTECHNICAL BASE LINE REPORT

**APPENDIX**

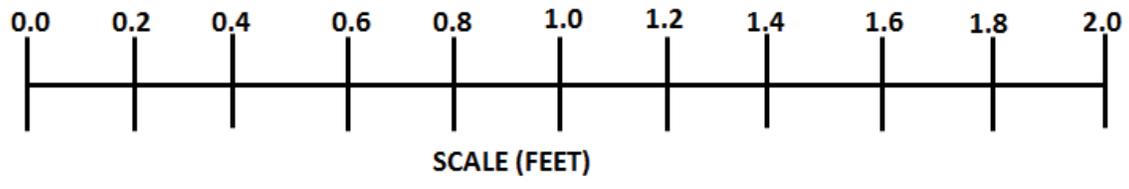
SECTION 6

CORE SPECIMEN PHOTOS

# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens



# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens





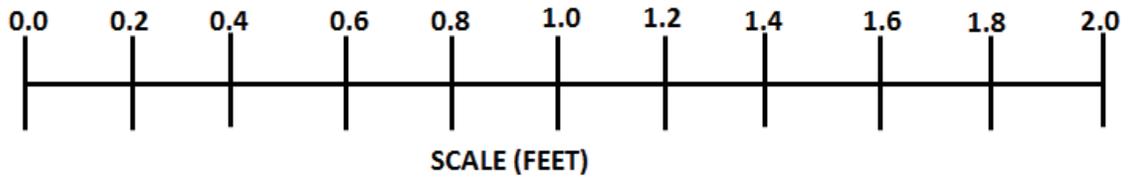
# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 8  
285.0 Feet



Begin Run 7  
280.0 Feet

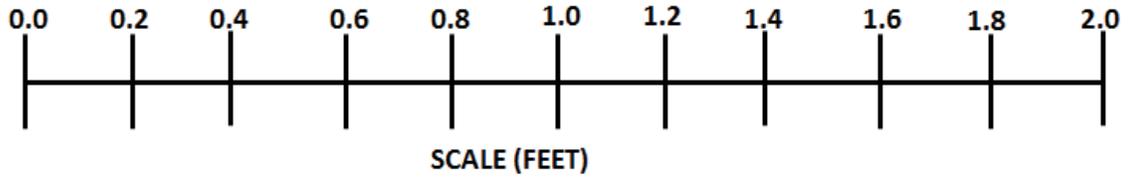
Begin Run 6  
275.0 Feet



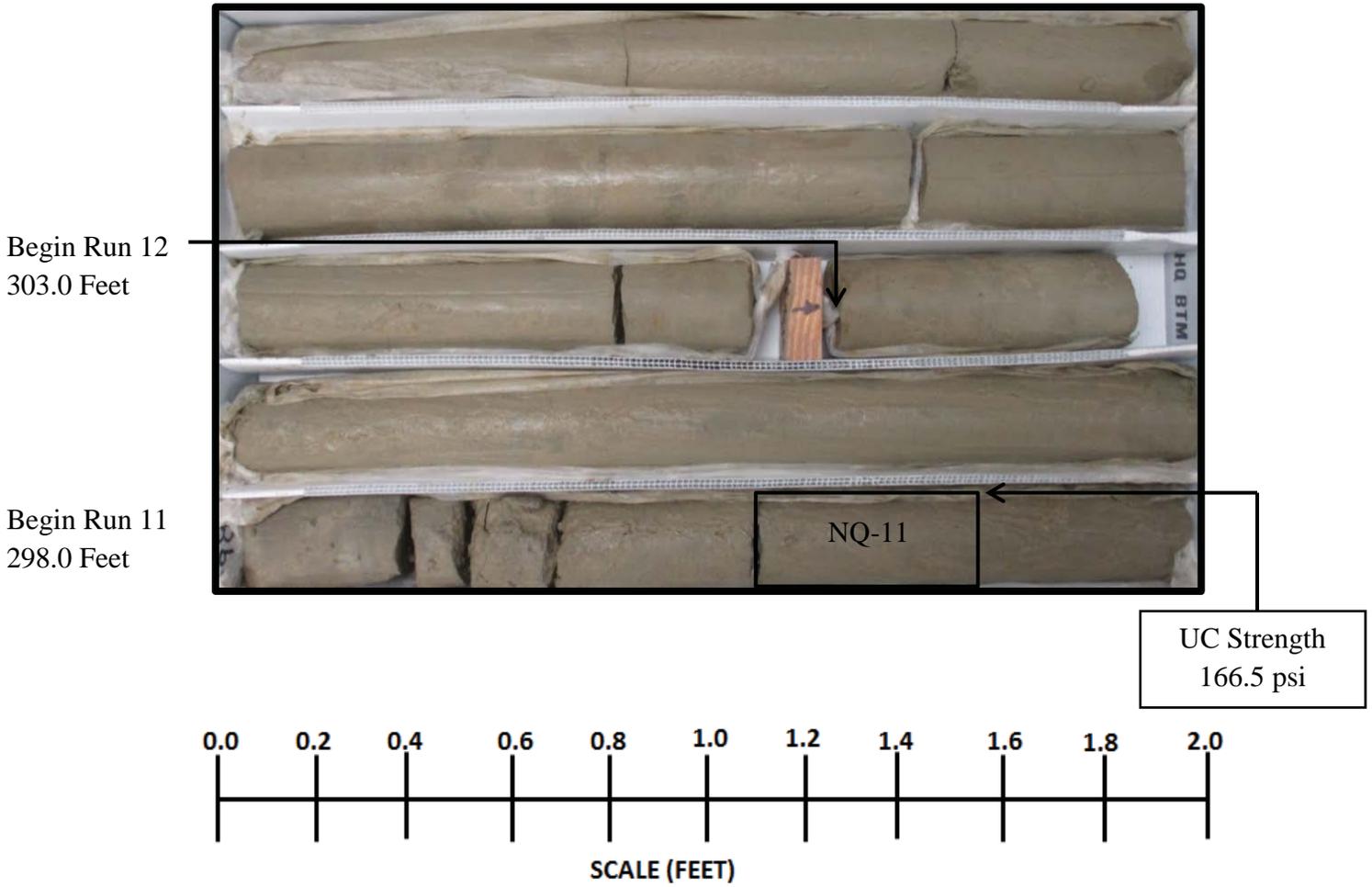
# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 10  
295.0 Feet

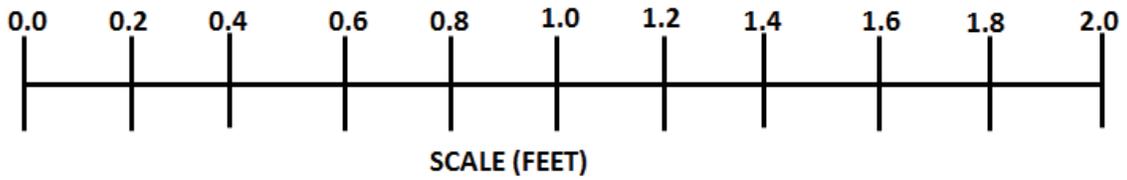
Begin Run 9  
290.0 Feet



# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens



# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

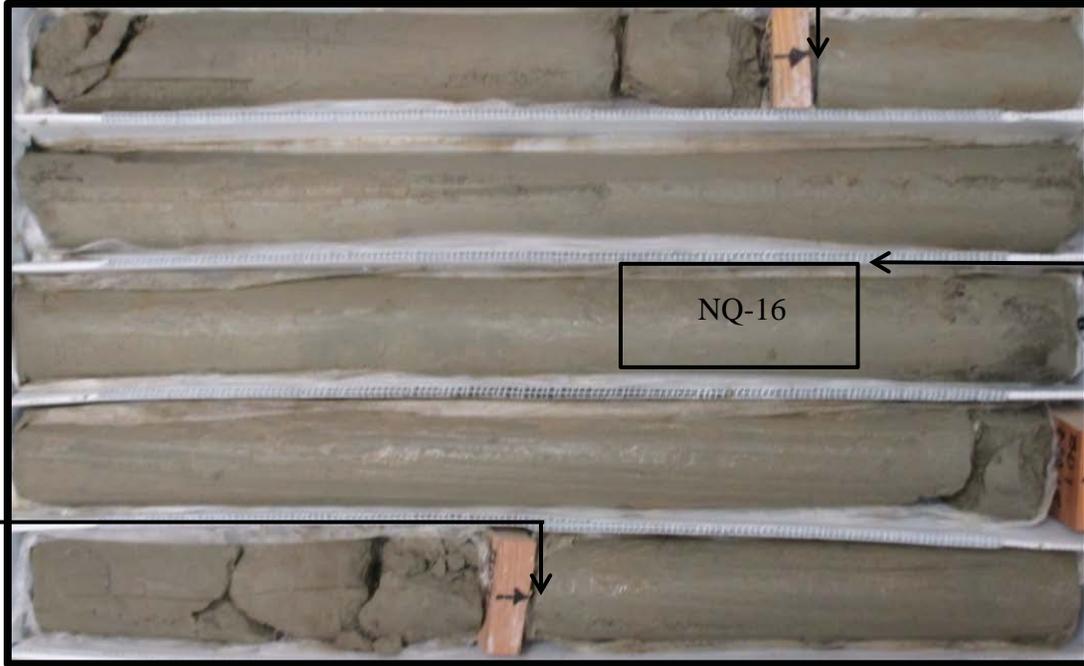


# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 17  
328.0 Feet

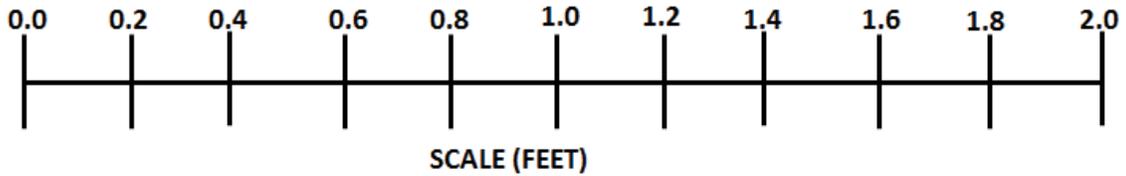
Begin Run 16  
323.0 Feet

Begin Run 15  
318.0 Feet

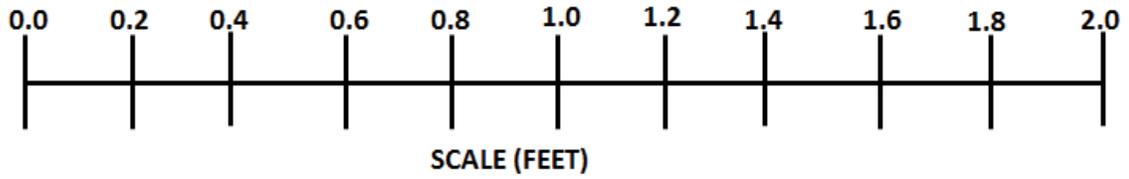


NQ-16

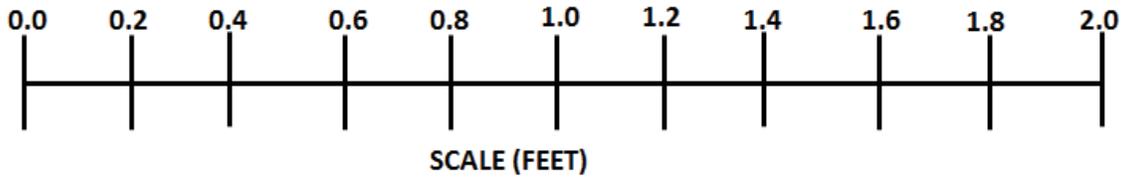
UC Strength  
85.9 psi



# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

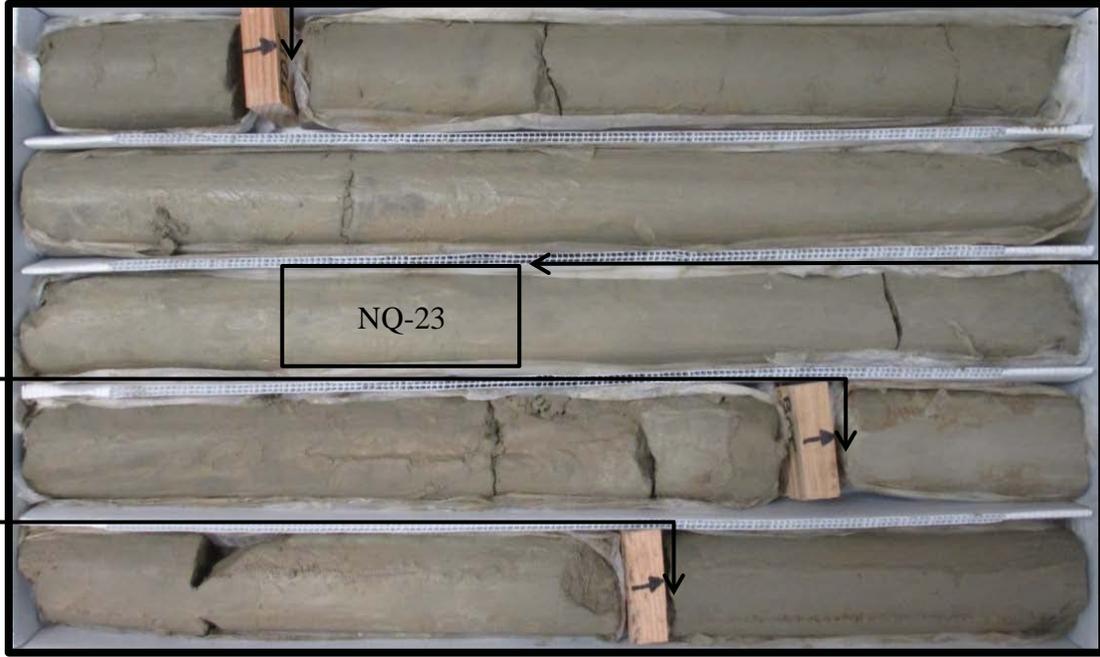


# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens



# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 24  
363.0 Feet

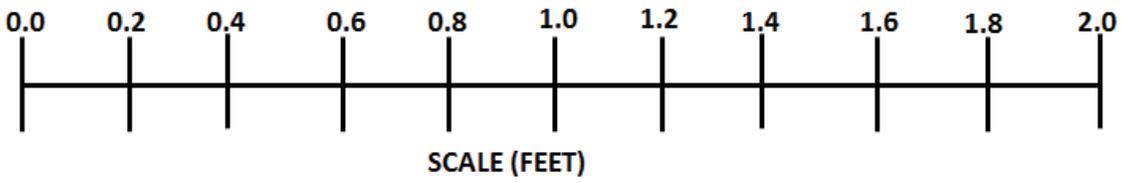


Begin Run 23  
358.0 Feet

Begin Run 22  
353.0 Feet

NQ-23

UC Strength  
236.4 psi

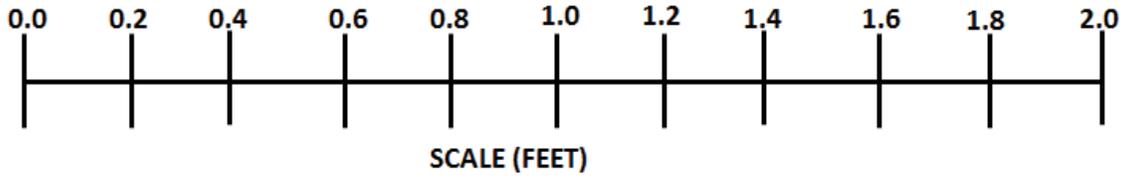




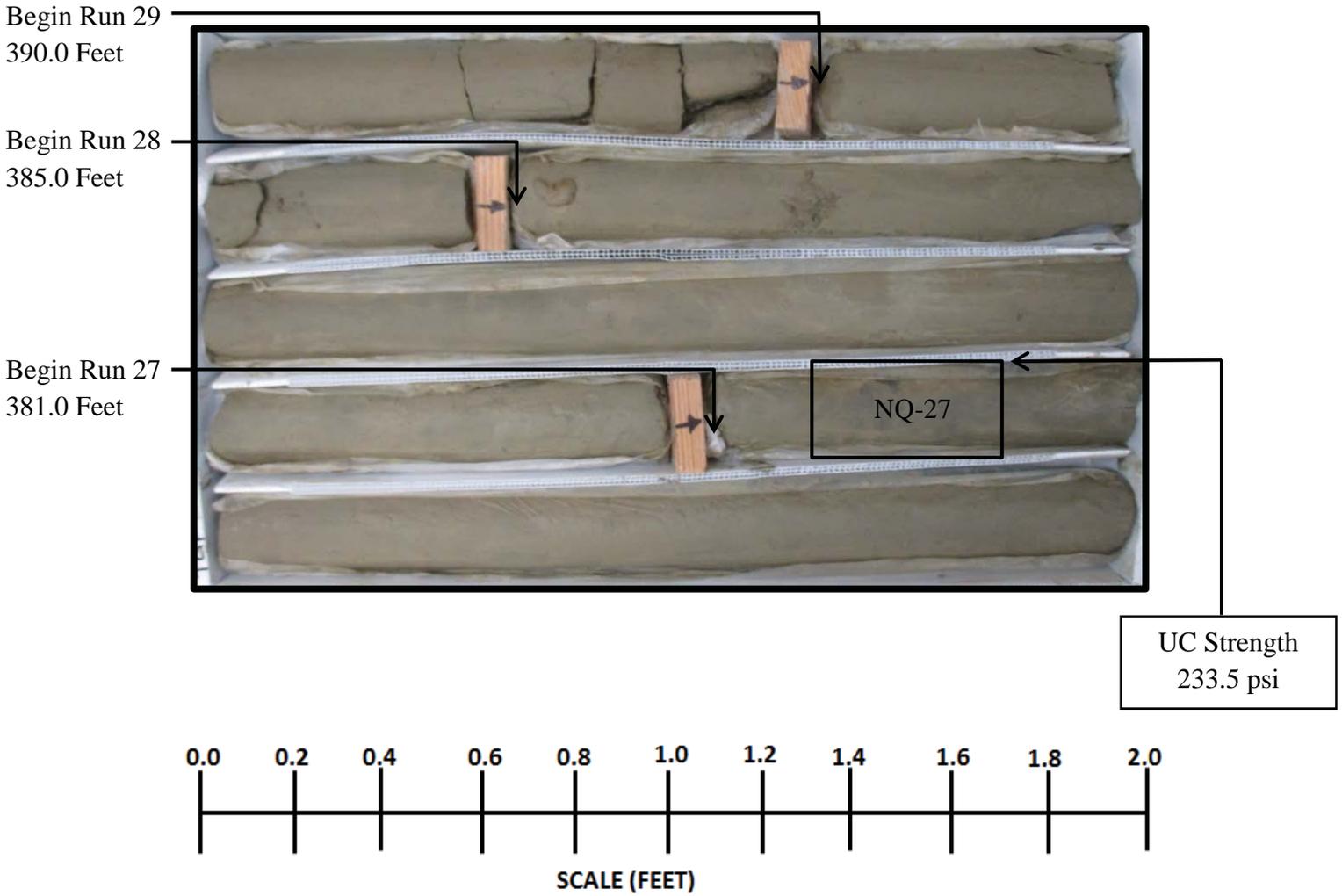
# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 26  
373.0 Feet

Begin Run 25  
368.0 Feet



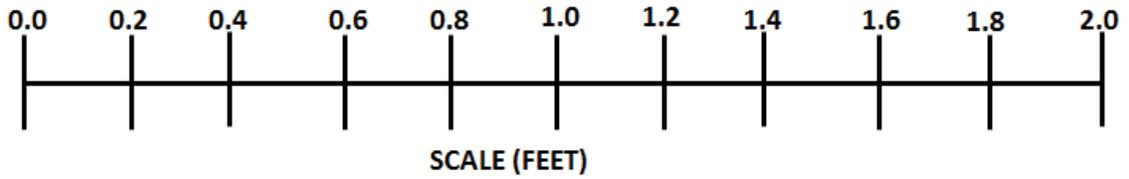
# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens



# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 31  
400.0 Feet

Begin Run 30  
395.0 Feet

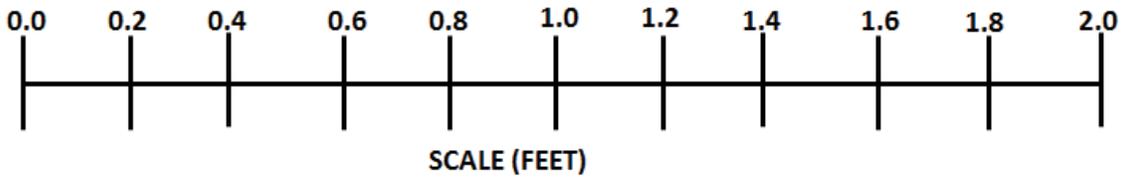


# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 33  
410.0 Feet



Begin Run 32  
405.0 Feet

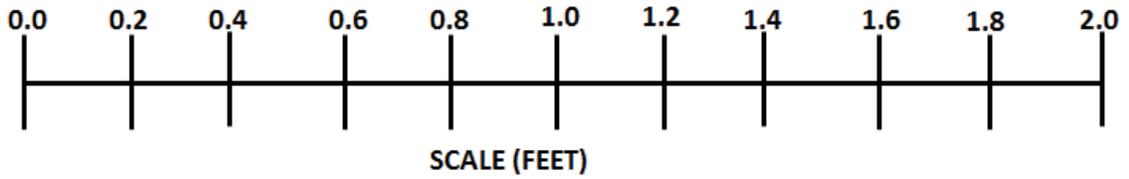


# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 35  
420.0 Feet



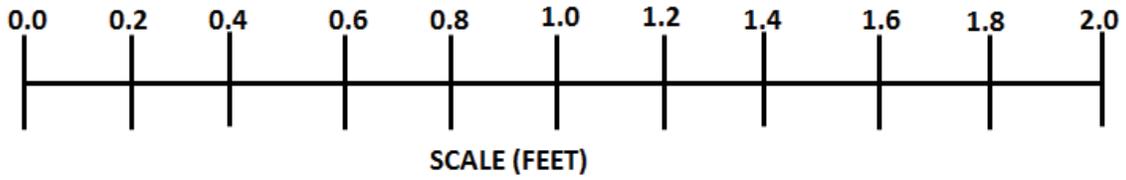
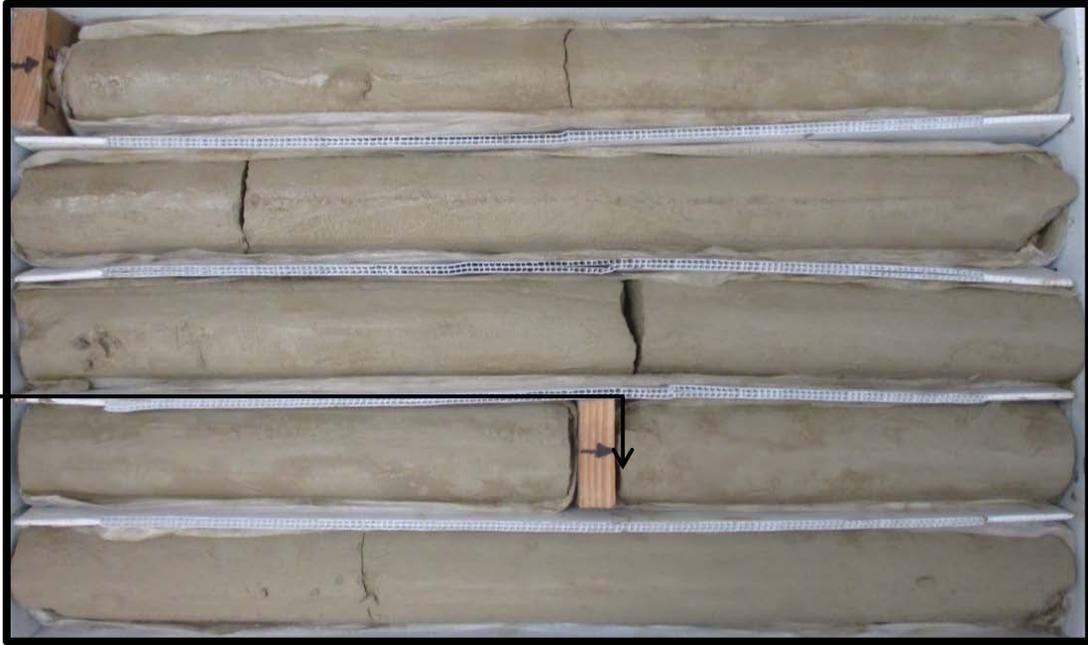
Begin Run 34  
415.0 Feet



# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 37  
430.0 Feet

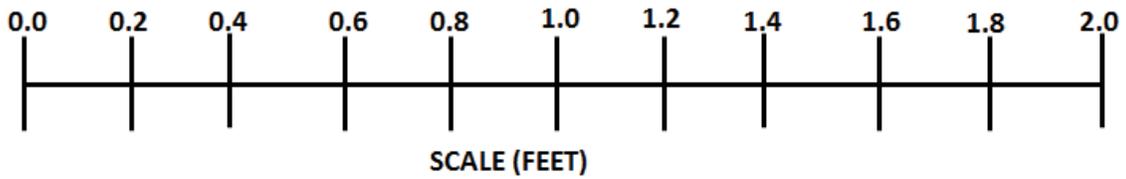
Begin Run 36  
425.0 Feet



# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 39  
440.0 Feet

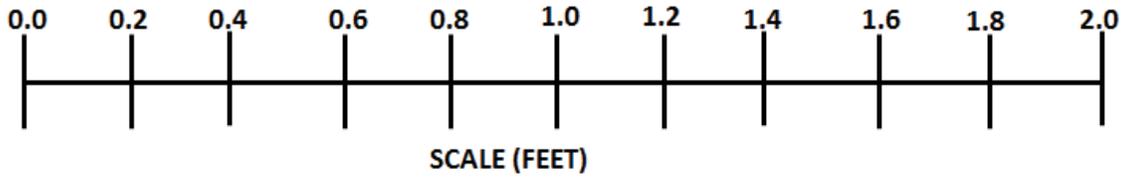
Begin Run 38  
435.0 Feet



# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

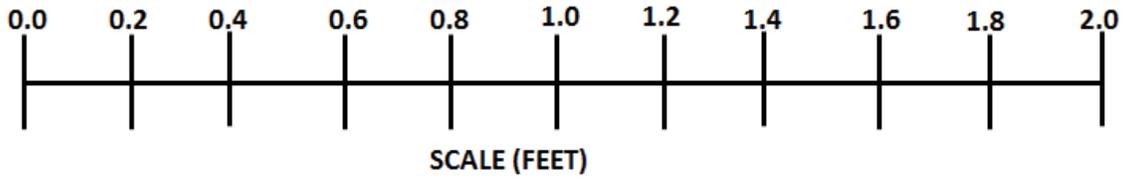
Begin Run 41  
450.0 Feet

Begin Run 40  
445.0 Feet



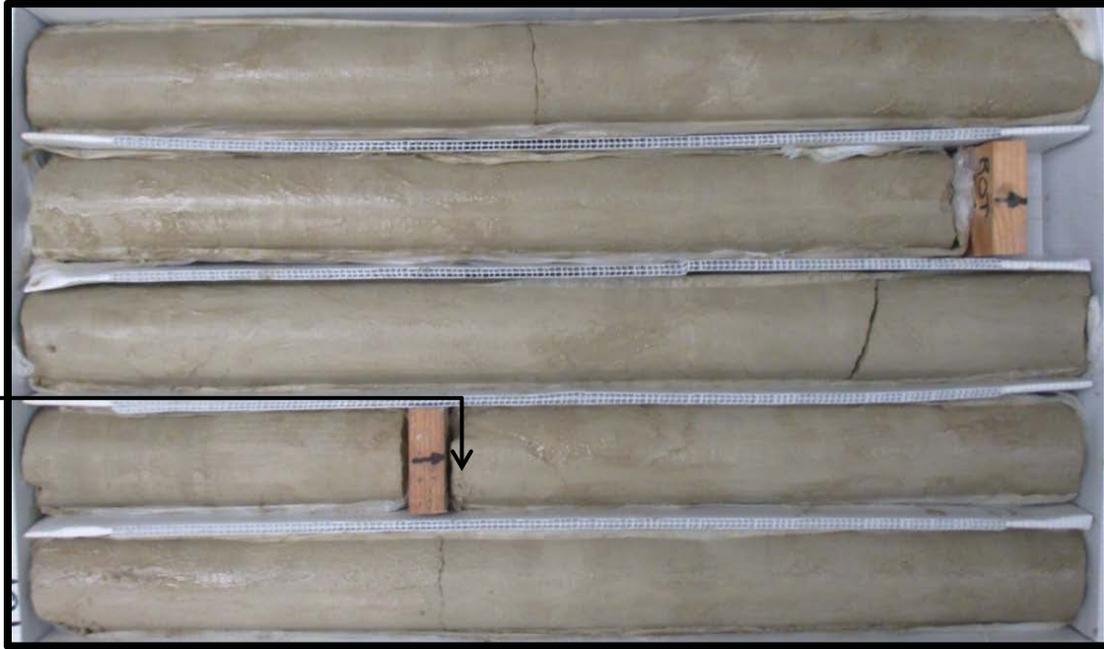


# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

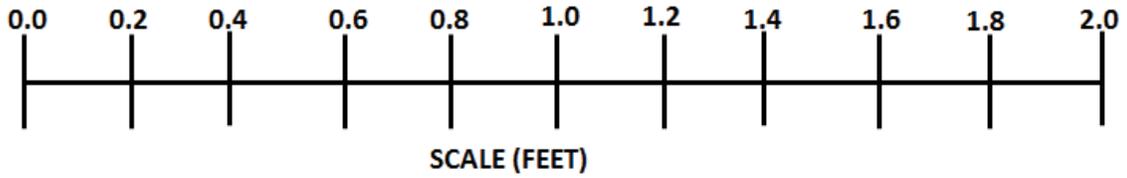


# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 45  
470.0 Feet



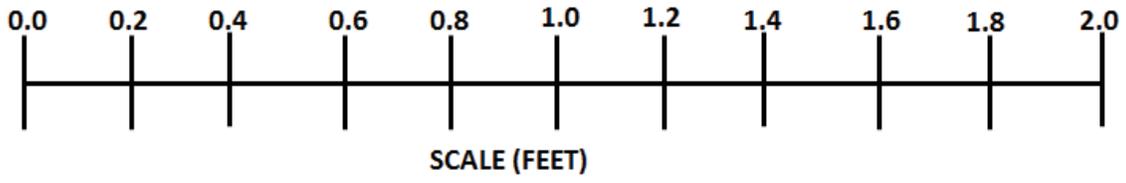
Begin Run 44  
465.0 Feet



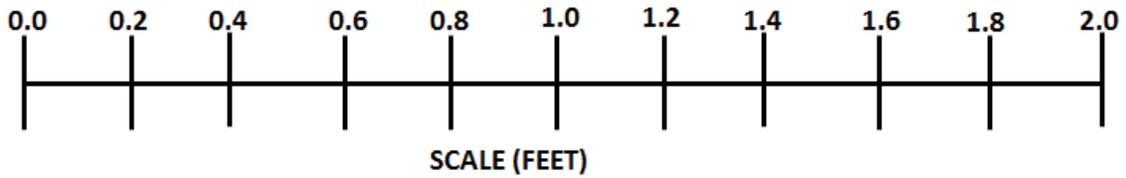
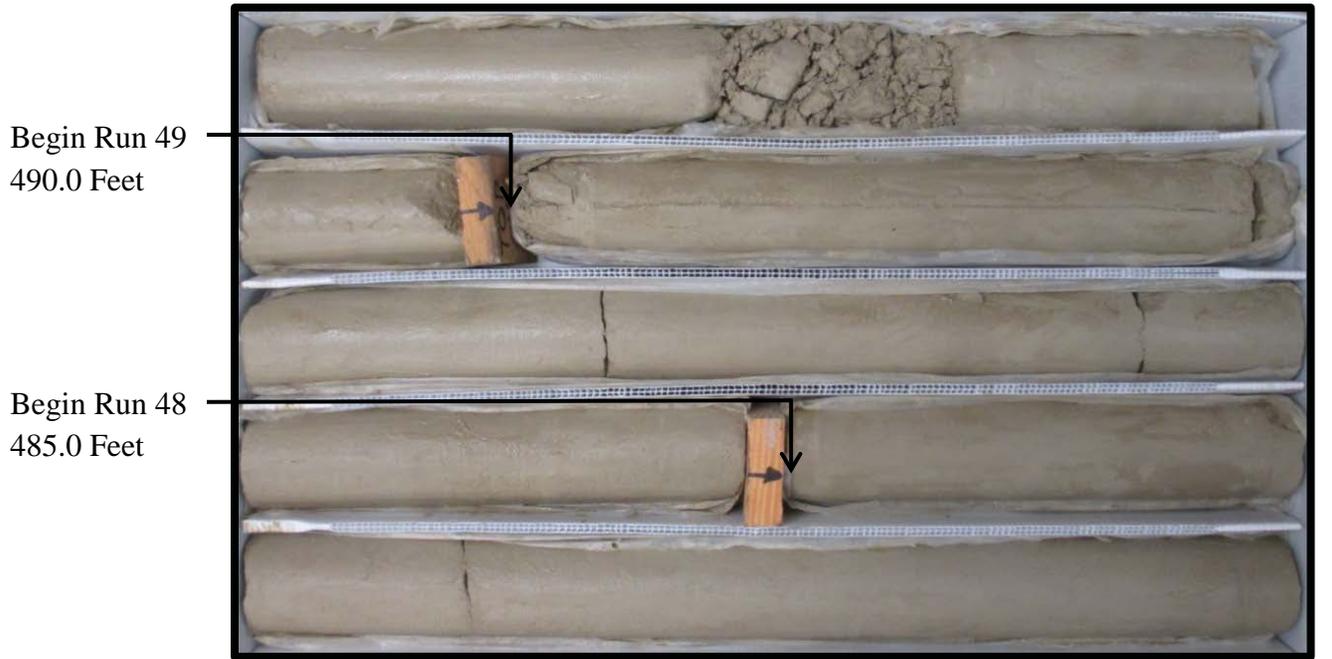
# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens

Begin Run 47  
480.0 Feet

Begin Run 46  
475.0 Feet

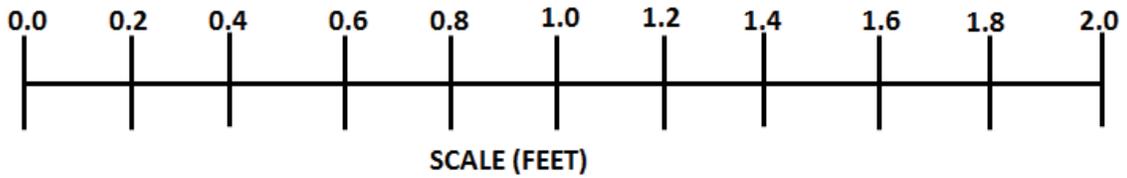


# US 21 Bridge Replacement over Harbor River Deep Hole Seismic Boring Core Specimens



US 21 Bridge Replacement over Harbor River  
Deep Hole Seismic Boring Core Specimens

Begin Run 50  
495.0 Feet



US 21 Bridge Replacement over Harbor River  
Deep Hole Seismic Boring Core Specimens

End Run 50  
500.0 Feet



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US 21 (SEA ISLAND PKWY.) BRIDGE REPLACEMENT OVER  
HARBOR RIVER  
GEOTECHNICAL BASE LINE REPORT

**APPENDIX**

SECTION 7

LABORATORY TEST RESULTS

**US-21 BRIDGE REPLACEMENT OVER HARBOR RIVER  
BEAUFORT COUNTY, SOUTH CAROLINA  
F&ME PROJECT NO.: G5396.00**

**FINAL LABORATORY ANALYSIS SUMMARY**

| BORING NUMBER | SAMPLE DEPTH (ft) | % MOISTURE | % GRAVEL | % SAND | % FINES (SILT/CLAY) | LL | PL | PI    | USCS      | AASHTO Class | % ORGANICS | pH  | Resistivity (Ohm-cm) | Sulfate (mg/kg) | Chloride (mg/kg) | Carbonate (% Calcite Equivalent) |
|---------------|-------------------|------------|----------|--------|---------------------|----|----|-------|-----------|--------------|------------|-----|----------------------|-----------------|------------------|----------------------------------|
| B-1           | 4.0-6.0           | --         | --       | --     | --                  | -- | -- | --    | --        | --           | 1.15       | --  | --                   | --              | --               | --                               |
|               | 6.0-8.0           | --         | --       | --     | --                  | -- | -- | --    | --        | --           | 1.07       | --  | --                   | --              | --               | --                               |
|               | 8.0-10.0          | 19.3       | 16.7     | 76.0   | 7.3                 | NP | NP | NP    | SP-SM     | A-1-b        | --         | --  | --                   | --              | --               | --                               |
|               | 12.0-14.0         | 19.2       | 8.4      | 83.7   | 8.0                 | NP | NP | NP    | SP-SM     | A-3          | --         | --  | --                   | --              | --               | --                               |
|               | 14.0-16.0         | --         | --       | --     | --                  | -- | -- | --    | --        | --           | 0.31       | --  | --                   | --              | --               | --                               |
|               | 18.0-20.0         | 27.4       | 0.0      | 96.7   | 3.3                 | NP | NP | NP    | SP        | A-3          | --         | --  | --                   | --              | --               | --                               |
|               | 28.5-30.0         | 34.7       | 0.2      | 92.4   | 7.4                 | NP | NP | NP    | SP-SM     | A-3          | --         | --  | --                   | --              | --               | --                               |
|               | 43.5-45.0         | 33.8       | 0.4      | 88.6   | 11.0                | NP | NP | NP    | SP-SM     | A-2-4        | --         | --  | --                   | --              | --               | --                               |
| 48.5-50.0     | 59.0              | 0.0        | 66.8     | 33.2   | NP                  | NP | NP | SM    | A-2-4     | --           | --         | --  | --                   | --              | --               |                                  |
| B-2           | 4.0-6.0           | --         | --       | --     | --                  | -- | -- | --    | --        | --           | 0.56       | --  | --                   | --              | --               | --                               |
|               | 6.0-8.0           | 28.7       | 0.0      | 95.1   | 4.9                 | NP | NP | NP    | SP        | A-3          | --         | --  | --                   | --              | --               | --                               |
|               | 8.0-10.0          | 27.9       | 0.0      | 97.5   | 2.5                 | NP | NP | NP    | SP        | A-3          | --         | --  | --                   | --              | --               | --                               |
|               | 10.0-12.0         | --         | --       | --     | --                  | -- | -- | --    | --        | --           | 0.45       | --  | --                   | --              | --               | --                               |
|               | 18.0-20.0         | 26.5       | 0.0      | 93.7   | 6.3                 | NP | NP | NP    | SP-SM     | A-3          | --         | --  | --                   | --              | --               | --                               |
|               | 23.5-25.0         | --         | --       | --     | --                  | -- | -- | --    | --        | --           | 1.25       | --  | --                   | --              | --               | --                               |
|               | 28.5-30.0         | 30.3       | 0.3      | 85.7   | 14.0                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 38.5-40.0         | 29.3       | 0.1      | 91.1   | 8.8                 | NP | NP | NP    | SP-SM     | A-3          | --         | --  | --                   | --              | --               | --                               |
| 53.5-55.0     | 28.4              | 0.3        | 89.7     | 10.0   | NP                  | NP | NP | SP-SM | A-3       | --           | --         | --  | --                   | --              | --               |                                  |
| B-3           | 0.0-2.0           | 36.9       | 0.2      | 62.3   | 37.5                | NP | NP | NP    | SM        | A-4(0)       | --         | --  | --                   | --              | --               | --                               |
|               | 4.0-6.0           | --         | --       | --     | --                  | -- | -- | --    | --        | --           | 3.55       | --  | --                   | --              | --               | --                               |
|               | 6.0-8.0           | 151.6      | 0.0      | 1.5    | 98.5                | 74 | 49 | 25    | MH        | A-7-5(36)    | --         | --  | --                   | --              | --               | --                               |
|               | 13.5-15.0         | 26.1       | 0.0      | 92.3   | 7.7                 | NP | NP | NP    | SP-SM     | A-3          | --         | --  | --                   | --              | --               | --                               |
|               | 18.5-20.0         | --         | --       | --     | --                  | -- | -- | --    | --        | --           | --         | 7.9 | 200                  | 126             | 5080             | --                               |
|               | 23.5-25.0         | 29.3       | 15.8     | 59.7   | 24.5                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 28.5-30.0         | 101.1      | 0.0      | 3.4    | 96.6                | 58 | 31 | 27    | MH        | A-7-5(32)    | --         | --  | --                   | --              | --               | --                               |
|               | 38.5-40.0         | 30.2       | 3.7      | 85.8   | 10.4                | NP | NP | NP    | SP-SM     | A-3          | --         | --  | --                   | --              | --               | --                               |
| B-4           | 2.0-4.0           | 52.5       | 4.9      | 63.2   | 31.9                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 4.0-6.0           | --         | --       | --     | --                  | -- | -- | --    | --        | --           | 2.68       | --  | --                   | --              | --               | --                               |
|               | 8.0-10.0          | 32.9       | 1.2      | 72.9   | 26.0                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 13.5-15.0         | 31.8       | 0.0      | 84.9   | 15.1                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 23.5-25.0         | 27.8       | 1.1      | 76.9   | 22.0                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 33.5-35.0         | 35.8       | 1.6      | 76.8   | 21.6                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 38.5-40.0         | --         | --       | --     | --                  | -- | -- | --    | --        | --           | --         | 8.0 | 180                  | 559             | 8350             | --                               |
|               | 48.5-50.0         | 31.8       | 0.6      | 82.4   | 17.0                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
| 63.5-65.0     | 64.5              | 0.0        | 46.9     | 53.1   | 71                  | 35 | 36 | MH    | A-7-5(16) | --           | --         | --  | --                   | --              | --               |                                  |
| B-5           | 2.0-4.0           | 27.9       | 0.0      | 93.4   | 6.6                 | NP | NP | NP    | SP-SM     | A-3          | --         | --  | --                   | --              | --               | --                               |
|               | 6.0-8.0           | 24.1       | 0.0      | 85.3   | 14.6                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 8.0-10.0          | --         | --       | --     | --                  | -- | -- | --    | --        | --           | 0.27       | --  | --                   | --              | --               | --                               |
|               | 13.5-15.0         | 36.1       | 0.3      | 79.9   | 19.7                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 23.5-25.0         | 26.8       | 0.1      | 89.4   | 10.5                | NP | NP | NP    | SP-SM     | A-3          | --         | --  | --                   | --              | --               | --                               |
|               | 28.5-30.0         | --         | --       | --     | --                  | -- | -- | --    | --        | --           | --         | 8.2 | 9.5                  | 488             | 8360             | --                               |
|               | 33.5-35.0         | 39.0       | 0.0      | 67.2   | 32.8                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 43.5-45.0         | 33.4       | 0.0      | 79.1   | 20.9                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
| 53.5-55.0     | 38.9              | 0.8        | 73.2     | 26.0   | NP                  | NP | NP | SM    | A-2-4     | --           | --         | --  | --                   | --              | --               |                                  |
| B-6           | 2.0-4.0           | --         | --       | --     | --                  | -- | -- | --    | --        | --           | 0.53       | --  | --                   | --              | --               | --                               |
|               | 4.0-6.0           | 28.4       | 0.0      | 82.8   | 17.2                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 8.0-10.0          | 24.6       | 0.0      | 84.3   | 15.7                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 13.5-15.0         | 34.8       | 0.3      | 73.6   | 26.1                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 23.5-25.0         | 24.8       | 0.0      | 86.3   | 13.7                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 28.5-30.0         | 28.8       | 0.0      | 89.0   | 11.0                | NP | NP | NP    | SP-SM     | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 38.5-40.0         | 27.5       | 0.0      | 81.7   | 18.3                | NP | NP | NP    | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |
|               | 58.5-60.0         | --         | --       | --     | --                  | -- | -- | --    | --        | --           | --         | 7.7 | 85                   | 763             | 16000            | --                               |





**US-21 BRIDGE REPLACEMENT OVER HARBOR RIVER  
BEAUFORT COUNTY, SOUTH CAROLINA  
F&ME PROJECT NO.: G5396.00**

**FINAL LABORATORY ANALYSIS SUMMARY**

| BORING NUMBER                 | SAMPLE DEPTH (ft) | % MOISTURE | % GRAVEL | % SAND | % FINES (SILT/CLAY) | LL | PL | PI | USCS      | AASHTO Class | % ORGANICS | pH  | Resistivity (Ohm-cm) | Sulfate (mg/kg) | Chloride (mg/kg) | Carbonate (% Calcite Equivalent) |     |
|-------------------------------|-------------------|------------|----------|--------|---------------------|----|----|----|-----------|--------------|------------|-----|----------------------|-----------------|------------------|----------------------------------|-----|
| B-15                          | 4.0-6.0           | 26.2       | 0.0      | 91.8   | 8.2                 | NP | NP | NP | SP-SM     | A-3          | --         | --  | --                   | --              | --               | --                               |     |
|                               | 6.0-8.0           | 23.5       | 0.0      | 94.9   | 5.1                 | NP | NP | NP | SP-SM     | A-3          | --         | --  | --                   | --              | --               | --                               |     |
|                               | 13.5-15.0         | 23.8       | 0.0      | 94.5   | 5.5                 | NP | NP | NP | SP-SM     | A-3          | --         | --  | --                   | --              | --               | --                               |     |
|                               | 18.5-20.0         | 33.2       | 0.2      | 82.3   | 17.5                | NP | NP | NP | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |     |
|                               | 38.5-40.0         | --         | --       | --     | --                  | -- | -- | -- | --        | --           | 4.15       | --  | --                   | --              | --               | --                               |     |
|                               | 43.5-45.0         | 31.6       | 0.6      | 78.7   | 20.7                | NP | NP | NP | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |     |
| 58.5-60.0                     | --                | --         | --       | --     | --                  | -- | -- | -- | --        | --           | --         | --  | --                   | --              | --               | 8                                |     |
| B-16                          | 6.0-8.0           | 24.5       | 0.0      | 97.9   | 2.1                 | NP | NP | NP | SP        | A-3          | --         | --  | --                   | --              | --               | --                               |     |
|                               | 13.5-15.0         | 24.3       | 0.0      | 97.9   | 2.1                 | NP | NP | NP | SP        | A-3          | --         | --  | --                   | --              | --               | --                               |     |
|                               | 23.5-25.0         | 37.4       | 0.0      | 86.1   | 13.9                | NP | NP | NP | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |     |
|                               | 38.5-40.0         | 56.7       | 0.0      | 53.4   | 46.6                | 36 | 21 | 15 | SC        | A-6(4)       | --         | --  | --                   | --              | --               | --                               |     |
|                               | 48.5-50.0         | 84.8       | 0.0      | 9.0    | 91.0                | 75 | 35 | 40 | MH        | A-7-5(25)    | --         | --  | --                   | --              | --               | --                               |     |
|                               | 53.5-55.0         | --         | --       | --     | --                  | -- | -- | -- | --        | --           | 7.22       | --  | --                   | --              | --               | --                               |     |
|                               | 78.5-80.0         | --         | --       | --     | --                  | -- | -- | -- | --        | --           | --         | --  | --                   | --              | --               | --                               | 15  |
| TS-1                          | 6.0-8.0           | 25.9       | 0.3      | 85.8   | 13.9                | NP | NP | NP | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |     |
|                               | 16.0-18.0         | 52.2       | 0.0      | 50.3   | 49.7                | 25 | 21 | 4  | SC-SM     | A-4(0)       | --         | --  | --                   | --              | --               | --                               |     |
|                               | 22.0-24.0         | 26.7       | 0.0      | 83.7   | 16.3                | NP | NP | NP | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |     |
|                               | 26.0-28.0         | 65.5       | 0.0      | 34.4   | 65.6                | 42 | 27 | 15 | ML        | A-7-6(9)     | --         | --  | --                   | --              | --               | --                               |     |
|                               | 32.0-34.0         | 40.2       | 1.0      | 70.7   | 28.3                | NP | NP | NP | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |     |
|                               | 44.0-46.0         | 24.0       | 3.7      | 84.1   | 12.2                | NP | NP | NP | SM        | A-2-4        | --         | --  | --                   | --              | --               | --                               |     |
|                               | 46.0-48.0         | 20.1       | 10.1     | 80.1   | 9.8                 | NP | NP | NP | SP-SM     | A-1-b        | --         | --  | --                   | --              | --               | --                               |     |
|                               | 56.0-58.0         | 62.4       | 0.0      | 35.8   | 64.2                | 44 | 39 | 5  | ML        | A-5(4)       | --         | --  | --                   | --              | --               | --                               |     |
|                               | 72.0-74.0         | 61.7       | 0.6      | 32.1   | 67.4                | 55 | 32 | 23 | MH        | A-7-5(16)    | --         | --  | --                   | --              | --               | --                               |     |
|                               | 76.0-78.0         | 44.5       | 2.0      | 33.3   | 64.7                | 31 | 23 | 8  | ML        | A-4(4)       | --         | --  | --                   | --              | --               | --                               |     |
|                               | 80.0-82.0         | 42.6       | 0.0      | 50.9   | 49.1                | NP | NP | NP | SM        | A-4(0)       | --         | --  | --                   | --              | --               | --                               |     |
|                               | 104.0-106.0       | 33.4       | 0.0      | 43.2   | 56.8                | NP | NP | NP | ML        | A-4(0)       | --         | --  | --                   | --              | --               | --                               |     |
|                               | 120.0-122.0       | 35.4       | 0.2      | 44.5   | 55.3                | NP | NP | NP | ML        | A-4(0)       | --         | --  | --                   | --              | --               | --                               |     |
| SB-1                          | 18.0-20.0         | --         | --       | --     | --                  | -- | -- | -- | --        | --           | 1.92       | --  | --                   | --              | --               | --                               |     |
|                               | 36.0-38.0         | --         | --       | --     | --                  | -- | -- | -- | --        | --           | 1.42       | --  | --                   | --              | --               | --                               |     |
|                               | 44.0-46.0         | 55.4       | 0.6      | 67.5   | 31.9                | 42 | 20 | 22 | SC        | A-2-7(2)     | --         | --  | --                   | --              | --               | --                               |     |
|                               | 93.5-95.0         | 44.7       | 2.2      | 56.5   | 41.3                | NP | NP | NP | SM        | A-4(0)       | --         | --  | --                   | --              | --               | --                               |     |
|                               | 138.5-140.0       | 68.0       | 0.0      | 13.7   | 86.3                | 63 | 29 | 34 | CH        | A-7-6(33)    | --         | --  | --                   | --              | --               | --                               |     |
|                               | 168.5-170.0       | --         | --       | --     | --                  | -- | -- | -- | --        | --           | --         | --  | --                   | --              | --               | --                               | 509 |
|                               | 178.5-180.0       | 32.9       | 0.2      | 56.3   | 43.5                | NP | NP | NP | SM        | A-4(0)       | --         | --  | --                   | --              | --               | --                               |     |
|                               | 198.5-200.0       | --         | --       | --     | --                  | -- | -- | -- | --        | --           | --         | --  | --                   | --              | --               | --                               | 443 |
|                               | 238.5-240.0       | 34.4       | 0.0      | 12.2   | 87.8                | 40 | 23 | 17 | CL        | A-6(16)      | --         | --  | --                   | --              | --               | --                               |     |
|                               | 255.0-257.0       | --         | --       | --     | --                  | -- | -- | -- | --        | --           | --         | --  | --                   | --              | --               | --                               | 361 |
|                               | 275.0-277.0       | 30.1       | 0.0      | 28.7   | 71.3                | 32 | 30 | 2  | ML        | A-4(1)       | --         | --  | --                   | --              | --               | --                               |     |
|                               | 303.0-308.0       | 30.3       | 23.6     | 23.2   | 53.3                | 37 | 34 | 3  | ML        | A-4(1)       | --         | --  | --                   | --              | --               | --                               |     |
|                               | 308.0-313.0       | --         | --       | --     | --                  | -- | -- | -- | --        | --           | --         | --  | --                   | --              | --               | --                               | 320 |
|                               | 338.0-343.0       | 25.9       | 0.6      | 16.5   | 82.9                | 40 | 26 | 14 | ML        | A-6(12)      | --         | --  | --                   | --              | --               | --                               |     |
|                               | 358.0-363.0       | 17.4       | 8.6      | 26.8   | 64.6                | 33 | 24 | 9  | ML        | A-4(4)       | --         | --  | --                   | --              | --               | --                               |     |
|                               | 373.0-378.0       | --         | --       | --     | --                  | -- | -- | -- | --        | --           | --         | --  | --                   | --              | --               | --                               | 222 |
| 381.0-385.0                   | 38.3              | 0.0        | 5.3      | 94.7   | 63                  | 38 | 25 | MH | A-7-5(31) | --           | --         | --  | --                   | --              | --               |                                  |     |
| H <sub>2</sub> O - River West | --                | --         | --       | --     | --                  | -- | -- | -- | --        | --           | --         | 6.8 | 27                   | 22,715 mg/L     | 16,596 mg/L      | --                               |     |
| H <sub>2</sub> O - River East | --                | --         | --       | --     | --                  | -- | -- | -- | --        | --           | --         | 6.9 | 26                   | 23,227 mg/L     | 16,396 mg/L      | --                               |     |

US-21 Bridge Replacement over Harbor River  
 BEAUFORT COUNTY, SOUTH CAROLINA  
 F&ME PROJECT NO.: G5396.00

FINAL LABORATORY ANALYSIS SUMMARY

| BORING NUMBER | SAMPLE DEPTH (ft) | % MOISTURE | % GRAVEL | % SAND | % FINES (SILT/CLAY) | LL  | PL | PI  | USCS  | AASHTO Class | CU Triaxial Shear |         |      |          | UC Strength (psi) | Standard Proctor             |                           | Direct Shear (φ) | Consolidation | Resonant Column |
|---------------|-------------------|------------|----------|--------|---------------------|-----|----|-----|-------|--------------|-------------------|---------|------|----------|-------------------|------------------------------|---------------------------|------------------|---------------|-----------------|
|               |                   |            |          |        |                     |     |    |     |       |              | φ                 | C (psf) | φ'   | C' (psi) |                   | Optimum Moisture Content (%) | Maximum Dry Density (pcf) |                  |               |                 |
|               |                   |            |          |        |                     |     |    |     |       |              |                   |         |      |          |                   |                              |                           |                  |               |                 |
| AP-1          | 16.0-18.0         | 63.0       | 0.0      | 39.0   | 61.0                | 65  | 21 | 44  | CH    | A-7-6(24)    | --                | --      | 29.0 | 0.878    | --                | --                           | --                        | --               | See Results   | --              |
|               | 18.0-20.0         | 86.3       | 0.2      | 26.5   | 73.3                | 111 | 34 | 77  | CH    | A-7-5(60)    | --                | --      | 38.0 | 0.5      | --                | --                           | --                        | --               | See Results   | --              |
| AP-2          | 16.0-18.0         | 56.0       | 2.1      | 48.0   | 49.9                | 66  | 22 | 44  | SC    | A-7-6(17)    | --                | --      | 31.5 | 0.435    | --                | --                           | --                        | --               | See Results   | --              |
|               | 18.0-20.0         | 69.3       | 0.0      | 36.5   | 63.5                | 81  | 27 | 54  | CH    | A-7-6(33)    | --                | --      | 18.5 | 1.85     | --                | --                           | --                        | --               | See Results   | --              |
| AP-3          | 25.0-27.0         | 83.0       | 0.1      | 20.4   | 79.5                | 85  | 27 | 58  | CH    | A-7-6(50)    | --                | --      | 26.0 | 1.5      | --                | --                           | --                        | --               | See Results   | --              |
|               | 27.0-29.0         | 78.8       | 0.1      | 18.5   | 81.4                | 74  | 25 | 49  | CH    | A-7-6(43)    | --                | --      | 7.2  | 2.95     | --                | --                           | --                        | --               | See Results   | --              |
| AP-4          | 38.0-40.0         | 69.0       | 0.0      | 28.7   | 71.3                | 71  | 24 | 47  | CH    | A-7-6(34)    | --                | --      | --   | --       | --                | --                           | --                        | --               | See Results   | --              |
|               | 40.0-42.0         | 33.8       | 0.2      | 78.4   | 21.5                | NP  | NP | NP  | SM    | A-2-4        | 13.0              | 4.1     | 24.0 | 4.1      | --                | --                           | --                        | --               | --            | --              |
|               | 70.0-72.0         | 58.8       | 0.0      | 48.0   | 52.0                | NP  | NP | NP  | ML    | A-4(0)       | 34.0              | 0.0     | --   | --       | --                | --                           | --                        | --               | --            | --              |
| AP-5          | 6.0-10.0          | 21.6       | 0.0      | 97.0   | 3.0                 | NP  | NP | NP  | SP    | A-3          | --                | --      | --   | --       | --                | --                           | --                        | 32.1             | --            | --              |
|               | 30.0-32.0         | 26.6       | 0.0      | 97.1   | 2.9                 | NP  | NP | NP  | SP    | A-3          | --                | --      | --   | --       | --                | --                           | --                        | 27.9             | --            | --              |
|               | 130.0-133.0       | 38.0       | 0.0      | 33.7   | 66.3                | 42  | 30 | 12  | ML    | A-7-5(8)     | --                | --      | --   | --       | --                | --                           | --                        | --               | --            | See Results     |
| SB-1          | 145.0-148.0       | 33.1       | 0.2      | 42.5   | 57.3                | 38  | 25 | 13  | ML    | A-6(6)       | --                | --      | 40.7 | 1.05     | --                | --                           | --                        | --               | --            | --              |
|               | 200.0-203.0       | 32.0       | 0.1      | 47.8   | 52.1                | 43  | 27 | 16  | ML    | A-7-6(6)     | --                | --      | --   | --       | --                | --                           | --                        | --               | --            | See Results     |
|               | 230.0-233.0       | 32.6       | 1.0      | 21.3   | 77.7                | 48  | 30 | 18  | ML    | A-7-5(15)    | --                | --      | 29.2 | 16.5     | --                | --                           | --                        | --               | --            | --              |
|               | 250.0-255.0       | 29.0       | --       | --     | --                  | --  | -- | --  | --    | --           | --                | --      | --   | --       | 143.5             | --                           | --                        | --               | --            | --              |
|               | 257.0-260.0       | 31.6       | 0.0      | 34.9   | 65.1                | 76  | 21 | 55  | CH    | A-7-6(34)    | --                | --      | --   | --       | --                | --                           | --                        | --               | --            | See Results     |
|               | 298.0-303.0       | 31.7       | --       | --     | --                  | --  | -- | --  | --    | --           | --                | --      | --   | --       | 166.5             | --                           | --                        | --               | --            | --              |
|               | 323.0-328.0       | 22.3       | --       | --     | --                  | --  | -- | --  | --    | --           | --                | --      | --   | --       | 85.9              | --                           | --                        | --               | --            | --              |
|               | 358.0-363.0       | 26.8       | --       | --     | --                  | --  | -- | --  | --    | --           | --                | --      | --   | --       | 236.4             | --                           | --                        | --               | --            | --              |
|               | 378.0-381.0       | 39.3       | 0.0      | 12.2   | 87.8                | 133 | 29 | 104 | CH    | A-7-6(104)   | --                | --      | --   | --       | --                | --                           | --                        | --               | --            | See Results     |
|               | 381.0-385.0       | 32.3       | --       | --     | --                  | --  | -- | --  | --    | --           | --                | --      | --   | --       | 233.5             | --                           | --                        | --               | --            | --              |
| BS-1          | 0.0-5.0           | 5.3        | 11.4     | 81.0   | 7.6                 | NP  | NP | NP  | SP-SM | A-3          | --                | --      | --   | --       | --                | 17.3                         | 100.3                     | 34.4             | --            | --              |
| BS-2          | 0.0-5.0           | 5.6        | 5.4      | 86.2   | 8.3                 | NP  | NP | NP  | SP-SM | A-3          | --                | --      | --   | --       | --                | 16.6                         | 100.8                     | 32.6             | --            | --              |
| BS-3          | 0.0-5.0           | 1.3        | 0.1      | 98.2   | 1.7                 | NP  | NP | NP  | SP    | A-3          | --                | --      | --   | --       | --                | 18.1                         | 97.8                      | 33.5             | --            | --              |
| BS-4          | 0.0-5.0           | 2.6        | 0.6      | 96.6   | 2.9                 | NP  | NP | NP  | SP    | A-3          | --                | --      | --   | --       | --                | 15.8                         | 94.6                      | 31.0             | --            | --              |

**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 14-1273 **DATE SAMPLE RECEIVED:** 9/3/2014  
**DESCRIPTION OF SOIL:** Various  
**TESTED BY:** KB **DATE OF TESTING:** 9/3/2014  
**DATE OF WEIGHING:** 9/4/2014

|                          |            |             |             |             |             |
|--------------------------|------------|-------------|-------------|-------------|-------------|
| <b>BORING NO.</b>        | B-1        | B-1         | B-1         | B-1         | B-1         |
| <b>SAMPLE NO.</b>        | 14-1273C   | 14-1273F    | 14-1273I    | 14-1273L    | 14-1273O    |
| <b>SAMPLE DEPTH</b>      | 8.0'-10.0' | 12.0'-14.0' | 18.0'-20.0' | 28.5'-30.0' | 43.5'-45.0' |
| <b>WATER CONTENT, W%</b> | 19.3       | 19.2        | 27.4        | 34.7        | 33.8        |

|                          |             |  |  |  |  |
|--------------------------|-------------|--|--|--|--|
| <b>BORING NO.</b>        | B-1         |  |  |  |  |
| <b>SAMPLE NO.</b>        | 14-1273R    |  |  |  |  |
| <b>SAMPLE DEPTH</b>      | 48.5'-50.0' |  |  |  |  |
| <b>WATER CONTENT, W%</b> | 59.0        |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

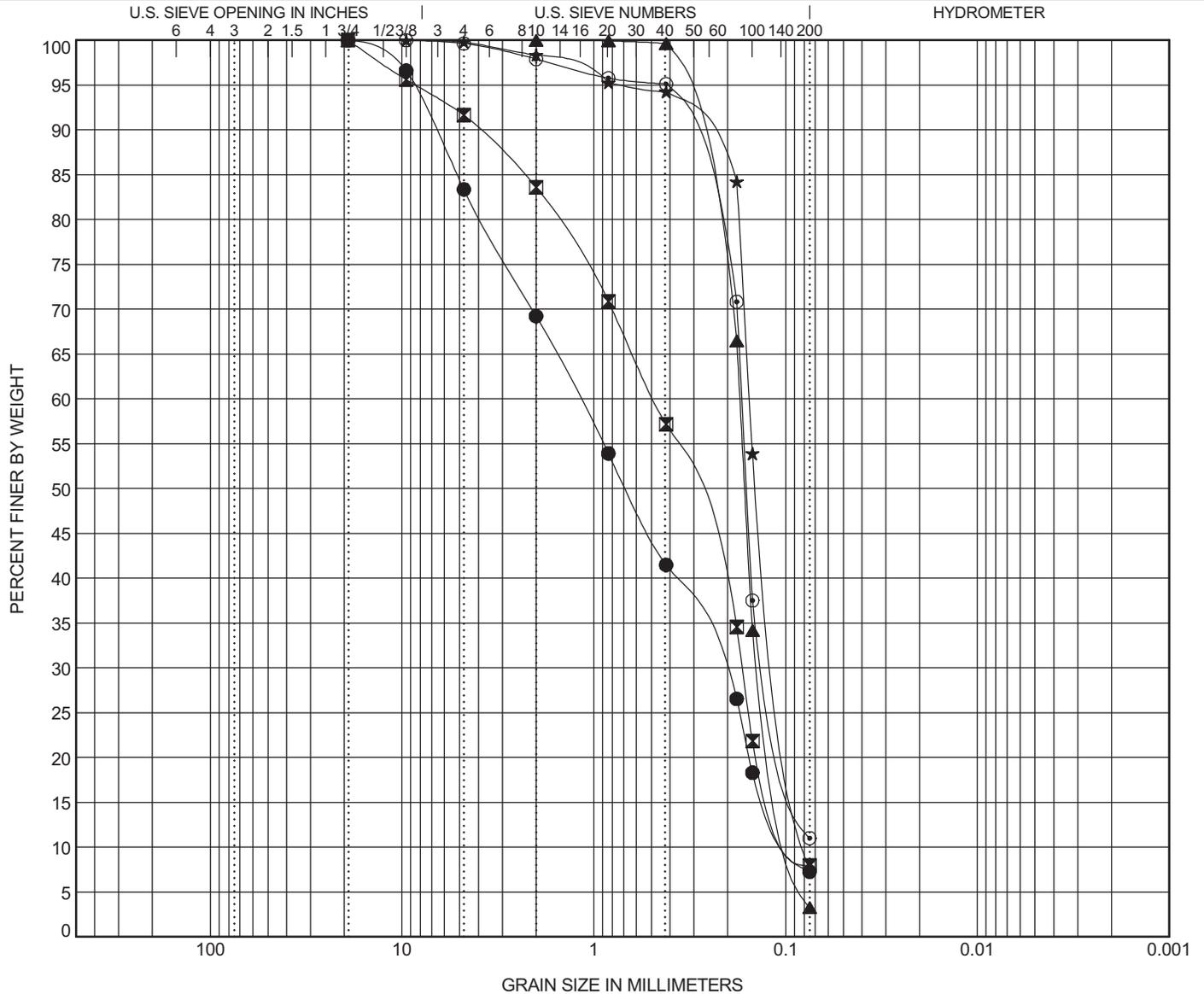


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification | LL                                                        | PL | PI | Cc | Cu |    |      |       |
|----------|-------|----------------|-----------------------------------------------------------|----|----|----|----|----|------|-------|
| ●        | B-1   | 10.0           | Poorly Graded F/C SAND (SP-SM) with Silt and Gravel A-1-b |    |    | NP | NP | NP | 0.46 | 13.35 |
| ⊠        | B-1   | 14.0           | Poorly Graded Fine SAND (SP-SM) with Silt A-3             |    |    | NP | NP | NP | 0.70 | 5.84  |
| ▲        | B-1   | 20.0           | Poorly Graded Fine SAND (SP) A-3                          |    |    | NP | NP | NP | 1.22 | 1.99  |
| ★        | B-1   | 30.0           | Poorly Graded Fine SAND (SP-SM) with Silt A-3             |    |    | NP | NP | NP | 0.91 | 1.99  |
| ◎        | B-1   | 45.0           | Poorly Graded Fine SAND (SP-SM) with Silt A-2-4           |    |    | NP | NP | NP | 1.22 | 2.32  |

| BOREHOLE | DEPTH | D100 | D95  | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|------|-------|-------|---------|-------|-------|-------|
| ●        | B-1   | 10.0 | 19.1 | 8.741 | 0.675 | 0.089   | 16.7  | 76.0  | 7.3   |
| ⊠        | B-1   | 14.0 | 19.1 | 8.544 | 0.321 | 0.083   | 8.4   | 83.7  | 8.0   |
| ▲        | B-1   | 20.0 | 2    | 0.373 | 0.163 | 0.087   | 0.0   | 96.7  | 3.3   |
| ★        | B-1   | 30.0 | 9.52 | 0.69  | 0.141 | 0.078   | 0.2   | 92.4  | 7.4   |
| ◎        | B-1   | 45.0 | 9.52 | 0.418 | 0.16  | 0.4     | 88.6  | 11.0  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16

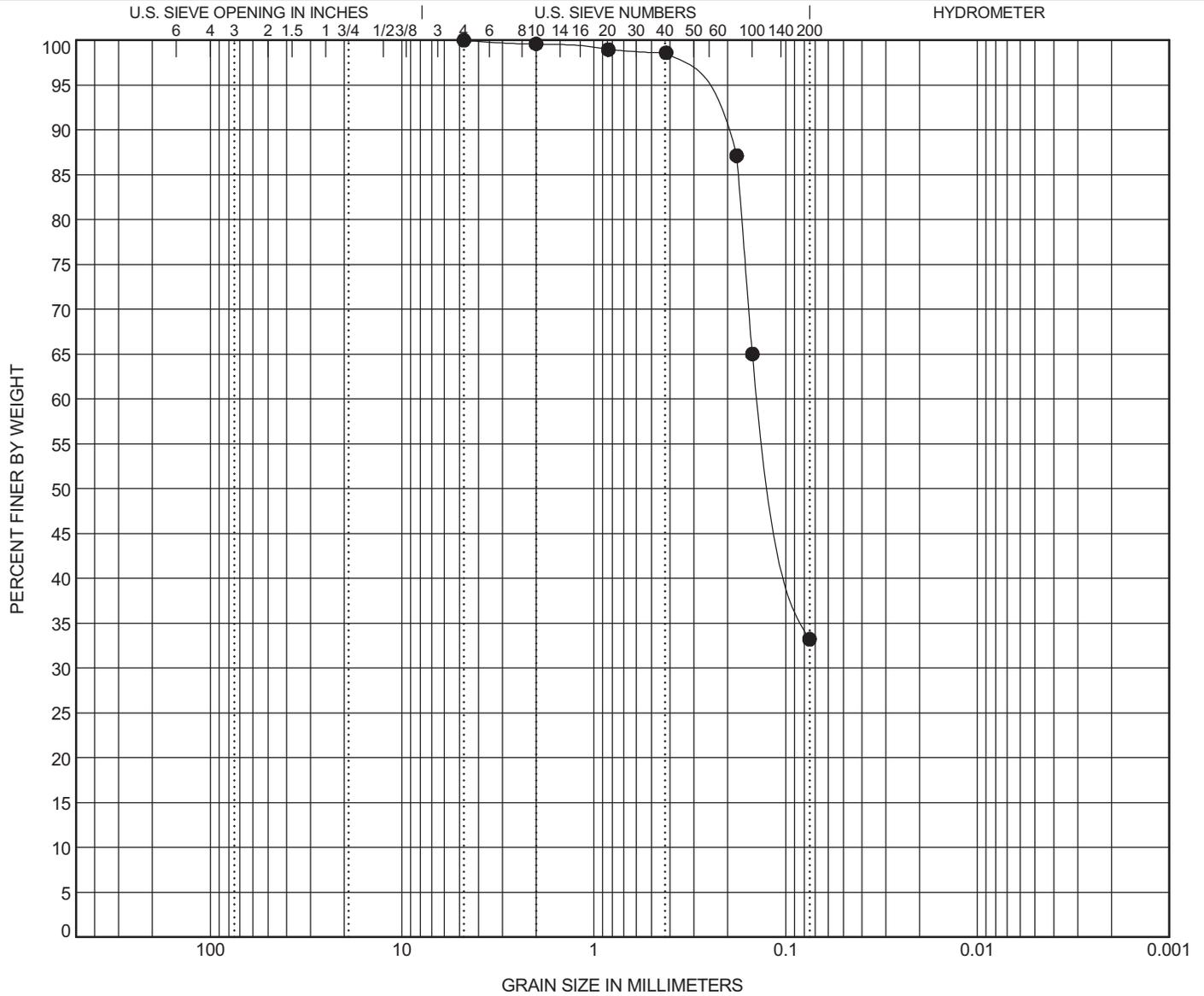


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                    | LL        | PL        | PI        | Cc | Cu |
|----------|-------|-----------------------------------|-----------|-----------|-----------|----|----|
| ● B-1    | 50.0  | <b>Silty Fine SAND (SM) A-2-4</b> | <b>NP</b> | <b>NP</b> | <b>NP</b> |    |    |

| BOREHOLE | DEPTH | D100        | D95          | D50          | D10 | %Gravel    | %Sand       | %Silt       | %Clay |
|----------|-------|-------------|--------------|--------------|-----|------------|-------------|-------------|-------|
| ● B-1    | 50.0  | <b>4.76</b> | <b>0.322</b> | <b>0.108</b> |     | <b>0.0</b> | <b>66.8</b> | <b>33.2</b> |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**ORGANIC IMPURITIES DETERMINATION**  
**(AASHTO T267)**

|                             |                                            |                              |          |
|-----------------------------|--------------------------------------------|------------------------------|----------|
| <b>PROJECT:</b>             | US 21 Bridge Replacement over Harbor River | <b>PROJECT NO.:</b>          | G5396    |
| <b>SAMPLE NUMBER:</b>       | 14-1273                                    | <b>DATE SAMPLE RECEIVED:</b> | 9/4/2014 |
| <b>DESCRIPTION OF SOIL:</b> | Various                                    |                              |          |
| <b>TESTED BY:</b>           | JH                                         | <b>DATE OF TESTING:</b>      | 9/8/2014 |
|                             |                                            | <b>DATE OF WEIGHING:</b>     | 9/8/2014 |

| BORING NO.                                           | B-1       | B-1       | B-1         |  |  |
|------------------------------------------------------|-----------|-----------|-------------|--|--|
| SAMPLE NO.                                           | 14-1273S  | 14-1273T  | 14-1273U    |  |  |
| SAMPLE DEPTH                                         | 4.0'-6.0' | 6.0'-8.0' | 14.0'-16.0' |  |  |
| WT. OF CRUCIBLE + DRY SOIL (BEFORE IGNITION) (GRAMS) | 171.13    | 173.78    | 149.23      |  |  |
| WT. OF CRUCIBLE + DRY SOIL (AFTER IGNITION) (GRAMS)  | 170.71    | 173.37    | 149.11      |  |  |
| WT. OF CRUCIBLE (GRAMS)                              | 134.66    | 135.55    | 110.79      |  |  |
| WT. OF DRY SOIL (BEFORE IGNITION) (GRAMS)            | 36.47     | 38.23     | 38.44       |  |  |
| WT. OF DRY SOIL (AFTER IGNITION) (GRAMS)             | 36.05     | 37.82     | 38.32       |  |  |
| IGNITION LOSS (GRAMS)                                | 0.42      | 0.41      | 0.12        |  |  |
| ORGANIC IMPURITIES %                                 | 1.15      | 1.07      | 0.31        |  |  |



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

|                                                                   |                                              |
|-------------------------------------------------------------------|----------------------------------------------|
| <b>PROJECT:</b> <u>US 21 Bridge Replacement over Harbor River</u> | <b>PROJECT NO.:</b> <u>G5396</u>             |
| <b>SAMPLE NUMBER:</b> <u>14-1328</u>                              | <b>DATE SAMPLE RECEIVED:</b> <u>9/4/2014</u> |
| <b>DESCRIPTION OF SOIL:</b> <u>Various</u>                        |                                              |
| <b>TESTED BY:</b> <u>KB</u>                                       | <b>DATE OF TESTING:</b> <u>9/5/2014</u>      |
|                                                                   | <b>DATE OF WEIGHING:</b> <u>9/8/2014</u>     |

|                          |           |            |             |             |             |
|--------------------------|-----------|------------|-------------|-------------|-------------|
| <b>BORING NO.</b>        | B-2       | B-2        | B-2         | B-2         | B-2         |
| <b>SAMPLE NO.</b>        | 14-1328F  | 14-1328I   | 14-1328L    | 14-1328O    | 14-1328R    |
| <b>SAMPLE DEPTH</b>      | 6.0'-8.0' | 8.0'-10.0' | 18.0'-20.0' | 28.5'-30.0' | 38.5'-40.0' |
| <b>WATER CONTENT, W%</b> | 28.7      | 27.9       | 26.5        | 30.3        | 29.3        |

|                          |             |  |  |  |  |
|--------------------------|-------------|--|--|--|--|
| <b>BORING NO.</b>        | B-2         |  |  |  |  |
| <b>SAMPLE NO.</b>        | 14-1328U    |  |  |  |  |
| <b>SAMPLE DEPTH</b>      | 53.5'-55.0' |  |  |  |  |
| <b>WATER CONTENT, W%</b> | 28.4        |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

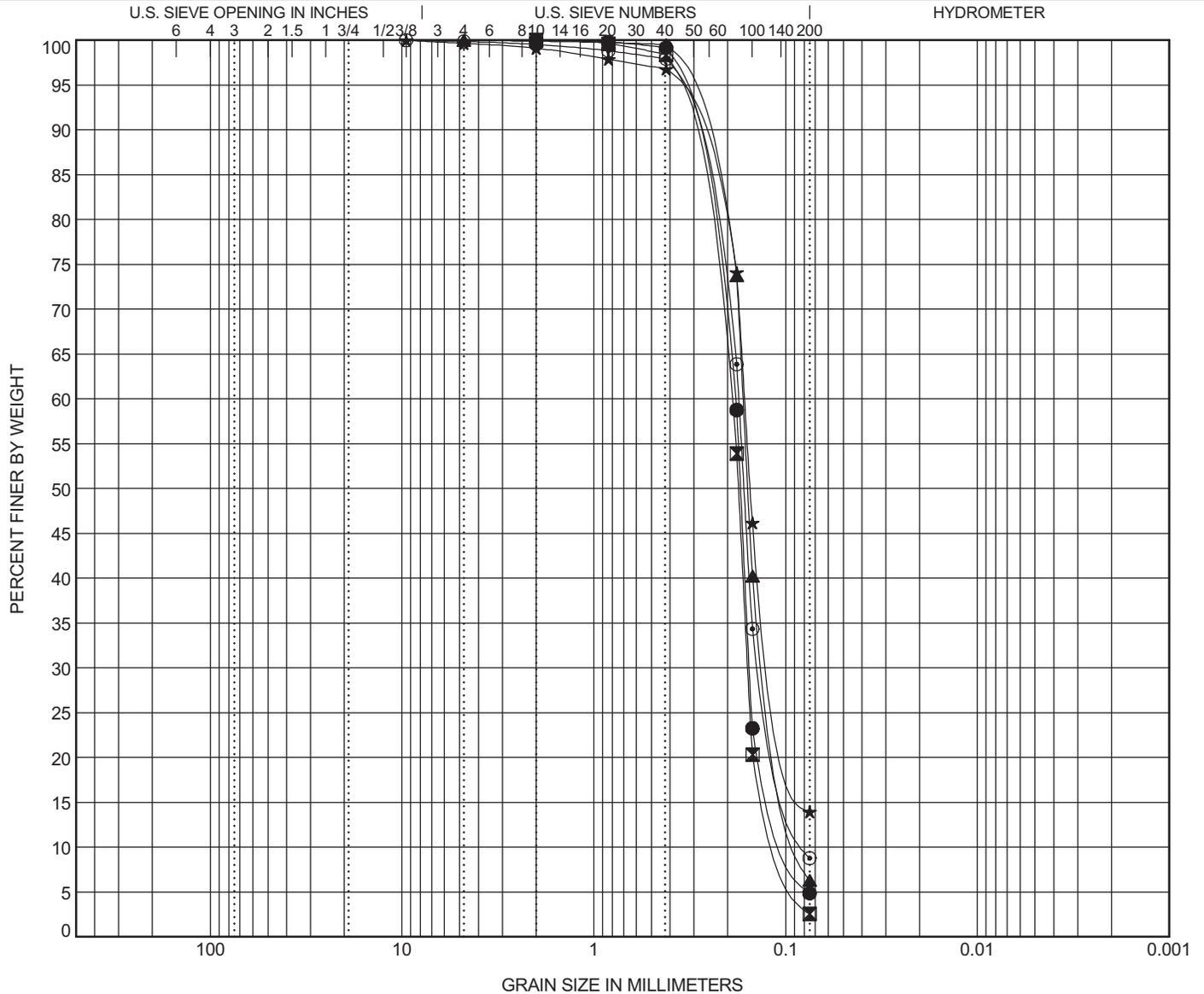


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                |       |       |       |         | LL    | PL    | PI    | Cc   | Cu   |
|----------|-------|-----------------------------------------------|-------|-------|-------|---------|-------|-------|-------|------|------|
| ● B-2    | 8.0   | Poorly Graded Fine SAND (SP) A-3              |       |       |       |         | NP    | NP    | NP    | 1.42 | 2.03 |
| ⊠ B-2    | 10.0  | Poorly Graded Fine SAND (SP) A-3              |       |       |       |         | NP    | NP    | NP    | 1.22 | 2.02 |
| ▲ B-2    | 20.0  | Poorly Graded Fine SAND (SP-SM) with Silt A-3 |       |       |       |         | NP    | NP    | NP    | 1.09 | 2.06 |
| ★ B-2    | 30.0  | Silty Fine SAND (SM) A-2-4                    |       |       |       |         | NP    | NP    | NP    |      |      |
| ⊙ B-2    | 40.0  | Poorly Graded Fine SAND (SP-SM) with Silt A-3 |       |       |       |         | NP    | NP    | NP    | 1.29 | 2.27 |
| BOREHOLE | DEPTH | D100                                          | D95   | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |      |      |
| ● B-2    | 8.0   | 2                                             | 0.385 | 0.172 | 0.091 | 0.0     | 95.1  | 4.9   |       |      |      |
| ⊠ B-2    | 10.0  | 2                                             | 0.394 | 0.176 | 0.1   | 0.0     | 97.5  | 2.5   |       |      |      |
| ▲ B-2    | 20.0  | 4.76                                          | 0.362 | 0.157 | 0.081 | 0.0     | 93.7  | 6.3   |       |      |      |
| ★ B-2    | 30.0  | 9.52                                          | 0.393 | 0.153 |       | 0.3     | 85.7  | 14.0  |       |      |      |
| ⊙ B-2    | 40.0  | 9.52                                          | 0.39  | 0.165 | 0.077 | 0.1     | 91.1  | 8.8   |       |      |      |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16

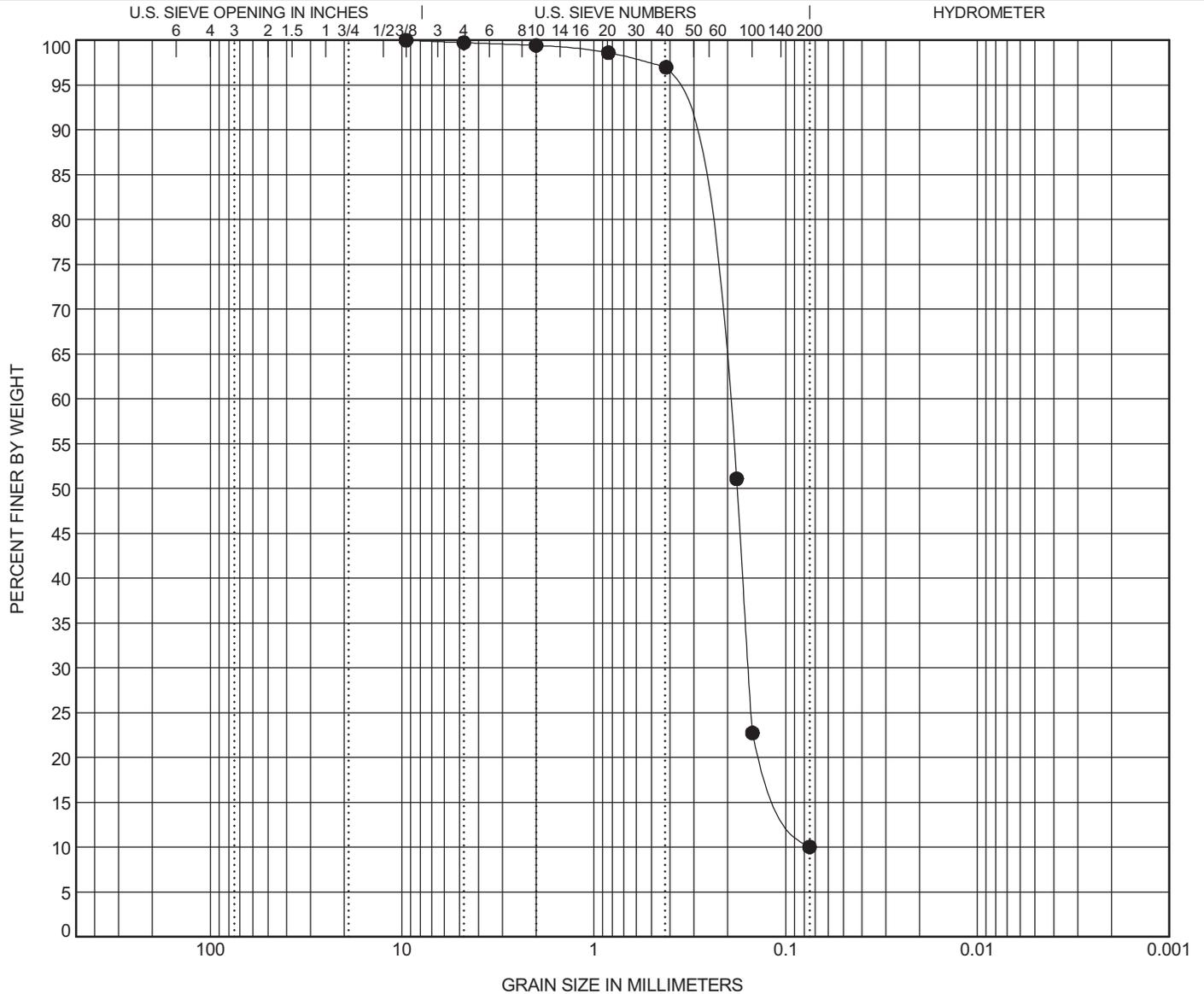


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                | LL | PL | PI | Cc   | Cu   |
|----------|-------|-----------------------------------------------|----|----|----|------|------|
| ● B-2    | 55.0  | Poorly Graded Fine SAND (SP-SM) with Silt A-3 | NP | NP | NP | 1.54 | 2.83 |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-2    | 55.0  | 9.52 | 0.405 | 0.179 |     | 0.3     | 89.7  | 10.0  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**ORGANIC IMPURITIES DETERMINATION**  
**(AASHTO T267)**

|                             |                                            |                              |          |
|-----------------------------|--------------------------------------------|------------------------------|----------|
| <b>PROJECT:</b>             | US 21 Bridge Replacement over Harbor River | <b>PROJECT NO.:</b>          | G5396    |
| <b>SAMPLE NUMBER:</b>       | 14-1328                                    | <b>DATE SAMPLE RECEIVED:</b> | 9/4/2014 |
| <b>DESCRIPTION OF SOIL:</b> | Various                                    |                              |          |
| <b>TESTED BY:</b>           | JH                                         | <b>DATE OF TESTING:</b>      | 9/8/2014 |
|                             |                                            | <b>DATE OF WEIGHING:</b>     | 9/8/2014 |

| BORING NO.                                           | B-2       | B-2         | B-2         |  |  |
|------------------------------------------------------|-----------|-------------|-------------|--|--|
| SAMPLE NO.                                           | 14-1328A  | 14-1328B    | 14-1328C    |  |  |
| SAMPLE DEPTH                                         | 4.0'-6.0' | 10.0'-12.0' | 23.5'-25.0' |  |  |
| WT. OF CRUCIBLE + DRY SOIL (BEFORE IGNITION) (GRAMS) | 171.92    | 171.93      | 172.55      |  |  |
| WT. OF CRUCIBLE + DRY SOIL (AFTER IGNITION) (GRAMS)  | 171.71    | 171.75      | 172.09      |  |  |
| WT. OF CRUCIBLE (GRAMS)                              | 134.66    | 132.08      | 135.70      |  |  |
| WT. OF DRY SOIL (BEFORE IGNITION) (GRAMS)            | 37.26     | 39.85       | 36.85       |  |  |
| WT. OF DRY SOIL (AFTER IGNITION) (GRAMS)             | 37.05     | 39.67       | 36.39       |  |  |
| IGNITION LOSS (GRAMS)                                | 0.21      | 0.18        | 0.46        |  |  |
| ORGANIC IMPURITIES %                                 | 0.56      | 0.45        | 1.25        |  |  |

**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396.00  
**SAMPLE NUMBER:** 15-1436 **DATE SAMPLE RECEIVED:** 10/1/2015  
**DESCRIPTION OF SOIL:** Various  
**TESTED BY:** MM **DATE OF TESTING:** 10/1/2015  
**DATE OF WEIGHING:** 10/2/2015

|                          |          |          |            |            |            |
|--------------------------|----------|----------|------------|------------|------------|
| <b>BORING NO.</b>        | B-3      | B-3      | B-3        | B-3        | B-3        |
| <b>SAMPLE NO.</b>        | 15-1436C | 15-1436G | 15-1436J   | 15-1436Q   | 15-1436T   |
| <b>SAMPLE DEPTH</b>      | 0.0-2.0' | 6.0-8.0' | 13.5-15.0' | 23.5-25.0' | 28.5-30.0' |
| <b>WATER CONTENT, W%</b> | 36.9     | 151.6    | 26.1       | 29.3       | 101.1      |

|                          |            |  |  |  |  |
|--------------------------|------------|--|--|--|--|
| <b>BORING NO.</b>        | B-3        |  |  |  |  |
| <b>SAMPLE NO.</b>        | 15-1436W   |  |  |  |  |
| <b>SAMPLE DEPTH</b>      | 38.5-40.0' |  |  |  |  |
| <b>WATER CONTENT, W%</b> | 30.2       |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

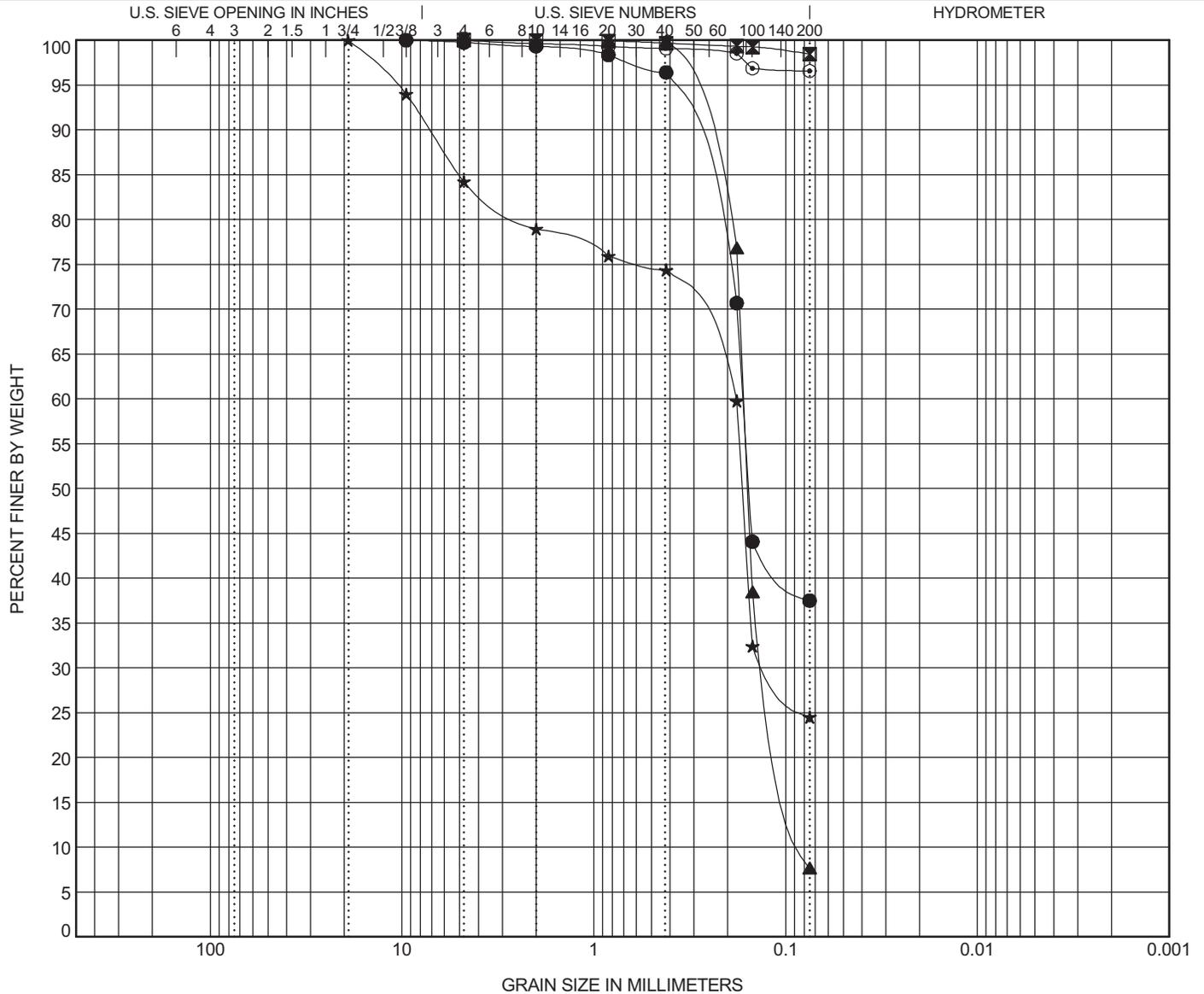


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                | LL | PL | PI | Cc   | Cu   |
|----------|-------|-----------------------------------------------|----|----|----|------|------|
| ● B-3    | 2.0   | Silty Fine SAND (SM) A-4(0)                   | NP | NP | NP |      |      |
| ☒ B-3    | 8.0   | Elastic SILT (MH) A-7-5(36)                   | 74 | 49 | 25 |      |      |
| ▲ B-3    | 15.0  | Poorly Graded Fine SAND (SP-SM) with Silt A-3 | NP | NP | NP | 1.16 | 2.10 |
| ★ B-3    | 25.0  | Silty Fine SAND (SM) with Gravel A-2-4        | NP | NP | NP |      |      |
| ◎ B-3    | 30.0  | Elastic SILT (MH) A-7-5(32)                   | 58 | 31 | 27 |      |      |

| BOREHOLE | DEPTH | D100 | D95    | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|--------|-------|-------|---------|-------|-------|-------|
| ● B-3    | 2.0   | 9.52 | 0.401  | 0.155 |       | 0.2     | 62.3  |       | 37.5  |
| ☒ B-3    | 8.0   | 4.76 |        |       |       | 0.0     | 1.5   |       | 98.5  |
| ▲ B-3    | 15.0  | 0.84 | 0.35   | 0.158 | 0.079 | 0.0     | 92.3  |       | 7.7   |
| ★ B-3    | 25.0  | 19.1 | 10.692 | 0.168 |       | 15.8    | 59.7  |       | 24.5  |
| ◎ B-3    | 30.0  | 4.76 |        |       |       | 0.0     | 3.4   |       | 96.6  |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16

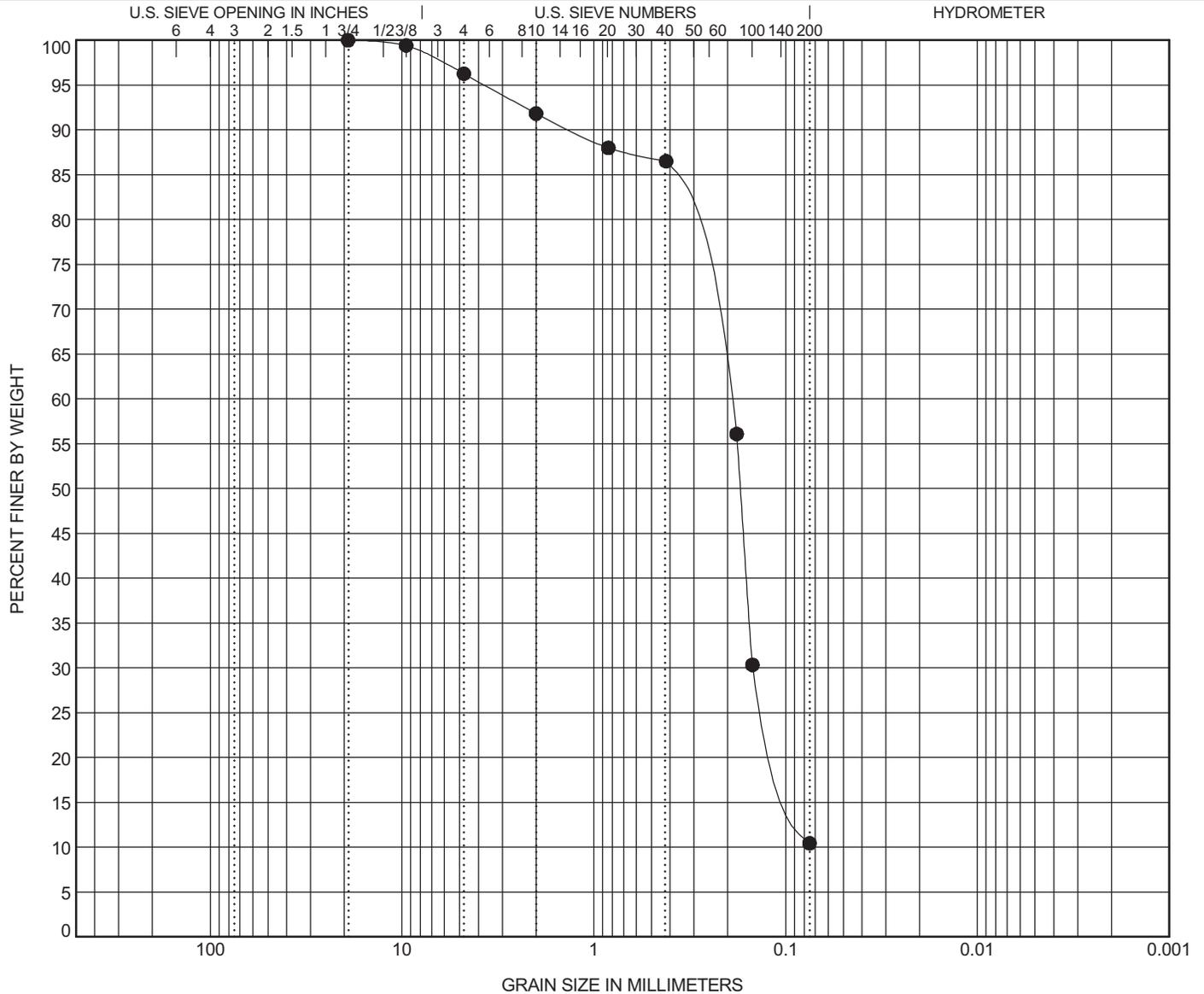


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                | LL | PL | PI | Cc   | Cu   |
|----------|-------|-----------------------------------------------|----|----|----|------|------|
| ● B-3    | 40.0  | Poorly Graded Fine SAND (SP-SM) with Silt A-3 | NP | NP | NP | 1.46 | 2.72 |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-3    | 40.0  | 19.1 | 3.709 | 0.172 |     | 3.7     | 85.8  | 10.4  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**ORGANIC IMPURITIES DETERMINATION**  
**(AASHTO T267)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396.00  
**SAMPLE NUMBER:** 15-1436D **DATE SAMPLE RECEIVED:** \_\_\_\_\_  
**DESCRIPTION OF SOIL:** \_\_\_\_\_  
**TESTED BY:** JH **DATE OF TESTING:** 10/13/2015  
**DATE OF WEIGHING:** 10/14/2015

|                                                             |           |  |  |  |  |
|-------------------------------------------------------------|-----------|--|--|--|--|
| <b>BORING NO.</b>                                           | B-3       |  |  |  |  |
| <b>SAMPLE NO.</b>                                           | 15-1436D  |  |  |  |  |
| <b>SAMPLE DEPTH</b>                                         | 4.0'-6.0' |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (BEFORE IGNITION) (GRAMS)</b> | 174.66    |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (AFTER IGNITION) (GRAMS)</b>  | 173.24    |  |  |  |  |
| <b>WT. OF CRUCIBLE (GRAMS)</b>                              | 134.66    |  |  |  |  |
| <b>WT. OF DRY SOIL (BEFORE IGNITION) (GRAMS)</b>            | 40.00     |  |  |  |  |
| <b>WT. OF DRY SOIL (AFTER IGNITION) (GRAMS)</b>             | 38.58     |  |  |  |  |
| <b>IGNITION LOSS (GRAMS)</b>                                | 1.42      |  |  |  |  |
| <b>ORGANIC IMPURITIES %</b>                                 | 3.55      |  |  |  |  |

**Determining pH of Soil for Use in Corrosion Testing  
AASHTO T 289**

|               |                        |              |              |
|---------------|------------------------|--------------|--------------|
| PROJECT TITLE | F&ME/HARBOR RIVER/SC   | SAMPLE ID    | B-3 15-1436M |
| PROJECT NO.   | 1524908.09             | SAMPLE TYPE  | Bag          |
| REMARKS       | F&ME Project No. G5396 | SAMPLE DEPTH | 18.5 - 20.0' |

**SAMPLE PREPARATION**

|                              |           |
|------------------------------|-----------|
| Sieved through the #10 Sieve | YES       |
| Air Dry                      | YES       |
| Type of Water                | DISTILLED |

| Trial | pH   | Temperature |
|-------|------|-------------|
| 1     | 7.90 | 20.0        |
| 2     | 7.88 | 20.1        |
| 3     | 7.89 | 20.2        |

|                |      |      |
|----------------|------|------|
| <b>AVERAGE</b> | 7.89 | 20.1 |
|----------------|------|------|

|             |                                    |
|-------------|------------------------------------|
| Description | SILTY SAND; dark gray, sea shells. |
| USCS        | (SM)                               |

|         |                                                                                       |
|---------|---------------------------------------------------------------------------------------|
| TECH    | TJ                                                                                    |
| DATE    | 10/13/15                                                                              |
| CHECK   |  |
| REVIEW  |  |
| APPROVE |                                                                                       |

## Determining Minimum Laboratory Soil Resistivity AASHTO T 288

|               |                        |              |              |          |
|---------------|------------------------|--------------|--------------|----------|
| PROJECT TITLE | F&ME/HARBOR RIVER/SC   | SAMPLE ID    | B-3          | 15-1436N |
| PROJECT NO.   | 1524908.09             | SAMPLE TYPE  | Bag          |          |
| REMARKS       | F&ME Project No. G5396 | SAMPLE DEPTH | 18.5 - 20.0' |          |

SAMPLE PREPARATION Sieved through the #10 Sieve  Yes

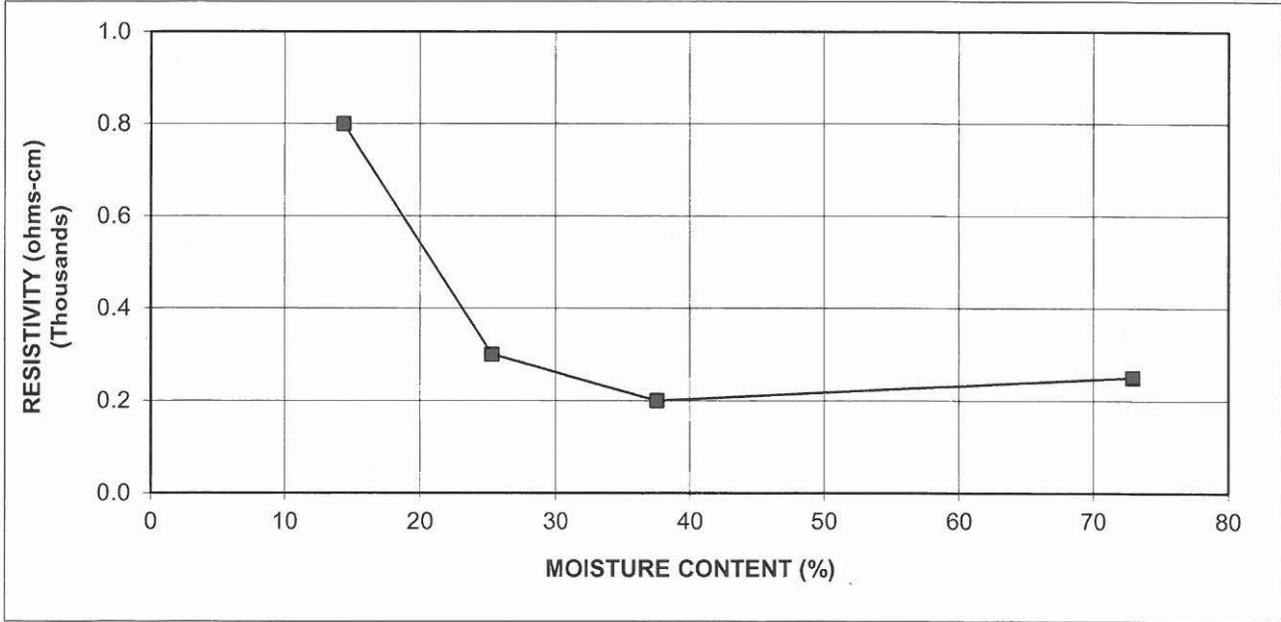
TEST APPARATUS Miller Soilbox and Nilsson 400 Soil Resistance Meter.

Identification: Lowest resistivity

|                       |     |     |     |     |
|-----------------------|-----|-----|-----|-----|
| SPECIMEN (Point)      | 1   | 2   | 3   | 4   |
| RESISTIVITY (ohms-cm) | 800 | 300 | 200 | 250 |

**MOISTURE CONTENT**

|                         |       |        |        |        |
|-------------------------|-------|--------|--------|--------|
| WET WEIGHT & TARE       | 89.43 | 106.77 | 116.52 | 195.83 |
| DRY WEIGHT & TARE       | 84.60 | 95.73  | 98.93  | 135.24 |
| TARE WEIGHT             | 51.00 | 52.02  | 52.10  | 52.15  |
| WEIGHT OF MOISTURE (gm) | 4.83  | 11.04  | 17.59  | 60.59  |
| WEIGHT OF DRY SOIL (gm) | 33.60 | 43.71  | 46.83  | 83.09  |
| MOISTURE CONTENT (%)    | 14.38 | 25.26  | 37.56  | 72.92  |



Description

USCS

|         |          |
|---------|----------|
| TECH    | TJ       |
| DATE    | 10/13/15 |
| CHECK   |          |
| REVIEW  |          |
| APPROVE |          |



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**Client:** Golder Associates, Inc.  
3730 Chamblee Tucker Road  
Atlanta, GA 30341-0000

**Client Proj #:** 1524908  
**ACL Project #:** 68442  
**Date Received:** 10/13/2015  
**Date Reported:** 10/30/2015

**Contact:** Mr. Henry Mock

**Sample ID:** B-3 18.5-20'

**Matrix:** Soil

**ACL #:** 307835

**Date/Time Sampled:** 10/13/2015 11:15

| <u>Analyte (Method)</u> | <u>Result</u> | <u>PQL</u> | <u>Units</u> | <u>DF</u> | <u>Prep Date/Time</u> | <u>Analysis Date/Time</u> | <u>Analyst</u> |
|-------------------------|---------------|------------|--------------|-----------|-----------------------|---------------------------|----------------|
| Sol. Chloride (9252A)*  | 5080          | 500        | mg/kg        | 50        | 10/16/2015 8:30       | 10/16/2015 8:30           | MM             |
| Sol. Sulfate (9038)*    | 126           | 50         | mg/kg        | 5         | 10/19/2015 10:20      | 10/19/2015 10:20          | MM             |

**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396.00  
**SAMPLE NUMBER:** 15-1437 **DATE SAMPLE RECEIVED:** 10/1/2015  
**DESCRIPTION OF SOIL:** Various  
**TESTED BY:** MM **DATE OF TESTING:** 10/1/2015  
**DATE OF WEIGHING:** 10/2/2015

|                          |          |           |            |            |            |
|--------------------------|----------|-----------|------------|------------|------------|
| <b>BORING NO.</b>        | B-4      | B-4       | B-4        | B-4        | B-4        |
| <b>SAMPLE NO.</b>        | 15-1437C | 15-1437G  | 15-1437J   | 15-1437M   | 15-1437P   |
| <b>SAMPLE DEPTH</b>      | 2.0-4.0' | 8.0-10.0' | 13.5-15.0' | 23.5-25.0' | 33.5-35.0' |
| <b>WATER CONTENT, W%</b> | 52.5     | 32.9      | 31.8       | 27.8       | 35.8       |

|                          |            |            |  |  |  |
|--------------------------|------------|------------|--|--|--|
| <b>BORING NO.</b>        | B-4        | B-4        |  |  |  |
| <b>SAMPLE NO.</b>        | 15-1437W   | 15-1437Z   |  |  |  |
| <b>SAMPLE DEPTH</b>      | 48.5-50.0' | 63.5-65.0' |  |  |  |
| <b>WATER CONTENT, W%</b> | 31.8       | 64.5       |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

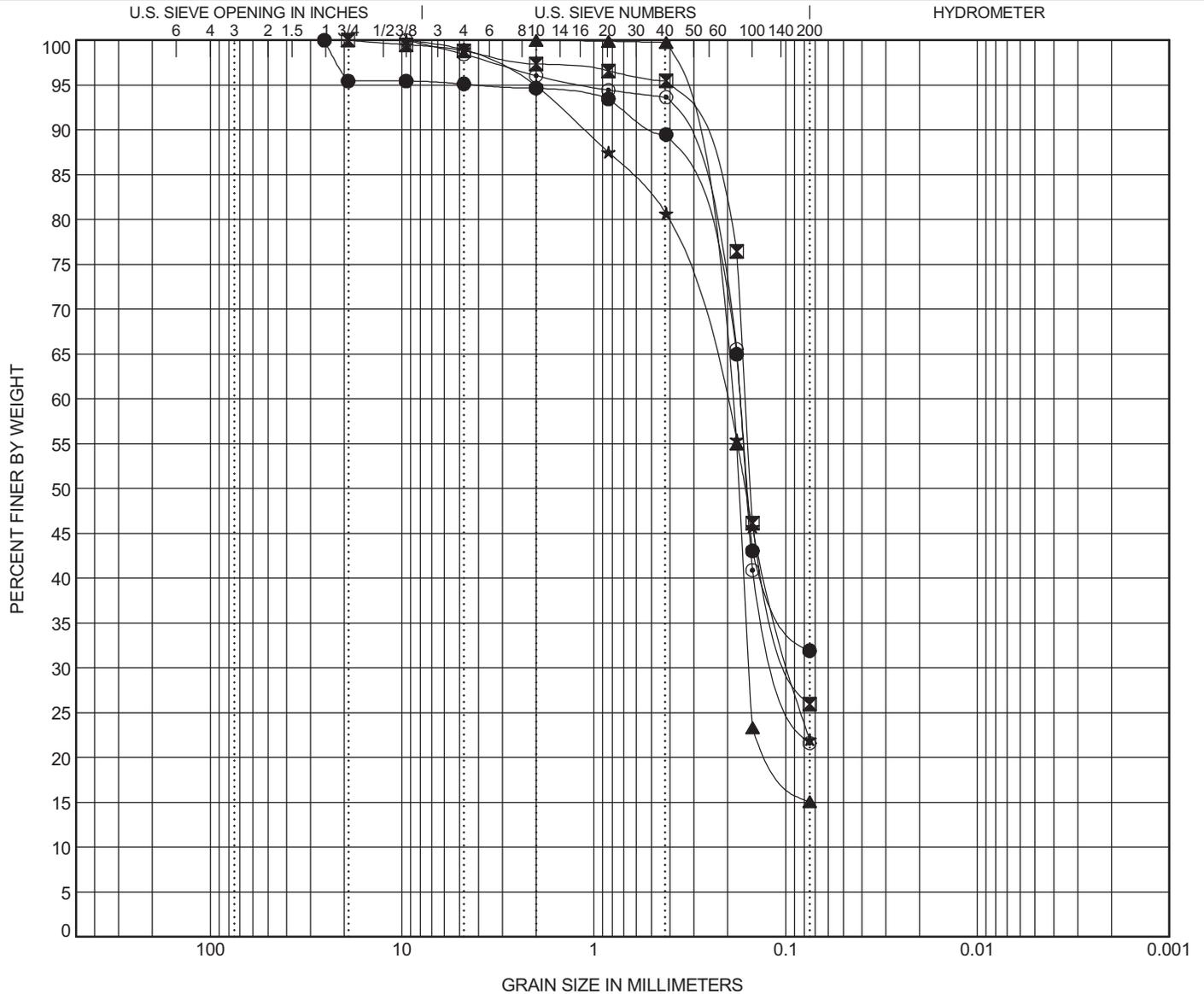


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification             |  |  |  |  | LL | PL | PI | Cc | Cu |
|----------|-------|----------------------------|--|--|--|--|----|----|----|----|----|
| ● B-4    | 4.0   | Silty Fine SAND (SM) A-2-4 |  |  |  |  | NP | NP | NP |    |    |
| ☒ B-4    | 10.0  | Silty Fine SAND (SM) A-2-4 |  |  |  |  | NP | NP | NP |    |    |
| ▲ B-4    | 15.0  | Silty Fine SAND (SM) A-2-4 |  |  |  |  | NP | NP | NP |    |    |
| ★ B-4    | 25.0  | Silty Fine SAND (SM) A-2-4 |  |  |  |  | NP | NP | NP |    |    |
| ◎ B-4    | 35.0  | Silty Fine SAND (SM) A-2-4 |  |  |  |  | NP | NP | NP |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-4    | 4.0   | 25.4 | 3.699 | 0.158 |     | 4.9     | 63.2  | 31.9  |       |
| ☒ B-4    | 10.0  | 19.1 | 0.411 | 0.153 |     | 1.2     | 72.9  | 26.0  |       |
| ▲ B-4    | 15.0  | 2    | 0.384 | 0.175 |     | 0.0     | 84.9  | 15.1  |       |
| ★ B-4    | 25.0  | 9.52 | 2.034 | 0.162 |     | 1.1     | 76.9  | 22.0  |       |
| ◎ B-4    | 35.0  | 9.52 | 1.13  | 0.16  |     | 1.6     | 76.8  | 21.6  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16

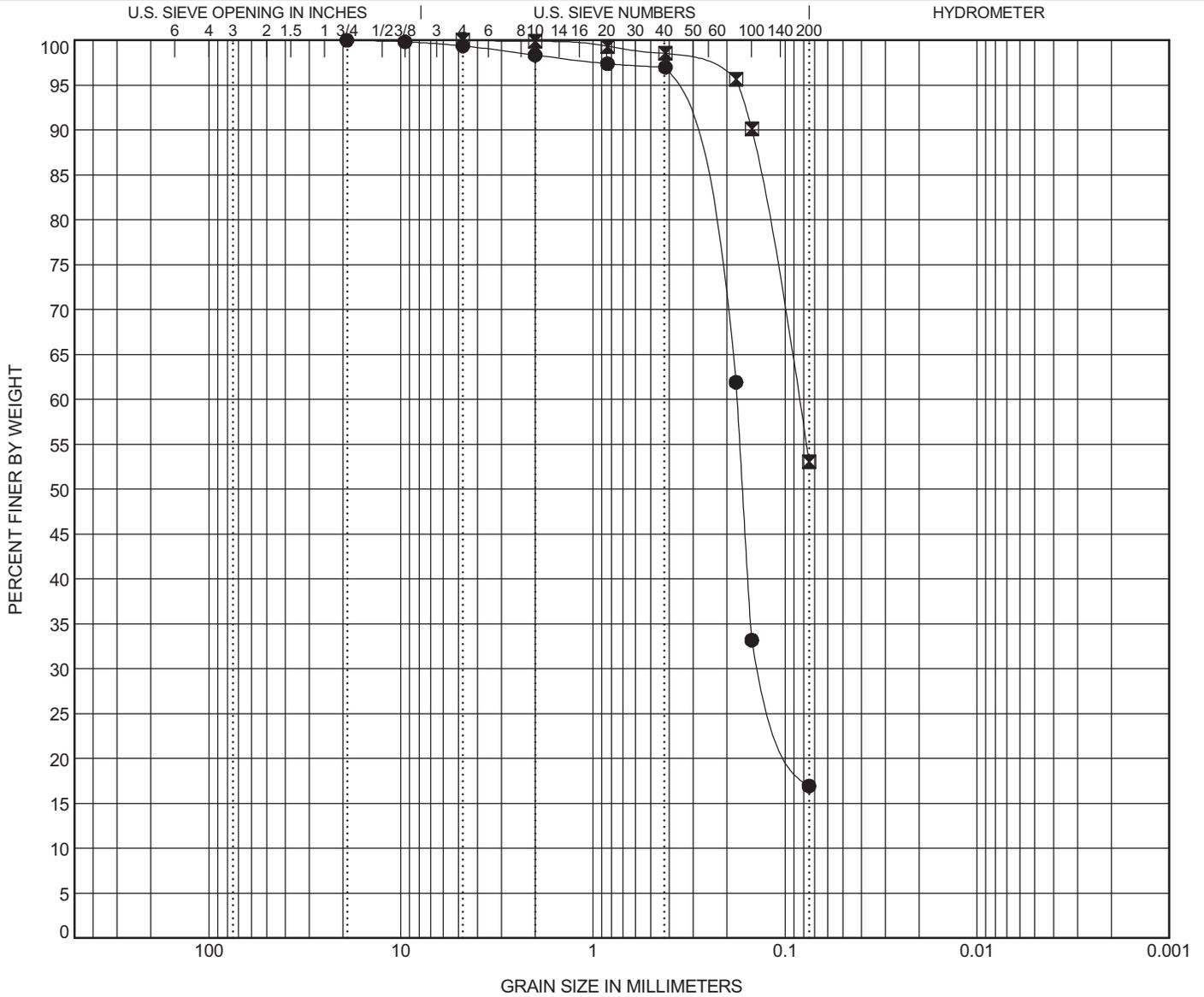


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                           |  |  |  |  | LL        | PL        | PI        | Cc | Cu |
|----------|-------|------------------------------------------|--|--|--|--|-----------|-----------|-----------|----|----|
| ● B-4    | 50.0  | <b>Silty Fine SAND (SM) A-2-4</b>        |  |  |  |  | <b>NP</b> | <b>NP</b> | <b>NP</b> |    |    |
| ☒ B-4    | 65.0  | <b>Sandy Elastic SILT (MH) A-7-5(16)</b> |  |  |  |  | <b>71</b> | <b>35</b> | <b>36</b> |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-4    | 50.0  | 19.1 | 0.4   | 0.166 |     | 0.6     | 82.4  | 17.0  |       |
| ☒ B-4    | 65.0  | 4.76 | 0.176 |       |     | 0.0     | 46.9  | 53.1  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**ORGANIC IMPURITIES DETERMINATION**  
**(AASHTO T267)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396.00  
**SAMPLE NUMBER:** 15-1437D **DATE SAMPLE RECEIVED:** \_\_\_\_\_  
**DESCRIPTION OF SOIL:** \_\_\_\_\_  
**TESTED BY:** JH **DATE OF TESTING:** 10/13/2015  
**DATE OF WEIGHING:** 10/14/2015

|                                                             |           |  |  |  |  |
|-------------------------------------------------------------|-----------|--|--|--|--|
| <b>BORING NO.</b>                                           | B-4       |  |  |  |  |
| <b>SAMPLE NO.</b>                                           | 15-1437D  |  |  |  |  |
| <b>SAMPLE DEPTH</b>                                         | 4.0'-6.0' |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (BEFORE IGNITION) (GRAMS)</b> | 172.08    |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (AFTER IGNITION) (GRAMS)</b>  | 171.01    |  |  |  |  |
| <b>WT. OF CRUCIBLE (GRAMS)</b>                              | 132.08    |  |  |  |  |
| <b>WT. OF DRY SOIL (BEFORE IGNITION) (GRAMS)</b>            | 40.00     |  |  |  |  |
| <b>WT. OF DRY SOIL (AFTER IGNITION) (GRAMS)</b>             | 38.93     |  |  |  |  |
| <b>IGNITION LOSS (GRAMS)</b>                                | 1.07      |  |  |  |  |
| <b>ORGANIC IMPURITIES %</b>                                 | 2.68      |  |  |  |  |

**Determining pH of Soil for Use in Corrosion Testing  
AASHTO T 289**

PROJECT TITLE

F&ME/HARBOR RIVER/SC

SAMPLE ID

B-4 15-1437S

PROJECT NO.

1524908.09

SAMPLE TYPE

Bag

REMARKS

F&ME Project No. G5396

SAMPLE DEPTH

38.5 - 40.0'

**SAMPLE PREPARATION**

Sieved through the #10 Sieve

YES

Air Dry

YES

Type of Water

DISTILLED

| Trial | pH   | Temperature |
|-------|------|-------------|
| 1     | 8.03 | 20.1        |
| 2     | 8.04 | 20.2        |
| 3     | 8.04 | 20.2        |

**AVERAGE**

8.04

20.2

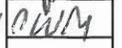
Description CLAYEY SAND; olive brown.

USCS (SC)

TECH TJ

DATE 10/13/15

CHECK 

REVIEW 

APPROVE

## Determining Minimum Laboratory Soil Resistivity AASHTO T 288

|               |                        |              |              |          |
|---------------|------------------------|--------------|--------------|----------|
| PROJECT TITLE | F&ME/HARBOR RIVER/SC   | SAMPLE ID    | B-4          | 15-1437T |
| PROJECT NO.   | 1524908.09             | SAMPLE TYPE  | Bag          |          |
| REMARKS       | F&ME Project No. G5396 | SAMPLE DEPTH | 38.5 - 40.0' |          |

SAMPLE PREPARATION Sieved through the #10 Sieve  Yes

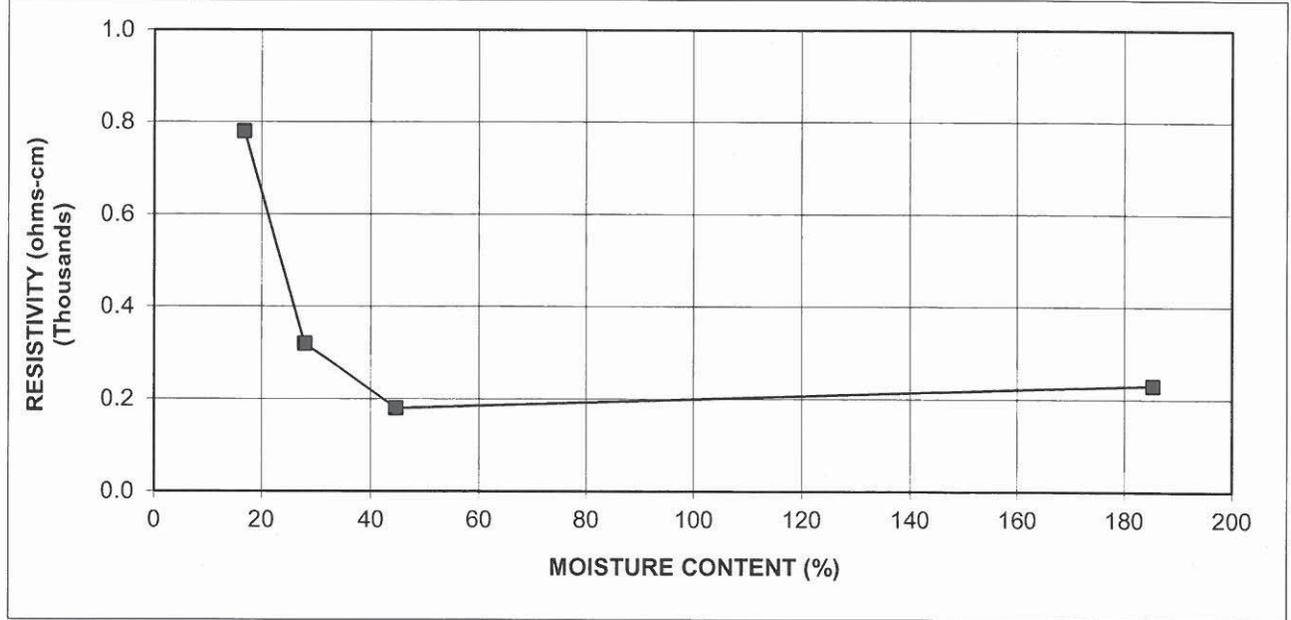
TEST APPARATUS Miller Soilbox and Nilsson 400 Soil Resistance Meter.

Identification: Lowest resistivity

|                       |     |     |     |     |
|-----------------------|-----|-----|-----|-----|
| SPECIMEN (Point)      | 1   | 2   | 3   | 4   |
| RESISTIVITY (ohms-cm) | 780 | 320 | 180 | 230 |

**MOISTURE CONTENT**

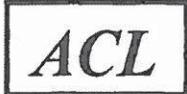
|                         |       |        |        |        |
|-------------------------|-------|--------|--------|--------|
| WET WEIGHT & TARE       | 89.28 | 100.21 | 117.14 | 258.52 |
| DRY WEIGHT & TARE       | 83.76 | 89.62  | 97.00  | 123.87 |
| TARE WEIGHT             | 50.92 | 51.73  | 51.88  | 51.22  |
| WEIGHT OF MOISTURE (gm) | 5.52  | 10.59  | 20.14  | 134.65 |
| WEIGHT OF DRY SOIL (gm) | 32.84 | 37.89  | 45.12  | 72.65  |
| MOISTURE CONTENT (%)    | 16.81 | 27.95  | 44.64  | 185.34 |



Description

USCS

|         |          |
|---------|----------|
| TECH    | TJ       |
| DATE    | 10/13/15 |
| CHECK   |          |
| REVIEW  |          |
| APPROVE |          |



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www.acl-labs.com

**Client:** Golder Associates, Inc.  
3730 Chamblee Tucker Road  
Atlanta, GA 30341-0000

**Client Proj #:** 1524908  
**ACL Project #:** 68442  
**Date Received:** 10/13/2015  
**Date Reported:** 10/30/2015

**Contact:** Mr. Henry Mock

**Sample ID:** B-4 38.5-40'

**Matrix:** Soil

**ACL #:** 307836

**Date/Time Sampled:** 10/13/2015 11:15

| <u>Analyte (Method)</u> | <u>Result</u> | <u>PQL</u> | <u>Units</u> | <u>DF</u> | <u>Prep Date/Time</u> | <u>Analysis Date/Time</u> | <u>Analyst</u> |
|-------------------------|---------------|------------|--------------|-----------|-----------------------|---------------------------|----------------|
| Sol. Chloride (9252A)*  | 8350          | 500        | mg/kg        | 50        | 10/16/2015 8:30       | 10/16/2015 8:30           | MM             |
| Sol. Sulfate (9038)*    | 559           | 200        | mg/kg        | 20        | 10/19/2015 10:20      | 10/19/2015 10:20          | MM             |

**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

|                                                                   |                                               |
|-------------------------------------------------------------------|-----------------------------------------------|
| <b>PROJECT:</b> <u>US 21 Bridge Replacement over Harbor River</u> | <b>PROJECT NO.:</b> <u>G5396.00</u>           |
| <b>SAMPLE NUMBER:</b> <u>15-1438</u>                              | <b>DATE SAMPLE RECEIVED:</b> <u>10/1/2015</u> |
| <b>DESCRIPTION OF SOIL:</b> <u>Various</u>                        |                                               |
| <b>TESTED BY:</b> <u>MM</u>                                       | <b>DATE OF TESTING:</b> <u>10/1/2015</u>      |
|                                                                   | <b>DATE OF WEIGHING:</b> <u>10/2/2015</u>     |

|                          |          |          |            |            |            |
|--------------------------|----------|----------|------------|------------|------------|
| <b>BORING NO.</b>        | B-5      | B-5      | B-5        | B-5        | B-5        |
| <b>SAMPLE NO.</b>        | 15-1438C | 15-1438F | 15-1438J   | 15-1438M   | 15-1438T   |
| <b>SAMPLE DEPTH</b>      | 2.0-4.0' | 6.0-8.0' | 13.5-15.0' | 23.5-25.0' | 33.5-35.0' |
| <b>WATER CONTENT, W%</b> | 27.9     | 24.1     | 36.1       | 26.8       | 39.0       |

|                          |            |            |  |  |  |
|--------------------------|------------|------------|--|--|--|
| <b>BORING NO.</b>        | B-5        | B-5        |  |  |  |
| <b>SAMPLE NO.</b>        | 15-1438W   | 15-1438Z   |  |  |  |
| <b>SAMPLE DEPTH</b>      | 43.5-45.0' | 53.5-55.0' |  |  |  |
| <b>WATER CONTENT, W%</b> | 33.4       | 38.9       |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

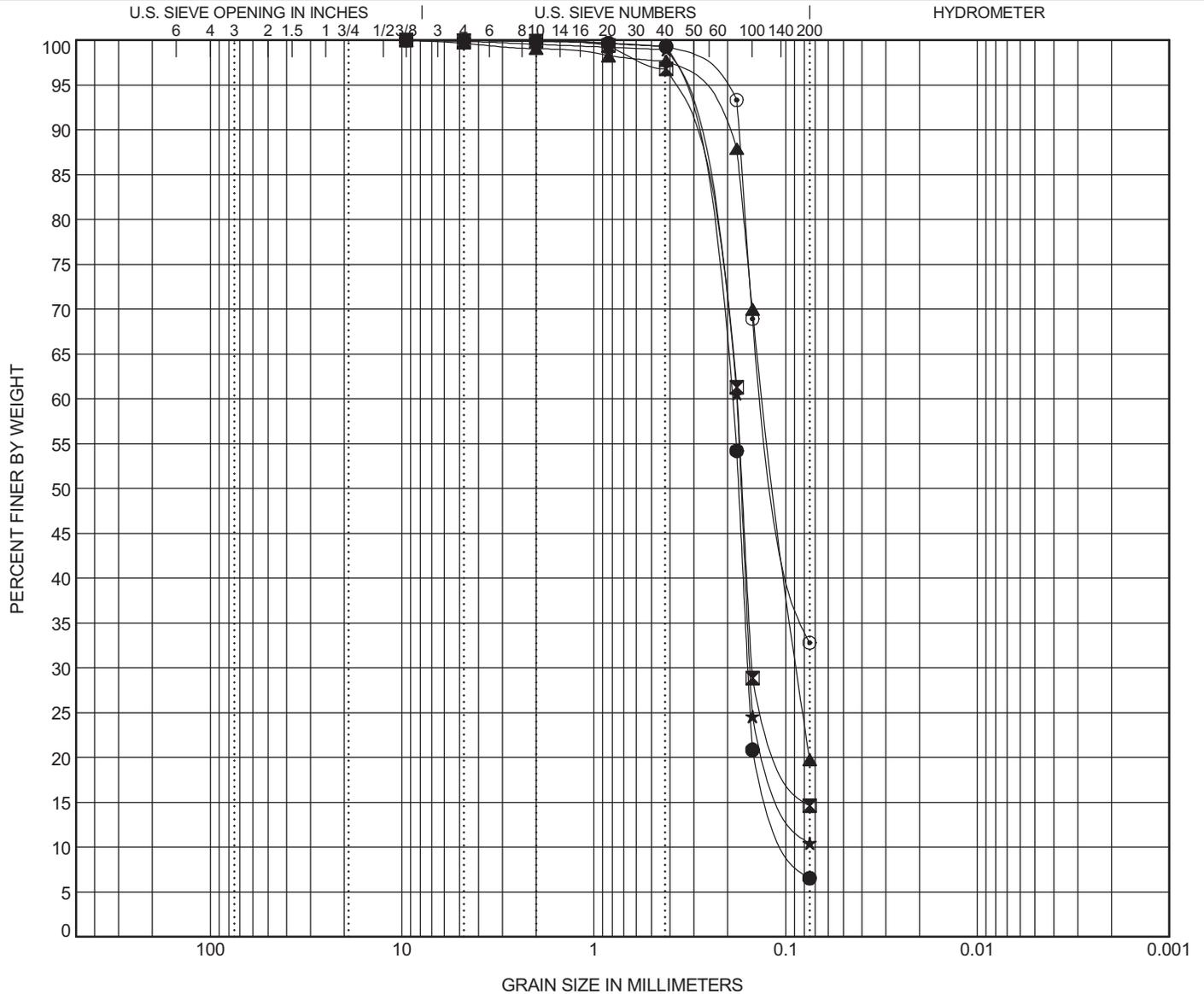


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                | LL | PL | PI | Cc   | Cu   |
|----------|-------|-----------------------------------------------|----|----|----|------|------|
| ● B-5    | 4.0   | Poorly Graded Fine SAND (SP-SM) with Silt A-3 | NP | NP | NP | 1.39 | 2.27 |
| ☒ B-5    | 8.0   | Silty Fine SAND (SM) A-2-4                    | NP | NP | NP |      |      |
| ▲ B-5    | 15.0  | Silty Fine SAND (SM) A-2-4                    | NP | NP | NP |      |      |
| ★ B-5    | 25.0  | Poorly Graded Fine SAND (SP-SM) with Silt A-3 | NP | NP | NP | 1.79 | 2.45 |
| ◎ B-5    | 35.0  | Silty Fine SAND (SM) A-2-4                    | NP | NP | NP |      |      |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-------|---------|-------|-------|-------|
| ● B-5    | 4.0   | 9.52 | 0.387 | 0.176 | 0.088 | 0.0     | 93.4  | 6.6   |       |
| ☒ B-5    | 8.0   | 9.52 | 0.402 | 0.169 |       | 0.0     | 85.3  | 14.6  |       |
| ▲ B-5    | 15.0  | 9.52 | 0.332 | 0.113 |       | 0.3     | 79.9  | 19.7  |       |
| ★ B-5    | 25.0  | 9.52 | 0.385 | 0.17  |       | 0.1     | 89.4  | 10.5  |       |
| ◎ B-5    | 35.0  | 4.76 | 0.227 | 0.104 |       | 0.0     | 67.2  | 32.8  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16

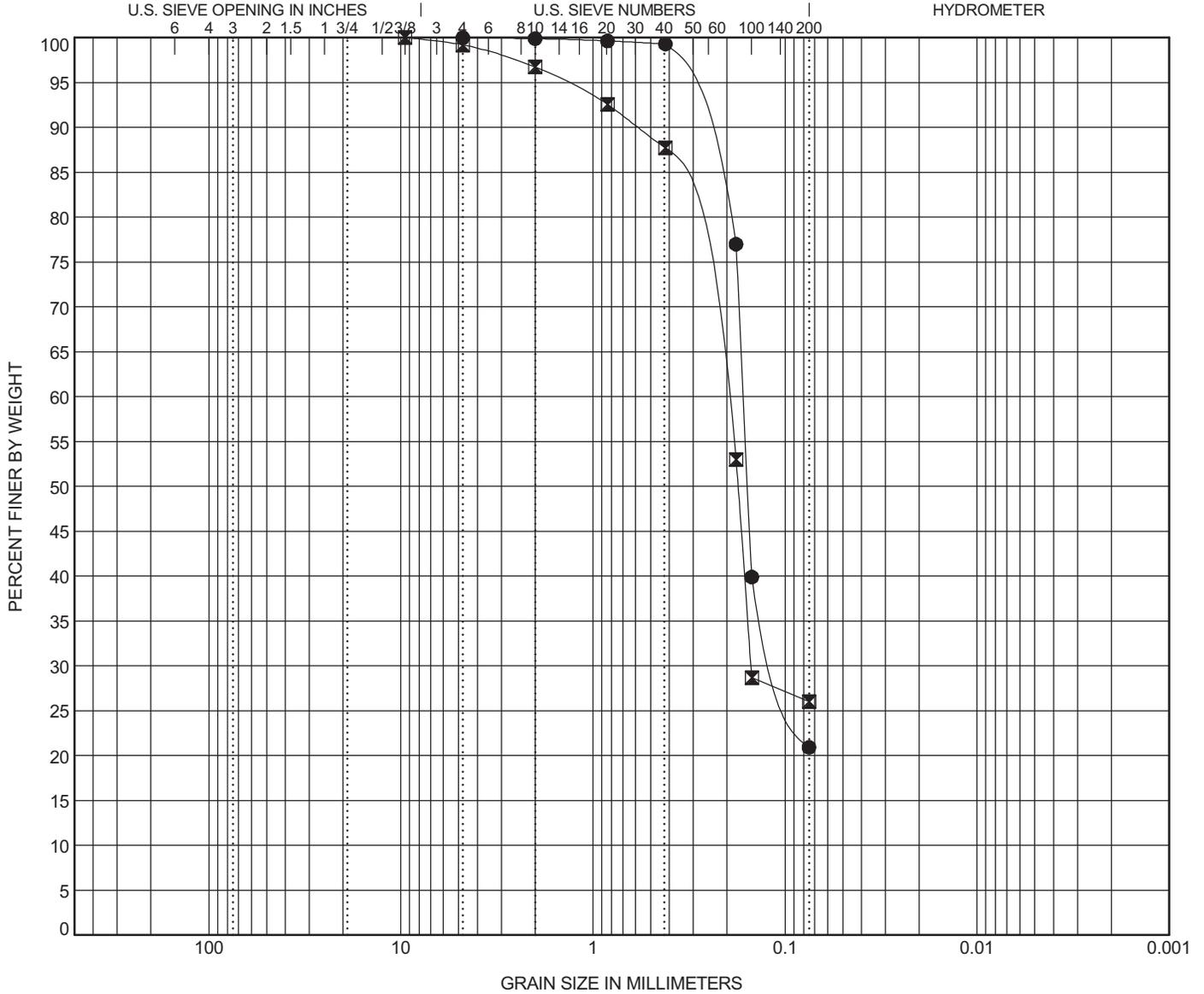


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification             |  |  |  |  | LL | PL | PI | Cc | Cu |
|----------|-------|----------------------------|--|--|--|--|----|----|----|----|----|
| ● B-5    | 45.0  | Silty Fine SAND (SM) A-2-4 |  |  |  |  | NP | NP | NP |    |    |
| ☒ B-5    | 55.0  | Silty Fine SAND (SM) A-2-4 |  |  |  |  | NP | NP | NP |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-5    | 45.0  | 4.76 | 0.357 | 0.157 |     | 0.0     | 79.1  | 20.9  |       |
| ☒ B-5    | 55.0  | 9.52 | 1.393 | 0.176 |     | 0.8     | 73.2  | 26.0  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**ORGANIC IMPURITIES DETERMINATION**  
**(AASHTO T267)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396.00  
**SAMPLE NUMBER:** 15-1438G **DATE SAMPLE RECEIVED:** \_\_\_\_\_  
**DESCRIPTION OF SOIL:** \_\_\_\_\_  
**TESTED BY:** JH **DATE OF TESTING:** 10/13/2015  
**DATE OF WEIGHING:** 10/14/2015

|                                                             |            |  |  |  |  |
|-------------------------------------------------------------|------------|--|--|--|--|
| <b>BORING NO.</b>                                           | B-5        |  |  |  |  |
| <b>SAMPLE NO.</b>                                           | 15-1438G   |  |  |  |  |
| <b>SAMPLE DEPTH</b>                                         | 8.0'-10.0' |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (BEFORE IGNITION) (GRAMS)</b> | 169.97     |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (AFTER IGNITION) (GRAMS)</b>  | 169.86     |  |  |  |  |
| <b>WT. OF CRUCIBLE (GRAMS)</b>                              | 129.97     |  |  |  |  |
| <b>WT. OF DRY SOIL (BEFORE IGNITION) (GRAMS)</b>            | 40.00      |  |  |  |  |
| <b>WT. OF DRY SOIL (AFTER IGNITION) (GRAMS)</b>             | 39.89      |  |  |  |  |
| <b>IGNITION LOSS (GRAMS)</b>                                | 0.11       |  |  |  |  |
| <b>ORGANIC IMPURITIES %</b>                                 | 0.27       |  |  |  |  |

**Determining pH of Soil for Use in Corrosion Testing  
AASHTO T 289**

|               |                        |              |              |
|---------------|------------------------|--------------|--------------|
| PROJECT TITLE | F&ME/HARBOR RIVER/SC   | SAMPLE ID    | B-5 15-1438P |
| PROJECT NO.   | 1524908.09             | SAMPLE TYPE  | Bag          |
| REMARKS       | F&ME Project No. G5396 | SAMPLE DEPTH | 28.5 - 30.0' |

**SAMPLE PREPARATION**

|                              |           |
|------------------------------|-----------|
| Sieved through the #10 Sieve | YES       |
| Air Dry                      | YES       |
| Type of Water                | DISTILLED |

| Trial | pH   | Temperature |
|-------|------|-------------|
| 1     | 8.20 | 20.1        |
| 2     | 8.19 | 20.2        |
| 3     | 8.21 | 20.2        |

|                |      |      |
|----------------|------|------|
| <b>AVERAGE</b> | 8.20 | 20.2 |
|----------------|------|------|

Description SILTY CLAY; olive brown.

USCS (CL)

|         |                                                                                       |
|---------|---------------------------------------------------------------------------------------|
| TECH    | TJ                                                                                    |
| DATE    | 10/13/15                                                                              |
| CHECK   |  |
| REVIEW  |  |
| APPROVE |                                                                                       |





**ADVANCED CHEMISTRY LABS, INC.**

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3039 Amwiler Road • Suite 100 • Atlanta, GA 30360  
P.O. Box 88610 • Atlanta, GA 30356  
[www.acl-labs.com](http://www.acl-labs.com)

**Client:** Golder Associates, Inc.  
3730 Chamblee Tucker Road  
Atlanta, GA 30341-0000

**Client Proj #:** 1524908  
**ACL Project #:** 68442  
**Date Received:** 10/13/2015  
**Date Reported:** 10/30/2015

**Contact:** Mr. Henry Mock

**Sample ID:** B-5 28.5-30'

**Matrix:** Soil

**ACL #:** 307837

**Date/Time Sampled:** 10/13/2015 11:15

| <u>Analyte (Method)</u> | <u>Result</u> | <u>PQL</u> | <u>Units</u> | <u>DF</u> | <u>Prep Date/Time</u> | <u>Analysis Date/Time</u> | <u>Analyst</u> |
|-------------------------|---------------|------------|--------------|-----------|-----------------------|---------------------------|----------------|
| Sol. Chloride (9252A)*  | 8360          | 500        | mg/kg        | 50        | 10/16/2015 8:30       | 10/16/2015 8:30           | MM             |
| Sol. Sulfate (9038)*    | 488           | 200        | mg/kg        | 20        | 10/19/2015 10:20      | 10/19/2015 10:20          | MM             |

**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396.00  
**SAMPLE NUMBER:** 15-1439 **DATE SAMPLE RECEIVED:** 10/1/2015  
**DESCRIPTION OF SOIL:** Various  
**TESTED BY:** MM **DATE OF TESTING:** 10/1/2015  
**DATE OF WEIGHING:** 10/2/2015

|                          |          |           |            |            |            |
|--------------------------|----------|-----------|------------|------------|------------|
| <b>BORING NO.</b>        | B-6      | B-6       | B-6        | B-6        | B-6        |
| <b>SAMPLE NO.</b>        | 15-1439D | 15-1439G  | 15-1439J   | 15-1439M   | 15-1439P   |
| <b>SAMPLE DEPTH</b>      | 4.0-6.0' | 8.0-10.0' | 13.5-15.0' | 23.5-25.0' | 28.5-30.0' |
| <b>WATER CONTENT, W%</b> | 28.4     | 24.6      | 34.8       | 24.8       | 28.8       |

|                          |            |  |  |  |  |
|--------------------------|------------|--|--|--|--|
| <b>BORING NO.</b>        | B-6        |  |  |  |  |
| <b>SAMPLE NO.</b>        | 15-1439S   |  |  |  |  |
| <b>SAMPLE DEPTH</b>      | 38.5-40.0' |  |  |  |  |
| <b>WATER CONTENT, W%</b> | 27.5       |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

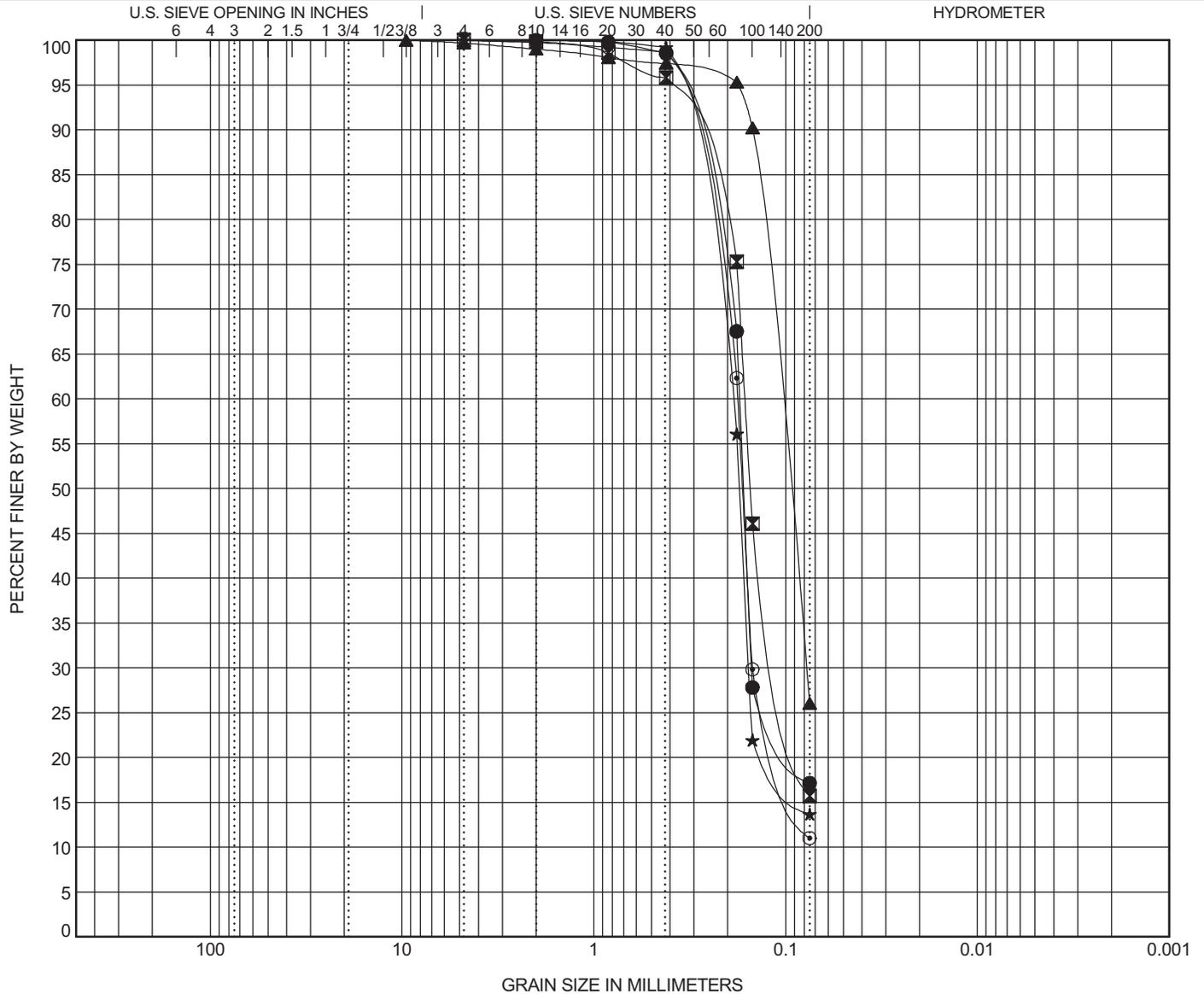


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                  | LL | PL | PI | Cc   | Cu   |
|----------|-------|-------------------------------------------------|----|----|----|------|------|
| ● B-6    | 6.0   | Silty Fine SAND (SM) A-2-4                      | NP | NP | NP |      |      |
| ⊠ B-6    | 10.0  | Silty Fine SAND (SM) A-2-4                      | NP | NP | NP |      |      |
| ▲ B-6    | 15.0  | Silty Fine SAND (SM) A-2-4                      | NP | NP | NP |      |      |
| ★ B-6    | 25.0  | Silty Fine SAND (SM) A-2-4                      | NP | NP | NP |      |      |
| ⊙ B-6    | 30.0  | Poorly Graded Fine SAND (SP-SM) with Silt A-2-4 | NP | NP | NP | 1.73 | 2.46 |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-6    | 6.0   | 2    | 0.381 | 0.166 |     | 0.0     | 82.8  |       | 17.2  |
| ⊠ B-6    | 10.0  | 4.76 | 0.405 | 0.153 |     | 0.0     | 84.3  |       | 15.7  |
| ▲ B-6    | 15.0  | 9.52 | 0.178 | 0.097 |     | 0.3     | 73.6  |       | 26.1  |
| ★ B-6    | 25.0  | 4.76 | 0.387 | 0.174 |     | 0.0     | 86.3  |       | 13.7  |
| ⊙ B-6    | 30.0  | 4.76 | 0.385 | 0.168 |     | 0.0     | 89.0  |       | 11.0  |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16

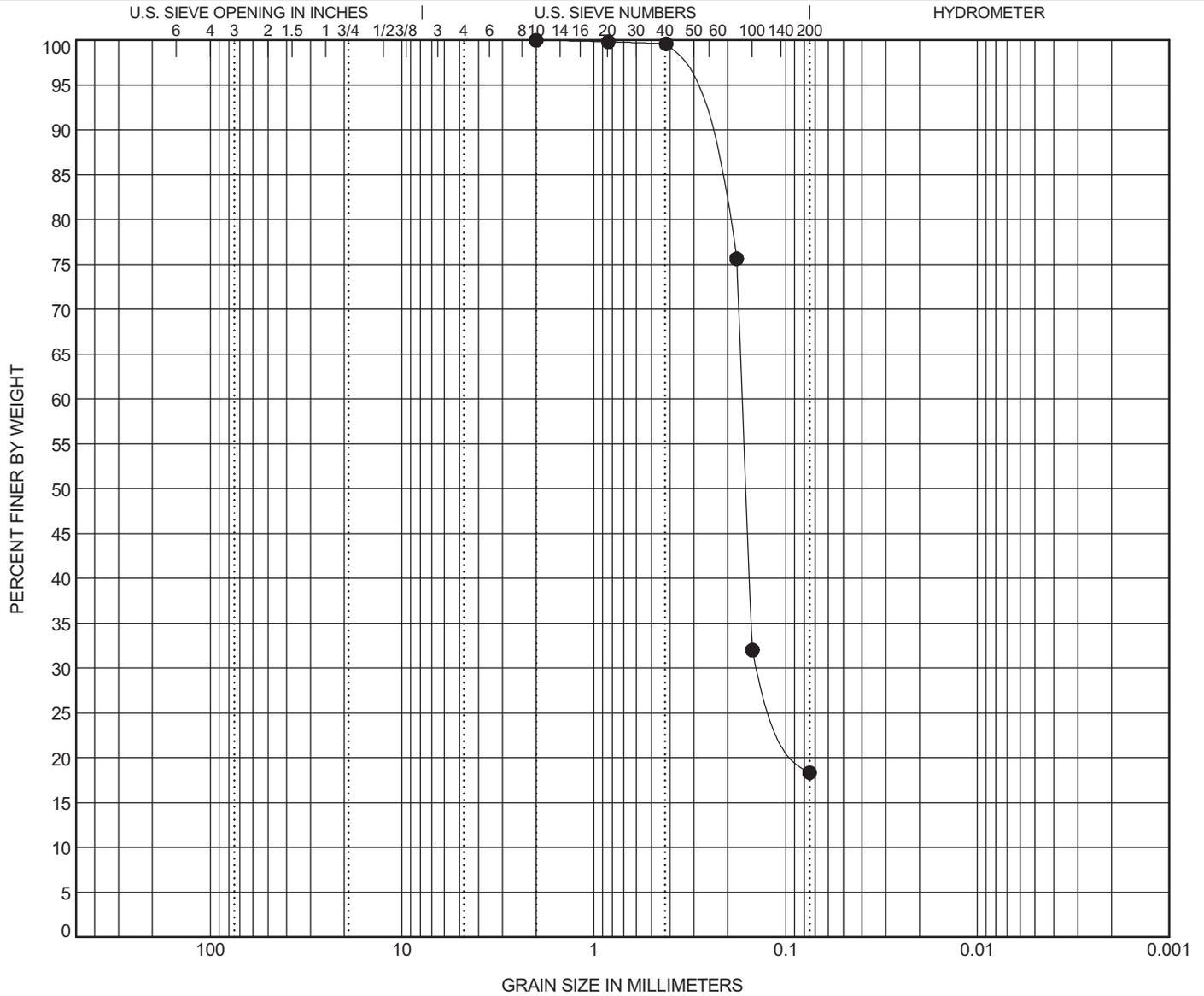


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                    |  |  |  |  | LL        | PL        | PI        | Cc | Cu |
|----------|-------|-----------------------------------|--|--|--|--|-----------|-----------|-----------|----|----|
| ● B-6    | 40.0  | <b>Silty Fine SAND (SM) A-2-4</b> |  |  |  |  | <b>NP</b> | <b>NP</b> | <b>NP</b> |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-6    | 40.0  | 2    | 0.357 | 0.161 |     | 0.0     | 81.7  | 18.3  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**ORGANIC IMPURITIES DETERMINATION**  
**(AASHTO T267)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396.00  
**SAMPLE NUMBER:** 15-1439A **DATE SAMPLE RECEIVED:** \_\_\_\_\_  
**DESCRIPTION OF SOIL:** \_\_\_\_\_  
**TESTED BY:** JH **DATE OF TESTING:** 10/13/2015  
**DATE OF WEIGHING:** 10/14/2015

|                                                             |           |  |  |  |  |
|-------------------------------------------------------------|-----------|--|--|--|--|
| <b>BORING NO.</b>                                           | B-6       |  |  |  |  |
| <b>SAMPLE NO.</b>                                           | 15-1439A  |  |  |  |  |
| <b>SAMPLE DEPTH</b>                                         | 2.0'-4.0' |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (BEFORE IGNITION) (GRAMS)</b> | 150.80    |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (AFTER IGNITION) (GRAMS)</b>  | 150.59    |  |  |  |  |
| <b>WT. OF CRUCIBLE (GRAMS)</b>                              | 110.80    |  |  |  |  |
| <b>WT. OF DRY SOIL (BEFORE IGNITION) (GRAMS)</b>            | 40.00     |  |  |  |  |
| <b>WT. OF DRY SOIL (AFTER IGNITION) (GRAMS)</b>             | 39.79     |  |  |  |  |
| <b>IGNITION LOSS (GRAMS)</b>                                | 0.21      |  |  |  |  |
| <b>ORGANIC IMPURITIES %</b>                                 | 0.53      |  |  |  |  |

**Determining pH of Soil for Use in Corrosion Testing  
AASHTO T 289**

PROJECT TITLE

F&ME/HARBOR RIVER/SC

SAMPLE ID

B-6 15-1439V

PROJECT NO.

1524908.09

SAMPLE TYPE

Bag

REMARKS

F&ME Project No. G5396

SAMPLE DEPTH

58.5 - 60.0'

**SAMPLE PREPARATION**

Sieved through the #10 Sieve

YES

Air Dry

YES

Type of Water

DISTILLED

| Trial | pH   | Temperature |
|-------|------|-------------|
| 1     | 7.66 | 20.1        |
| 2     | 7.67 | 20.1        |
| 3     | 7.64 | 20.1        |

AVERAGE

7.66

20.1

Description SILTY CLAY; grayish brown.

USCS

(CL)

TECH TJ

DATE 10/13/15

CHECK 

REVIEW 

APPROVE

## Determining Minimum Laboratory Soil Resistivity AASHTO T 288

|               |                        |              |              |          |
|---------------|------------------------|--------------|--------------|----------|
| PROJECT TITLE | F&ME/HARBOR RIVER/SC   | SAMPLE ID    | B-6          | 15-1439W |
| PROJECT NO.   | 1524908.09             | SAMPLE TYPE  | Bag          |          |
| REMARKS       | F&ME Project No. G5396 | SAMPLE DEPTH | 58.5 - 60.0' |          |

SAMPLE PREPARATION Sieved through the #10 Sieve  Yes

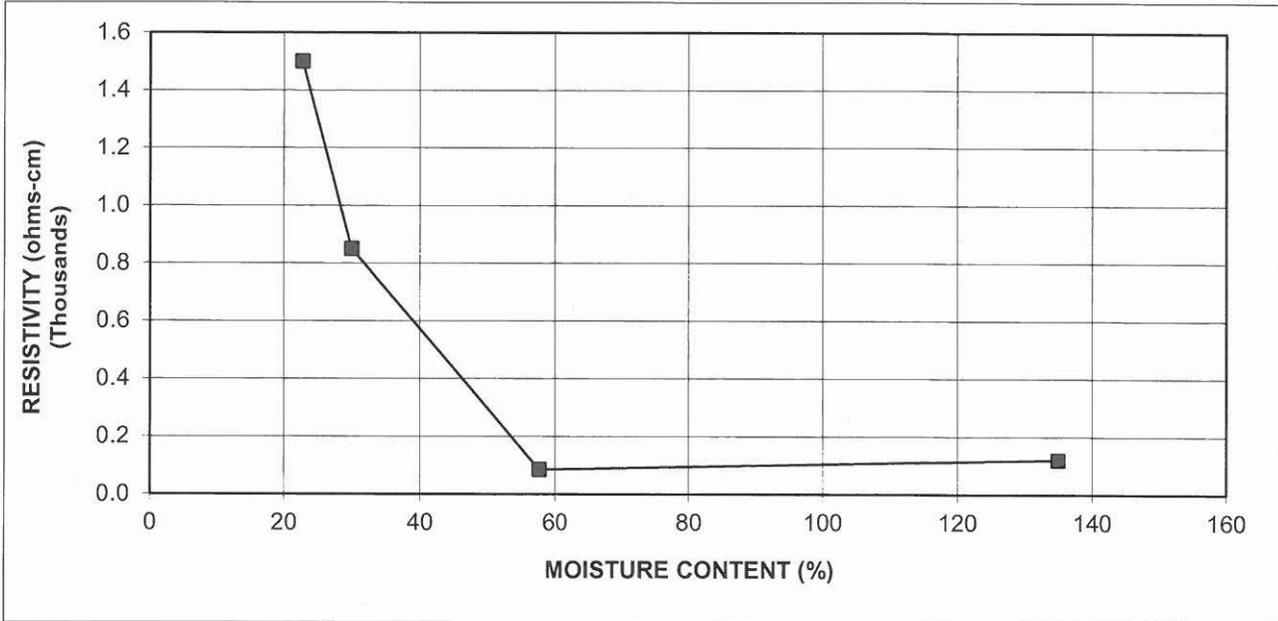
TEST APPARATUS Miller Soilbox and Nilsson 400 Soil Resistance Meter.

Identification: Lowest resistivity

| SPECIMEN (Point)      | 1     | 2   | 3  | 4   |
|-----------------------|-------|-----|----|-----|
| RESISTIVITY (ohms-cm) | 1,500 | 850 | 85 | 120 |

**MOISTURE CONTENT**

|                         |        |        |        |        |
|-------------------------|--------|--------|--------|--------|
| WET WEIGHT & TARE       | 110.92 | 145.08 | 179.10 | 321.03 |
| DRY WEIGHT & TARE       | 99.29  | 121.54 | 132.64 | 166.52 |
| TARE WEIGHT             | 48.19  | 43.00  | 52.04  | 52.01  |
| WEIGHT OF MOISTURE (gm) | 11.63  | 23.54  | 46.46  | 154.51 |
| WEIGHT OF DRY SOIL (gm) | 51.10  | 78.54  | 80.60  | 114.51 |
| MOISTURE CONTENT (%)    | 22.76  | 29.97  | 57.64  | 134.93 |



Description

USCS

|         |                    |
|---------|--------------------|
| TECH    | TJ                 |
| DATE    | 10/13/15           |
| CHECK   | <i>[Signature]</i> |
| REVIEW  | <i>[Signature]</i> |
| APPROVE | <i>[Signature]</i> |



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**Client:** Golder Associates, Inc.  
3730 Chamblee Tucker Road  
Atlanta, GA 30341-0000

**Client Proj #:** 1524908  
**ACL Project #:** 68442  
**Date Received:** 10/13/2015  
**Date Reported:** 10/30/2015

**Contact:** Mr. Henry Mock

**Sample ID:** B-6 58.5-60'

**Matrix:** Soil

**ACL #:** 307838

**Date/Time Sampled:** 10/13/2015 11:15

| <u>Analyte (Method)</u> | <u>Result</u> | <u>PQL</u> | <u>Units</u> | <u>DF</u> | <u>Prep Date/Time</u> | <u>Analysis Date/Time</u> | <u>Analyst</u> |
|-------------------------|---------------|------------|--------------|-----------|-----------------------|---------------------------|----------------|
| Sol. Chloride (9252A)*  | 16000         | 1000       | mg/kg        | 100       | 10/16/2015 8:30       | 10/16/2015 8:30           | MM             |
| Sol. Sulfate (9038)*    | 763           | 200        | mg/kg        | 20        | 10/19/2015 10:20      | 10/19/2015 10:20          | MM             |

**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1197 **DATE SAMPLE RECEIVED:** 7/21/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** MB **DATE OF TESTING:** 7/25/2016  
**DATE OF WEIGHING:** 7/26/2016

|                          |          |           |            |            |            |
|--------------------------|----------|-----------|------------|------------|------------|
| <b>BORING NO.</b>        | B-7      | B-7       | B-7        | B-7        | B-7        |
| <b>SAMPLE NO.</b>        | 16-1197C | 16-1197F  | 16-1197I   | 16-1197L   | 16-1197O   |
| <b>SAMPLE DEPTH</b>      | 4.0-6.0' | 8.0-10.0' | 13.5-15.0' | 18.5-20.0' | 43.5-45.0' |
| <b>WATER CONTENT, W%</b> | 24.2     | 33.1      | 31.3       | 24.2       | 38.0       |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

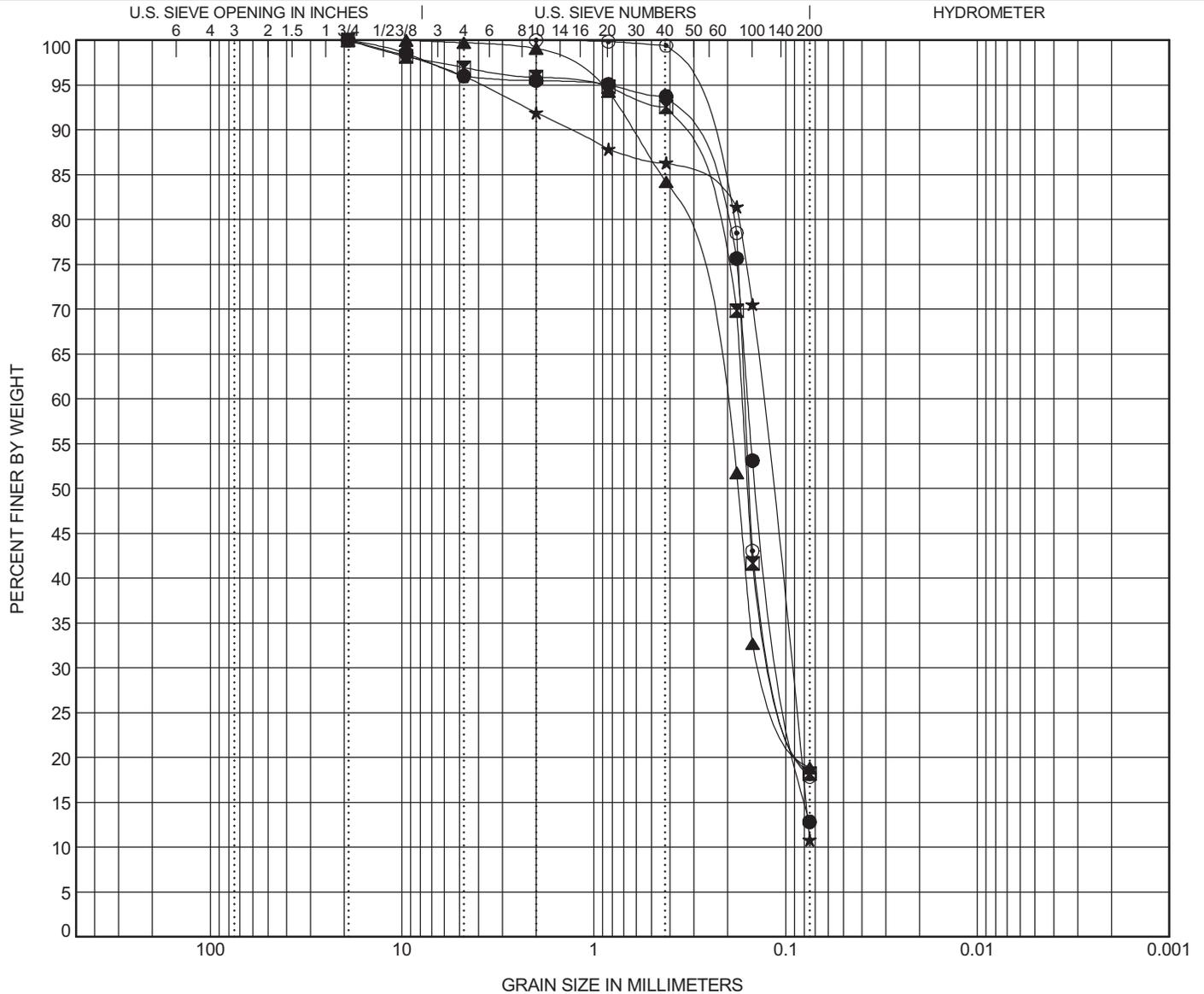


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                 | LL | PL | PI | Cc   | Cu   |
|----------|-------|------------------------------------------------|----|----|----|------|------|
| ● B-7    | 6.0   | Silty Fine SAND (SM) A-2-4                     | NP | NP | NP |      |      |
| ⊠ B-7    | 10.0  | Silty Fine SAND (SM) A-2-4                     | NP | NP | NP |      |      |
| ▲ B-7    | 15.0  | Silty F/M SAND (SM) A-2-4                      | NP | NP | NP |      |      |
| ★ B-7    | 20.0  | Poorly Graded F/C SAND (SP-SM) with Silt A-2-4 | NP | NP | NP | 0.89 | 1.78 |
| ⊙ B-7    | 45.0  | Silty Fine SAND (SM) A-2-4                     | NP | NP | NP |      |      |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-7    | 6.0   | 19.1 | 0.801 | 0.141 |     | 4.0     | 83.2  | 12.8  |       |
| ⊠ B-7    | 10.0  | 19.1 | 0.954 | 0.158 |     | 3.0     | 78.8  | 18.2  |       |
| ▲ B-7    | 15.0  | 9.52 | 0.957 | 0.177 |     | 0.3     | 80.9  | 18.9  |       |
| ★ B-7    | 20.0  | 19.1 | 3.859 | 0.118 |     | 4.0     | 85.1  | 10.8  |       |
| ⊙ B-7    | 45.0  | 2    | 0.351 | 0.155 |     | 0.0     | 82.1  | 17.9  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16







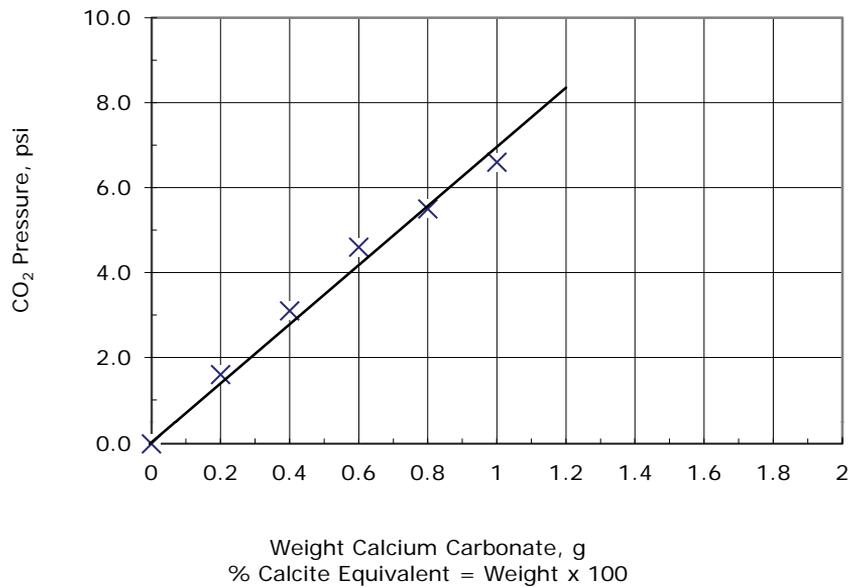
|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 08/23/16                                   |
| Tested By:        | jbr                                        |
| Checked By:       | jdt                                        |

## Rapid Determination of Carbonate Content of Soils by ASTM D4373

| Boring ID | Sample ID | Depth, ft | *CO <sub>2</sub> Pressure, psi | Weight of Sample used, g | Weight CaCO <sub>3</sub> , grams | Calcite Equivalent, % |
|-----------|-----------|-----------|--------------------------------|--------------------------|----------------------------------|-----------------------|
| B-7       | 16-1197P  | 28.5-30   | 0.20                           | 2.00                     | 0.08                             | 8                     |

Notes: Calcium Carbonate content precise to +/- 1.5%  
 \*CO<sub>2</sub> Pressure is based on the weight of sample as indicated in the table.  
 The reported Calcite Equivalent (%) is based on one gram

Figure 1: Calibration Curve



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1242 **DATE SAMPLE RECEIVED:** 7/29/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** JH **DATE OF TESTING:** 8/1/2016  
**DATE OF WEIGHING:** 8/2/2016

|                          |          |            |            |            |            |
|--------------------------|----------|------------|------------|------------|------------|
| <b>BORING NO.</b>        | B-8      | B-8        | B-8        | B-8        | B-8        |
| <b>SAMPLE NO.</b>        | 16-1242C | 16-1242S   | 16-1242F   | 16-1242I   | 16-1242M   |
| <b>SAMPLE DEPTH</b>      | 4.0-6.0' | 18.5-20.0' | 23.5-25.0' | 28.5-30.0' | 43.5-45.0' |
| <b>WATER CONTENT, W%</b> | 24.0     | 73.8       | 54.5       | 38.8       | 27.3       |

|                          |            |  |  |  |  |
|--------------------------|------------|--|--|--|--|
| <b>BORING NO.</b>        | B-8        |  |  |  |  |
| <b>SAMPLE NO.</b>        | 16-1242P   |  |  |  |  |
| <b>SAMPLE DEPTH</b>      | 48.5-50.0' |  |  |  |  |
| <b>WATER CONTENT, W%</b> | 37.1       |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

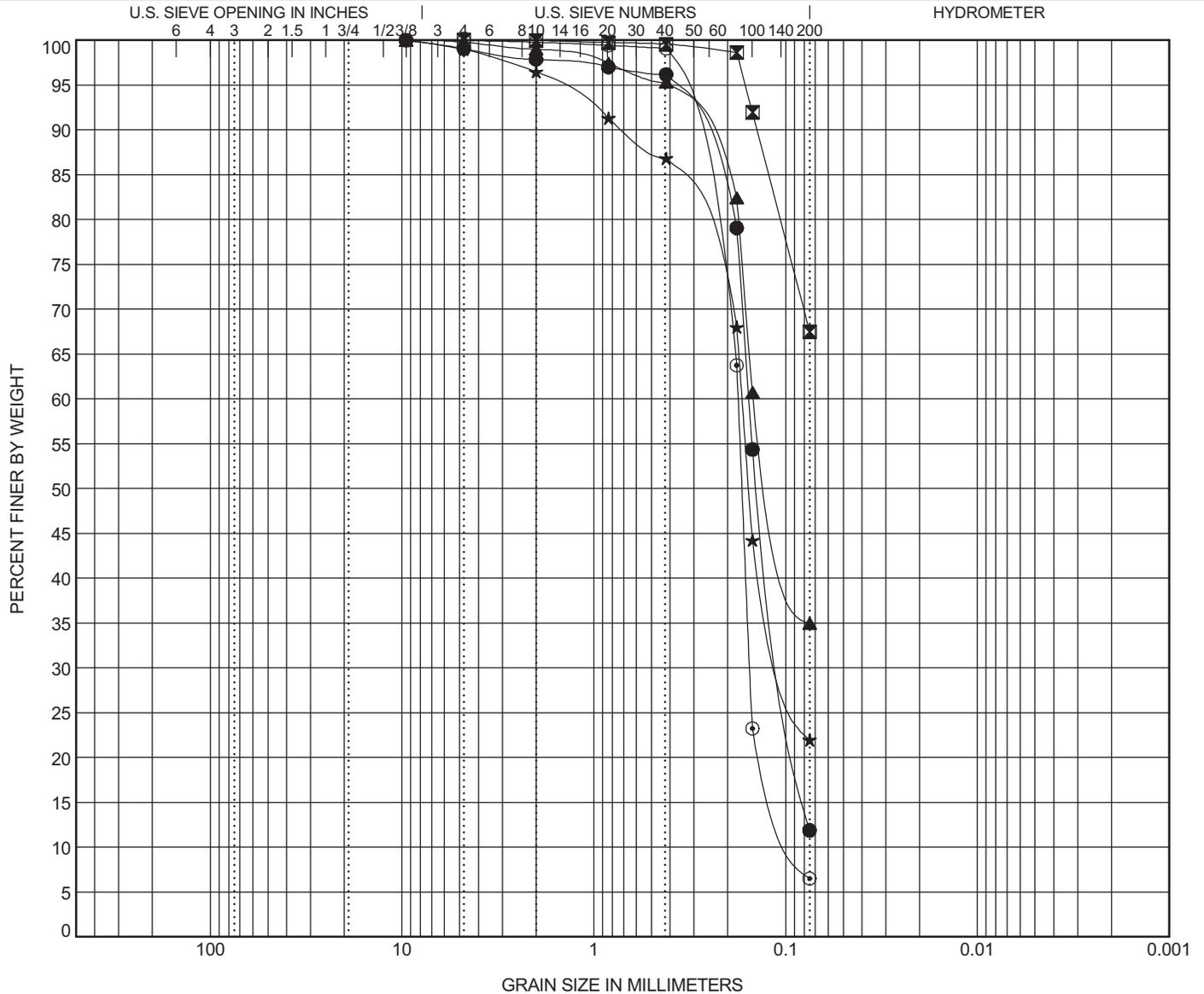


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification |                                                |       |       |         | LL    | PL    | PI    | Cc | Cu   |      |
|----------|-------|----------------|------------------------------------------------|-------|-------|---------|-------|-------|-------|----|------|------|
| ●        | B-8   | 6.0            | Poorly Graded F/M SAND (SP-SM) with Silt A-2-4 |       |       |         |       | NP    | NP    | NP | 0.89 | 2.14 |
| ☒        | B-8   | 20.0           | Sandy Lean CLAY (CL) A-6(8)                    |       |       |         |       | 34    | 20    | 14 |      |      |
| ▲        | B-8   | 25.0           | Clayey F/M SAND (SC) A-2-6(0)                  |       |       |         |       | 30    | 19    | 11 |      |      |
| ★        | B-8   | 30.0           | Silty F/M SAND (SM) A-2-4                      |       |       |         |       | NP    | NP    | NP |      |      |
| ◎        | B-8   | 45.0           | Poorly Graded F/M SAND (SP-SM) with Silt A-3   |       |       |         |       | NP    | NP    | NP | 1.54 | 2.04 |
| BOREHOLE | DEPTH | D100           | D95                                            | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |    |      |      |
| ●        | B-8   | 6.0            | 9.52                                           | 0.396 | 0.139 | 1.0     | 87.2  | 11.9  |       |    |      |      |
| ☒        | B-8   | 20.0           | 4.76                                           | 0.162 |       | 0.0     | 32.5  | 67.5  |       |    |      |      |
| ▲        | B-8   | 25.0           | 9.52                                           | 0.412 | 0.112 | 0.2     | 64.8  | 34.9  |       |    |      |      |
| ★        | B-8   | 30.0           | 9.52                                           | 1.559 | 0.156 | 1.0     | 77.0  | 22.0  |       |    |      |      |
| ◎        | B-8   | 45.0           | 4.76                                           | 0.381 | 0.169 | 0.087   | 0.0   | 93.5  | 6.5   |    |      |      |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16

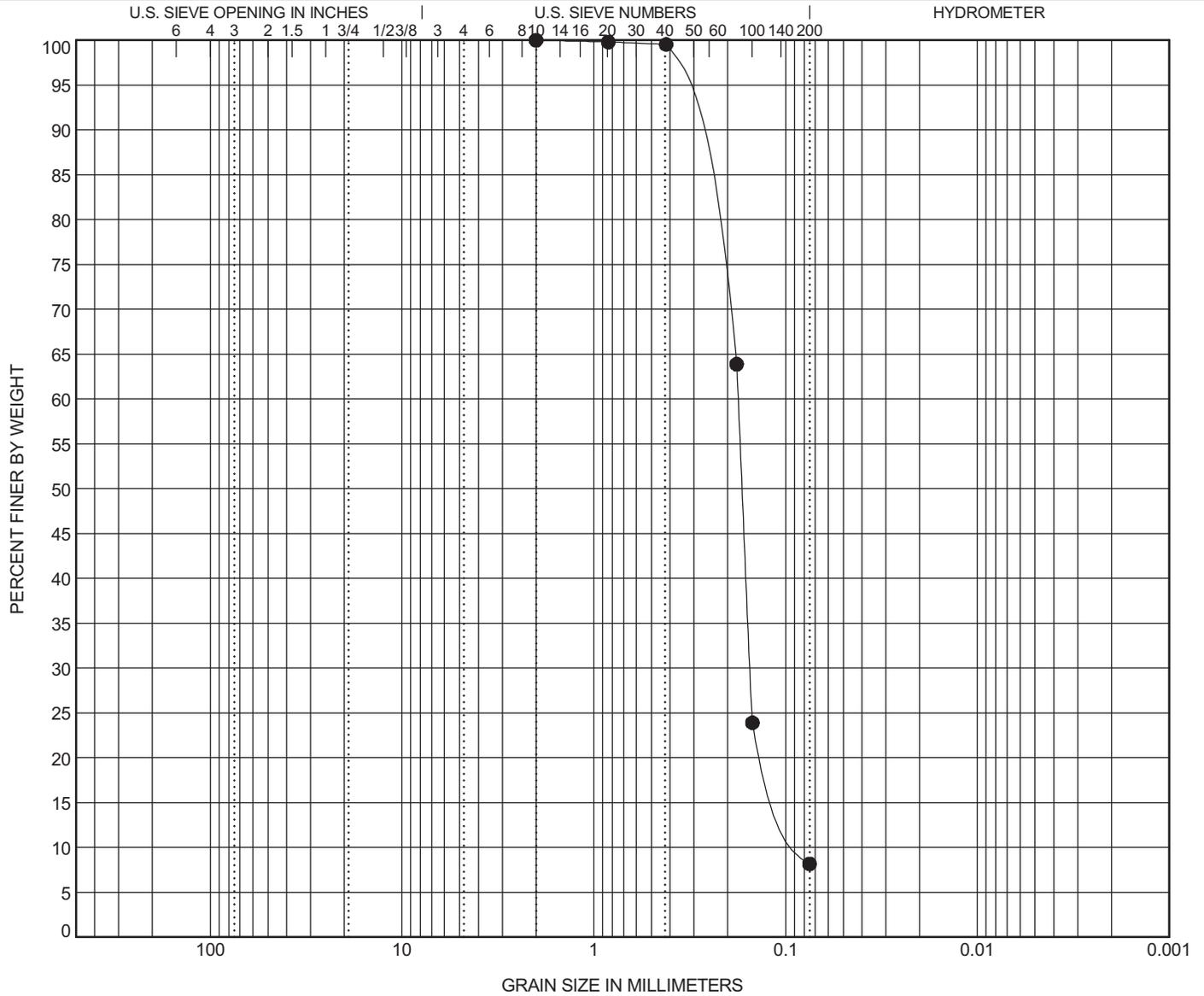


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                | LL | PL | PI | Cc   | Cu   |
|----------|-------|-----------------------------------------------|----|----|----|------|------|
| ● B-8    | 50.0  | Poorly Graded Fine SAND (SP-SM) with Silt A-3 | NP | NP | NP | 1.64 | 2.18 |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-------|---------|-------|-------|-------|
| ● B-8    | 50.0  | 2    | 0.377 | 0.169 | 0.081 | 0.0     | 91.8  | 8.2   |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





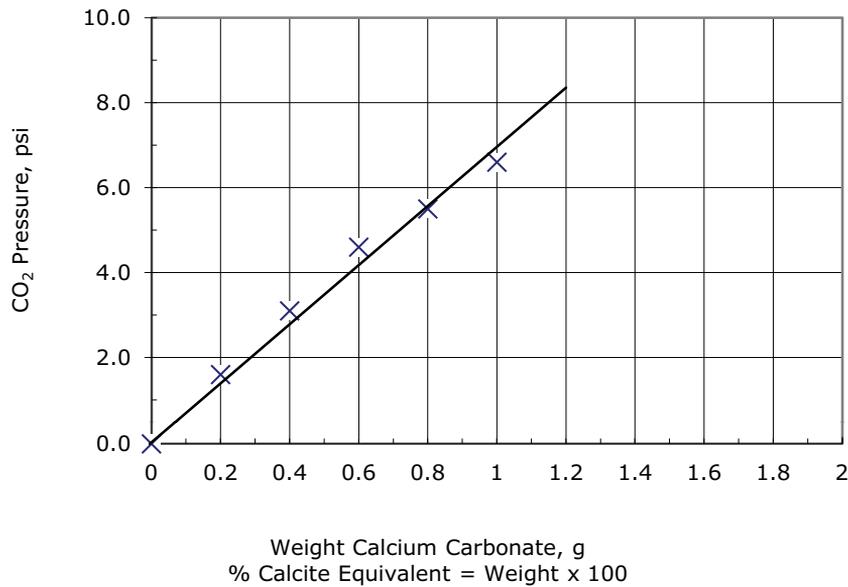
|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 08/23/16                                   |
| Tested By:        | jbr                                        |
| Checked By:       | jdt                                        |

## Rapid Determination of Carbonate Content of Soils by ASTM D4373

| Boring ID | Sample ID | Depth, ft | *CO <sub>2</sub> Pressure, psi | Weight of Sample used, g | Weight CaCO <sub>3</sub> , grams | Calcite Equivalent, % |
|-----------|-----------|-----------|--------------------------------|--------------------------|----------------------------------|-----------------------|
| B-8       | 16-1242J  | 33.5-35   | 0.20                           | 1.00                     | 0.16                             | 16                    |

Notes: Calcium Carbonate content precise to +/- 1.5%  
 \*CO<sub>2</sub> Pressure is based on the weight of sample as indicated in the table.  
 The reported Calcite Equivalent (%) is based on one gram

Figure 1: Calibration Curve



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1243 **DATE SAMPLE RECEIVED:** 7/29/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** MB **DATE OF TESTING:** 8/1/2016  
**DATE OF WEIGHING:** 8/2/2016

|                          |          |          |           |            |            |
|--------------------------|----------|----------|-----------|------------|------------|
| <b>BORING NO.</b>        | B-9      | B-9      | B-9       | B-9        | B-9        |
| <b>SAMPLE NO.</b>        | 16-1243F | 16-1243I | 16-1243L  | 16-1243C   | 16-1243P   |
| <b>SAMPLE DEPTH</b>      | 2.0-4.0' | 4.0-6.0' | 8.0-10.0' | 28.5-30.0' | 43.5-45.0' |
| <b>WATER CONTENT, W%</b> | 22.6     | 21.9     | 25.6      | 88.5       | 25.6       |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

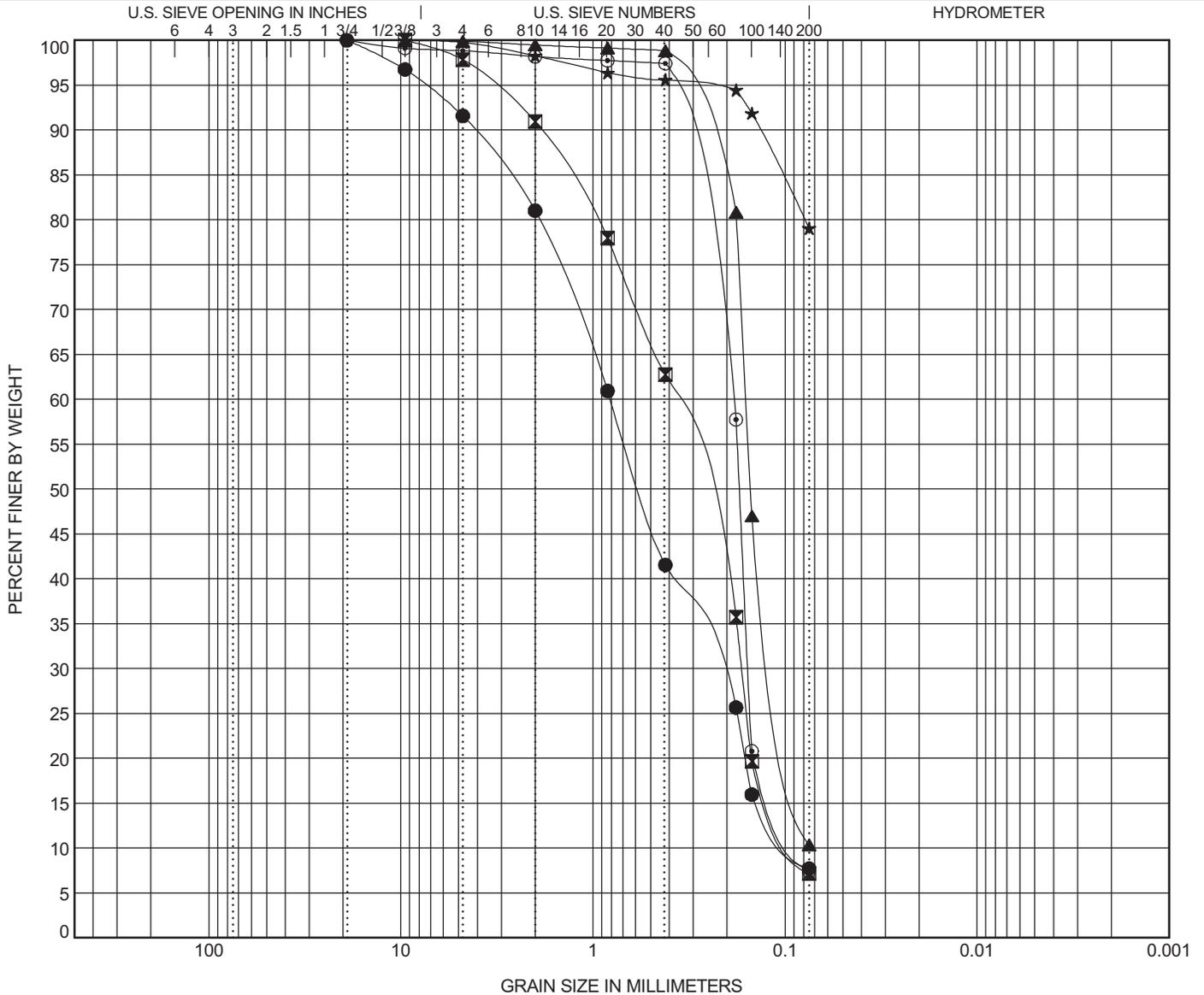


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                 | LL | PL | PI | Cc   | Cu   |
|----------|-------|------------------------------------------------|----|----|----|------|------|
| ● B-9    | 4.0   | Poorly Graded F/C SAND (SP-SM) with Silt A-1-b | NP | NP | NP | 0.70 | 8.97 |
| ⊠ B-9    | 6.0   | Poorly Graded F/C SAND (SP-SM) with Silt A-3   | NP | NP | NP | 0.84 | 4.40 |
| ▲ B-9    | 10.0  | Poorly Graded Fine SAND (SP-SM) with Silt A-3  | NP | NP | NP | 0.98 | 2.15 |
| ★ B-9    | 30.0  | Fat CLAY with Fine Sand (CH) A-7-5(24)         | 58 | 30 | 28 |      |      |
| ⊙ B-9    | 45.0  | Poorly Graded Fine SAND (SP-SM) with Silt A-3  | NP | NP | NP | 1.51 | 2.21 |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-------|---------|-------|-------|-------|
| ● B-9    | 4.0   | 19.1 | 7.521 | 0.568 | 0.091 | 8.4     | 83.8  | 7.7   |       |
| ⊠ B-9    | 6.0   | 9.52 | 3.326 | 0.282 | 0.088 | 2.2     | 90.7  | 7.2   |       |
| ▲ B-9    | 10.0  | 9.52 | 0.35  | 0.152 |       | 0.1     | 89.6  | 10.3  |       |
| ★ B-9    | 30.0  | 9.52 | 0.27  |       |       | 0.2     | 20.7  | 79.1  |       |
| ⊙ B-9    | 45.0  | 19.1 | 0.399 | 0.173 | 0.085 | 1.2     | 91.4  | 7.5   |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16







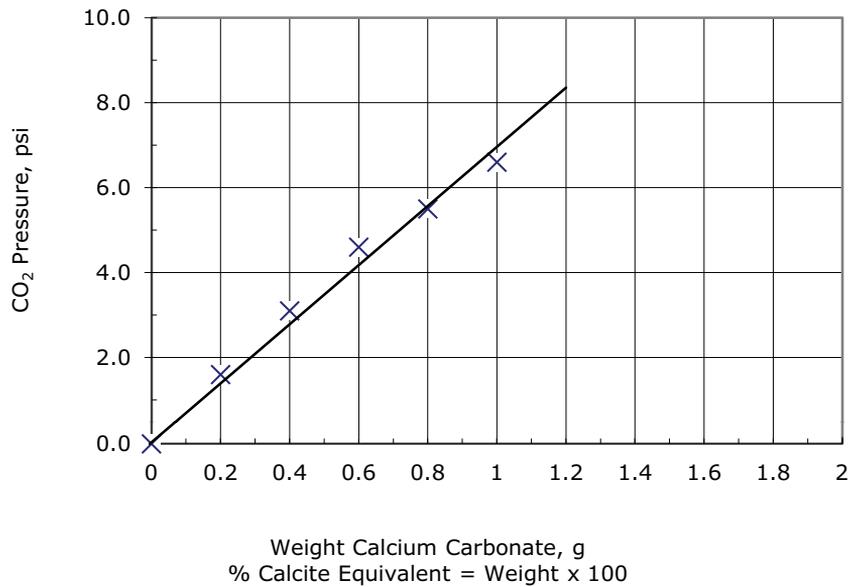
|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 08/23/16                                   |
| Tested By:        | jbr                                        |
| Checked By:       | jdt                                        |

## Rapid Determination of Carbonate Content of Soils by ASTM D4373

| Boring ID | Sample ID | Depth, ft | *CO <sub>2</sub> Pressure, psi | Weight of Sample used, g | Weight CaCO <sub>3</sub> , grams | Calcite Equivalent, % |
|-----------|-----------|-----------|--------------------------------|--------------------------|----------------------------------|-----------------------|
| B-9       | 16-1243M  | 13.5-15   | 0.30                           | 5.00                     | 0.05                             | 5                     |

Notes: Calcium Carbonate content precise to +/- 1.5%  
 \*CO<sub>2</sub> Pressure is based on the weight of sample as indicated in the table.  
 The reported Calcite Equivalent (%) is based on one gram

Figure 1: Calibration Curve



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1110 **DATE SAMPLE RECEIVED:** 7/5/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** MB **DATE OF TESTING:** 7/12/2016  
**DATE OF WEIGHING:** 7/13/2016

|                          |          |          |            |            |            |
|--------------------------|----------|----------|------------|------------|------------|
| <b>BORING NO.</b>        | B-10     | B-10     | B-10       | B-10       | B-10       |
| <b>SAMPLE NO.</b>        | 16-1110C | 16-1110F | 16-1110I   | 16-1110L   | 16-1110O   |
| <b>SAMPLE DEPTH</b>      | 3.5-5.5' | 7.5-9.5' | 25.0-26.5' | 46.0-47.5' | 56.5-58.0' |
| <b>WATER CONTENT, W%</b> | 50.0     | 24.1     | 58.3       | 21.9       | 58.1       |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

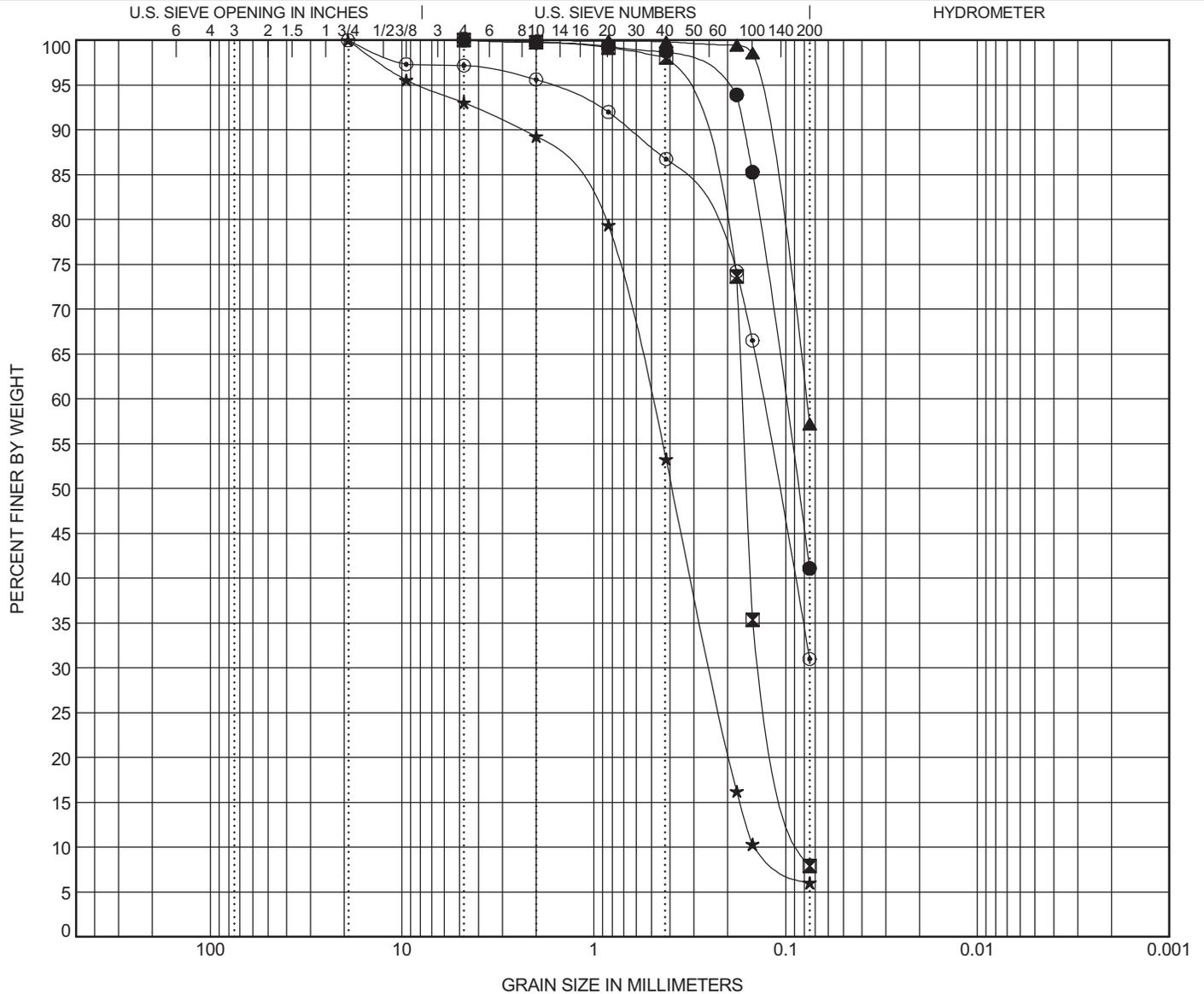


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                | LL | PL | PI | Cc   | Cu   |
|----------|-------|-----------------------------------------------|----|----|----|------|------|
| ● B-10   | 5.5   | Clayey Fine SAND (SC) A-4(1)                  | 26 | 17 | 9  |      |      |
| ■ B-10   | 9.5   | Poorly Graded Fine SAND (SP-SM) with Silt A-3 | NP | NP | NP | 1.28 | 2.13 |
| ▲ B-10   | 26.5  | Sandy SILT (ML) A-4(2)                        | 33 | 26 | 7  |      |      |
| ★ B-10   | 47.5  | Poorly Graded F/C SAND (SP-SM) with Silt A-3  | NP | NP | NP | 0.86 | 3.56 |
| ◎ B-10   | 58.0  | Silty F/M SAND (SM) A-2-6(0)                  | 39 | 27 | 12 |      |      |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-------|---------|-------|-------|-------|
| ● B-10   | 5.5   | 4.76 | 0.217 | 0.086 |       | 0.0     | 58.9  | 41.1  |       |
| ■ B-10   | 9.5   | 4.76 | 0.377 | 0.16  | 0.079 | 0.0     | 92.1  | 7.9   |       |
| ▲ B-10   | 26.5  | 2    | 0.14  |       |       | 0.0     | 42.8  | 57.2  |       |
| ★ B-10   | 47.5  | 19.1 | 8.124 | 0.39  | 0.141 | 7.0     | 87.0  | 6.0   |       |
| ◎ B-10   | 58.0  | 19.1 | 1.721 | 0.108 |       | 2.8     | 66.2  | 31.0  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





|            |                                            |              |             |                 |
|------------|--------------------------------------------|--------------|-------------|-----------------|
| Client:    | F&ME Consultants                           |              | Project No: | GTX-305005      |
| Project:   | US-21 Replacement Bridge over Harbor River |              |             |                 |
| Location:  | ---                                        |              |             |                 |
| Boring ID: | ---                                        | Sample Type: | ---         | Tested By: GA   |
| Sample ID: | ---                                        | Test Date:   | 08/09/16    | Checked By: mcm |
| Depth :    | ---                                        | Test Id:     | 386279      |                 |

**pH of Soil by ASTM D4972**

| Boring ID | Sample ID | Depth      | Visual Description          | pH of Soil in Distilled Water | pH of Soil in Calcium Chloride |
|-----------|-----------|------------|-----------------------------|-------------------------------|--------------------------------|
| B-10      | ---       | 30.5-32 ft | Moist, dark gray silty sand | 7.1                           | 6.8                            |

Notes: Sample Preparation: screened through #10 sieve  
Method A, pH meter used



|             |                                            |
|-------------|--------------------------------------------|
| Client:     | F&ME Consultants                           |
| Project:    | US-21 Replacement Bridge over Harbor River |
| Location:   | ---                                        |
| GTX#:       | 305005                                     |
| Test Date:  | 08/09/16                                   |
| Tested By:  | jm                                         |
| Checked By: | mcm                                        |

**Laboratory Measurement of Soil Resistivity Using  
the Wenner Four-Electrode Method by ASTM G57  
(Laboratory Measurement)**

| Boring ID | Sample ID | Depth, ft. | Sample Description          | Electrical Resistivity, ohm-cm | Electrical Conductivity, (ohm-cm) <sup>-1</sup> |
|-----------|-----------|------------|-----------------------------|--------------------------------|-------------------------------------------------|
| B-10      | ---       | 30.5-32    | Moist, dark gray silty sand | 62                             | 1.61E-02                                        |

Notes: Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box  
Water added to sample to create a thick slurry prior to testing (saturated condition).  
Electrical Conductivity is calculated as inverse of Electrical Resistivity (per ASTM G57)  
Test conducted in standard laboratory atmosphere: 68-73 F

**Project Name:** US-21 REP. BRIDGE OVER HARBOR  
**Project Number:** 305005

**Lab Number:** L1623916  
**Report Date:** 08/08/16

**SAMPLE RESULTS**

**Lab ID:** L1623916-01  
**Client ID:** B-10 / 30.5-32.0 FT  
**Sample Location:** Not Specified  
**Matrix:** Soil

**Date Collected:** 08/01/16 11:51  
**Date Received:** 08/02/16  
**Field Prep:** Not Specified

| Parameter                                  | Result | Qualifier | Units | RL    | MDL | Dilution Factor | Date Prepared | Date Analyzed  | Analytical Method | Analyst |
|--------------------------------------------|--------|-----------|-------|-------|-----|-----------------|---------------|----------------|-------------------|---------|
| <b>General Chemistry - Westborough Lab</b> |        |           |       |       |     |                 |               |                |                   |         |
| Solids, Total                              | 56.7   |           | %     | 0.100 | NA  | 1               | -             | 08/03/16 02:46 | 121,2540G         | VB      |
| Chloride                                   | 8400   |           | mg/kg | 170   | --  | 10              | -             | 08/05/16 18:53 | 1,9251            |         |
| Sulfate                                    | 2400   |           | mg/kg | 880   | --  | 5               | -             | 08/04/16 11:30 | 1,9038            | AW      |







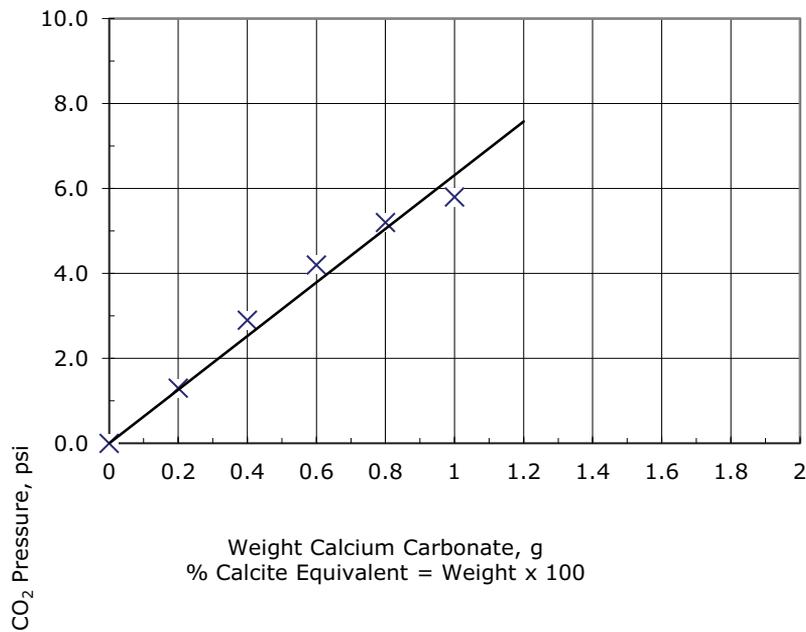
|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 08/23/16                                   |
| Tested By:        | jbr                                        |
| Checked By:       | jdt                                        |

## Rapid Determination of Carbonate Content of Soils by ASTM D4373

| Boring ID | Sample ID | Depth, ft | *CO <sub>2</sub> Pressure, psi | Weight of Sample used, g | Weight CaCO <sub>3</sub> , grams | Calcite Equivalent, % |
|-----------|-----------|-----------|--------------------------------|--------------------------|----------------------------------|-----------------------|
| B-10      | ---       | 86.5-88   | 5.60                           | 1.00                     | 4.60                             | 460                   |

Notes: Calcium Carbonate content precise to +/- 1.5%  
 \*CO<sub>2</sub> Pressure is based on the weight of sample as indicated in the table.  
 The reported Calcite Equivalent (%) is based on one gram

Figure 1: Calibration Curve



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1111 **DATE SAMPLE RECEIVED:** 7/5/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** MB **DATE OF TESTING:** 7/12/2016  
**DATE OF WEIGHING:** 7/13/2016

|                          |            |            |            |            |            |
|--------------------------|------------|------------|------------|------------|------------|
| <b>BORING NO.</b>        | B-11       | B-11       | B-11       | B-11       | B-11       |
| <b>SAMPLE NO.</b>        | 16-1111C   | 16-1111F   | 16-1111I   | 16-1111L   | 16-1111O   |
| <b>SAMPLE DEPTH</b>      | 26.0-28.0' | 28.0-30.0' | 30.0-32.0' | 36.5-38.0' | 83.0-84.5' |
| <b>WATER CONTENT, W%</b> | 33.7       | 57.6       | 30.5       | 93.7       | 45.3       |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

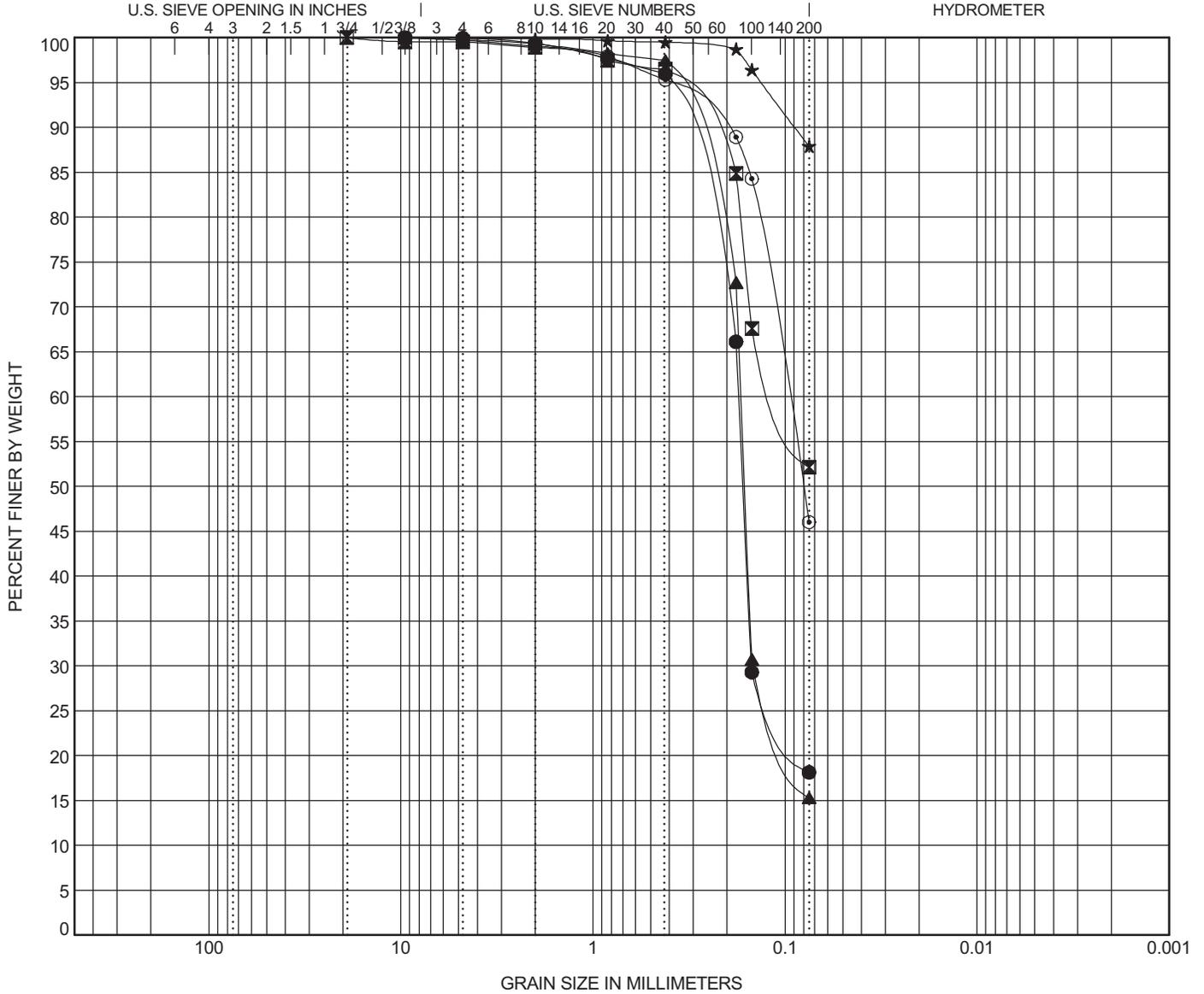


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification              | LL | PL | PI | Cc | Cu |
|----------|-------|-----------------------------|----|----|----|----|----|
| ● B-11   | 28.0  | Silty Fine SAND (SM) A-2-4  | 22 | NP | NP |    |    |
| ⊠ B-11   | 30.0  | Sandy Lean CLAY (CL) A-4(2) | 26 | 17 | 9  |    |    |
| ▲ B-11   | 32.0  | Silty Fine SAND (SM) A-2-4  | NP | NP | NP |    |    |
| ★ B-11   | 38.0  | Elastic SILT (MH) A-7-5(25) | 58 | 35 | 23 |    |    |
| ⊙ B-11   | 84.5  | Silty Fine SAND (SM) A-4(0) | 31 | NP | NP |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-11   | 28.0  | 9.52 | 0.409 | 0.166 |     | 0.0     | 81.8  | 18.1  |       |
| ⊠ B-11   | 30.0  | 19.1 | 0.376 |       |     | 0.5     | 47.4  | 52.1  |       |
| ▲ B-11   | 32.0  | 9.52 | 0.386 | 0.162 |     | 0.2     | 84.5  | 15.3  |       |
| ★ B-11   | 38.0  | 9.52 | 0.133 |       |     | 0.0     | 12.1  | 87.9  |       |
| ⊙ B-11   | 84.5  | 9.52 | 0.402 | 0.081 |     | 0.3     | 53.7  | 46.0  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





|            |                                            |              |             |                 |
|------------|--------------------------------------------|--------------|-------------|-----------------|
| Client:    | F&ME Consultants                           |              | Project No: | GTX-305005      |
| Project:   | US-21 Replacement Bridge over Harbor River |              |             |                 |
| Location:  | ---                                        | Sample Type: | ---         | Tested By: GA   |
| Boring ID: | ---                                        | Test Date:   | 08/09/16    | Checked By: mcm |
| Sample ID: | ---                                        | Test Id:     | 386279      |                 |
| Depth :    | ---                                        |              |             |                 |

**pH of Soil by ASTM D4972**

| Boring ID | Sample ID | Depth      | Visual Description               | pH of Soil in Distilled Water | pH of Soil in Calcium Chloride |
|-----------|-----------|------------|----------------------------------|-------------------------------|--------------------------------|
| B-11      | ---       | 92.5-94 ft | Moist, dark olive clay with sand | 7.0                           | 6.8                            |

Notes: Sample Preparation: screened through #10 sieve  
Method A, pH meter used



|             |                                            |
|-------------|--------------------------------------------|
| Client:     | F&ME Consultants                           |
| Project:    | US-21 Replacement Bridge over Harbor River |
| Location:   | ---                                        |
| GTX#:       | 305005                                     |
| Test Date:  | 08/09/16                                   |
| Tested By:  | jm                                         |
| Checked By: | mcm                                        |

**Laboratory Measurement of Soil Resistivity Using  
the Wenner Four-Electrode Method by ASTM G57  
(Laboratory Measurement)**

| Boring ID | Sample ID | Depth, ft. | Sample Description          | Electrical Resistivity, ohm-cm | Electrical Conductivity, (ohm-cm) <sup>-1</sup> |
|-----------|-----------|------------|-----------------------------|--------------------------------|-------------------------------------------------|
| B-11      | ---       | 92.5-94    | Moist, olive clay with sand | 101                            | 9.91E-03                                        |

Notes: Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box  
Water added to sample to create a thick slurry prior to testing (saturated condition).  
Electrical Conductivity is calculated as inverse of Electrical Resistivity (per ASTM G57)  
Test conducted in standard laboratory atmosphere: 68-73 F

**Project Name:** US-21 REP. BRIDGE OVER HARBOR  
**Project Number:** 305005

**Lab Number:** L1623916  
**Report Date:** 08/08/16

**SAMPLE RESULTS**

**Lab ID:** L1623916-02  
**Client ID:** B-11 / 92.5-94.0 FT  
**Sample Location:** Not Specified  
**Matrix:** Soil

**Date Collected:** 08/01/16 11:59  
**Date Received:** 08/02/16  
**Field Prep:** Not Specified

| Parameter                           | Result | Qualifier | Units | RL    | MDL | Dilution Factor | Date Prepared | Date Analyzed  | Analytical Method | Analyst |
|-------------------------------------|--------|-----------|-------|-------|-----|-----------------|---------------|----------------|-------------------|---------|
| General Chemistry - Westborough Lab |        |           |       |       |     |                 |               |                |                   |         |
| Solids, Total                       | 62.2   |           | %     | 0.100 | NA  | 1               | -             | 08/03/16 02:46 | 121,2540G         | VB      |
| Chloride                            | 5700   |           | mg/kg | 140   | --  | 10              | -             | 08/05/16 17:53 | 1,9251            |         |
| Sulfate                             | 2000   |           | mg/kg | 800   | --  | 5               | -             | 08/04/16 11:30 | 1,9038            | AW      |





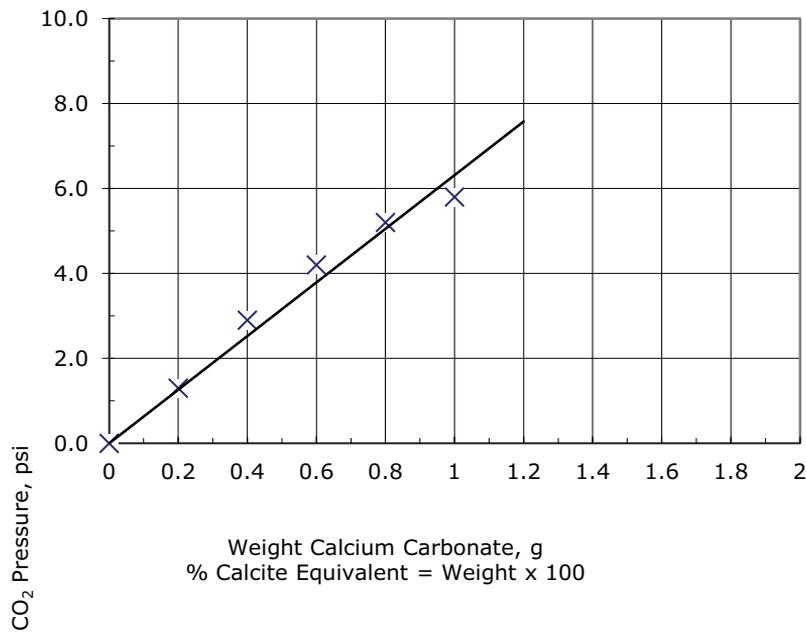
|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 08/23/16                                   |
| Tested By:        | jbr                                        |
| Checked By:       | jdt                                        |

## Rapid Determination of Carbonate Content of Soils by ASTM D4373

| Boring ID | Sample ID | Depth, ft | *CO <sub>2</sub> Pressure, psi | Weight of Sample used, g | Weight CaCO <sub>3</sub> , grams | Calcite Equivalent, % |
|-----------|-----------|-----------|--------------------------------|--------------------------|----------------------------------|-----------------------|
| B-11      | ---       | 68.5-70   | 5.50                           | 1.00                     | 4.51                             | 451                   |

Notes: Calcium Carbonate content precise to +/- 1.5%  
 \*CO<sub>2</sub> Pressure is based on the weight of sample as indicated in the table.  
 The reported Calcite Equivalent (%) is based on one gram

Figure 1: Calibration Curve





**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1182 **DATE SAMPLE RECEIVED:** 7/15/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** MB **DATE OF TESTING:** 7/20/2016  
**DATE OF WEIGHING:** 7/21/2016

|                          |            |            |            |            |            |
|--------------------------|------------|------------|------------|------------|------------|
| <b>BORING NO.</b>        | B-12       | B-12       | B-12       | B-12       | B-12       |
| <b>SAMPLE NO.</b>        | 16-1182C   | 16-1182F   | 16-1182I   | 16-1182L   | 16-1182O   |
| <b>SAMPLE DEPTH</b>      | 37.0-39.0' | 45.5-47.0' | 61.0-62.5' | 80.0-81.5' | 96.5-98.0' |
| <b>WATER CONTENT, W%</b> | 32.9       | 24.6       | 81.2       | 61.8       | 33.7       |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

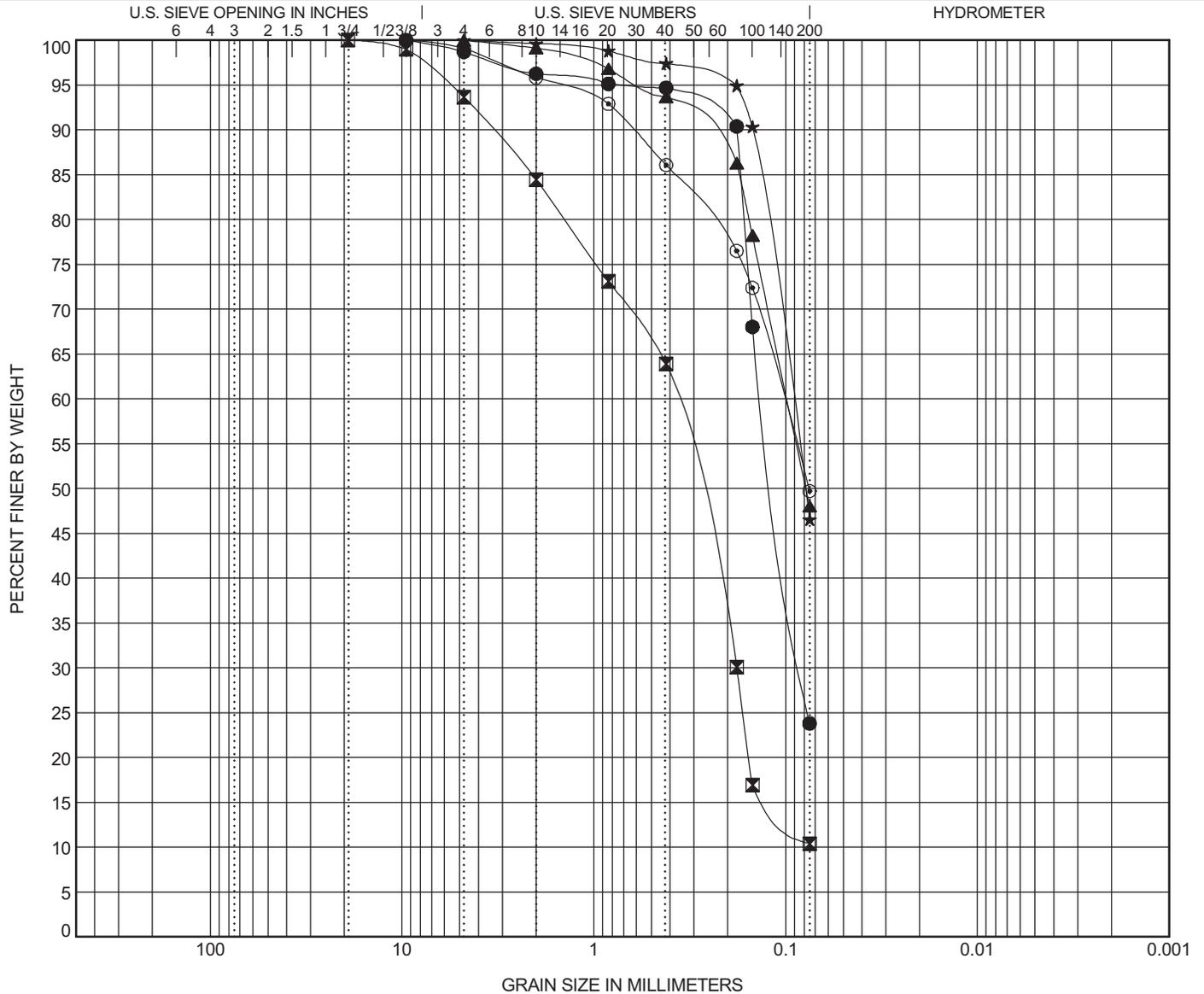


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                               | LL | PL | PI | Cc   | Cu   |
|----------|-------|----------------------------------------------|----|----|----|------|------|
| ● B-12   | 39.0  | Silty F/M SAND (SM) A-2-4                    | NP | NP | NP |      |      |
| ☒ B-12   | 47.0  | Poorly Graded F/C SAND (SP-SM) with Silt A-3 | NP | NP | NP | 1.18 | 5.30 |
| ▲ B-12   | 62.5  | Silty F/M SAND (SM) A-5(0)                   | 51 | NP | NP |      |      |
| ★ B-12   | 81.5  | Silty Fine SAND (SM) A-7-5(4)                | 44 | 31 | 13 |      |      |
| ◎ B-12   | 98.0  | Silty F/M SAND (SM) A-4(0)                   | 30 | NP | NP |      |      |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-12   | 39.0  | 9.52 | 0.672 | 0.113 |     | 1.3     | 74.9  | 23.8  |       |
| ☒ B-12   | 47.0  | 19.1 | 5.662 | 0.296 |     | 6.4     | 83.2  | 10.4  |       |
| ▲ B-12   | 62.5  | 4.76 | 0.561 | 0.078 |     | 0.0     | 52.0  | 48.0  |       |
| ★ B-12   | 81.5  | 4.76 | 0.184 | 0.079 |     | 0.0     | 53.4  | 46.6  |       |
| ◎ B-12   | 98.0  | 9.52 | 1.56  | 0.076 |     | 0.9     | 49.3  | 49.7  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





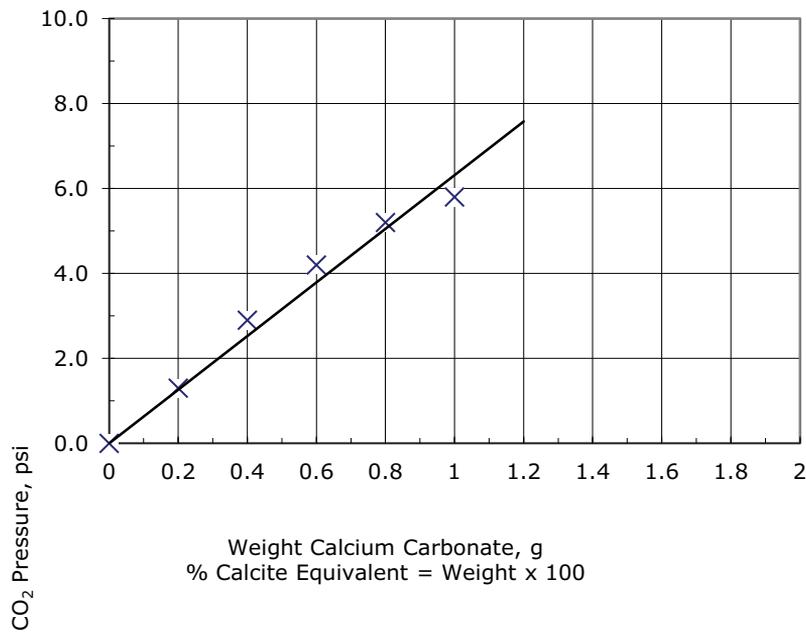
|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 08/23/16                                   |
| Tested By:        | jbr                                        |
| Checked By:       | jdt                                        |

## Rapid Determination of Carbonate Content of Soils by ASTM D4373

| Boring ID | Sample ID | Depth, ft | *CO <sub>2</sub> Pressure, psi | Weight of Sample used, g | Weight CaCO <sub>3</sub> , grams | Calcite Equivalent, % |
|-----------|-----------|-----------|--------------------------------|--------------------------|----------------------------------|-----------------------|
| B-12      | ---       | 115.5-117 | 6.00                           | 1.00                     | 4.93                             | 493                   |

Notes: Calcium Carbonate content precise to +/- 1.5%  
 \*CO<sub>2</sub> Pressure is based on the weight of sample as indicated in the table.  
 The reported Calcite Equivalent (%) is based on one gram

Figure 1: Calibration Curve



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1039 **DATE SAMPLE RECEIVED:** 7/6/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** MB **DATE OF TESTING:** 7/6/2016  
**DATE OF WEIGHING:** 7/7/2016

|                          |            |            |            |            |             |
|--------------------------|------------|------------|------------|------------|-------------|
| <b>BORING NO.</b>        | B-13       | B-13       | B-13       | B-13       | B-13        |
| <b>SAMPLE NO.</b>        | 16-1039C   | 16-1039F   | 16-1039I   | 16-1039L   | 16-1039O    |
| <b>SAMPLE DEPTH</b>      | 32.0-34.0' | 42.5-44.0' | 52.5-54.0' | 63.5-65.0' | 99.5-101.0' |
| <b>WATER CONTENT, W%</b> | 34.6       | 63.6       | 78.3       | 73.8       | 37.3        |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

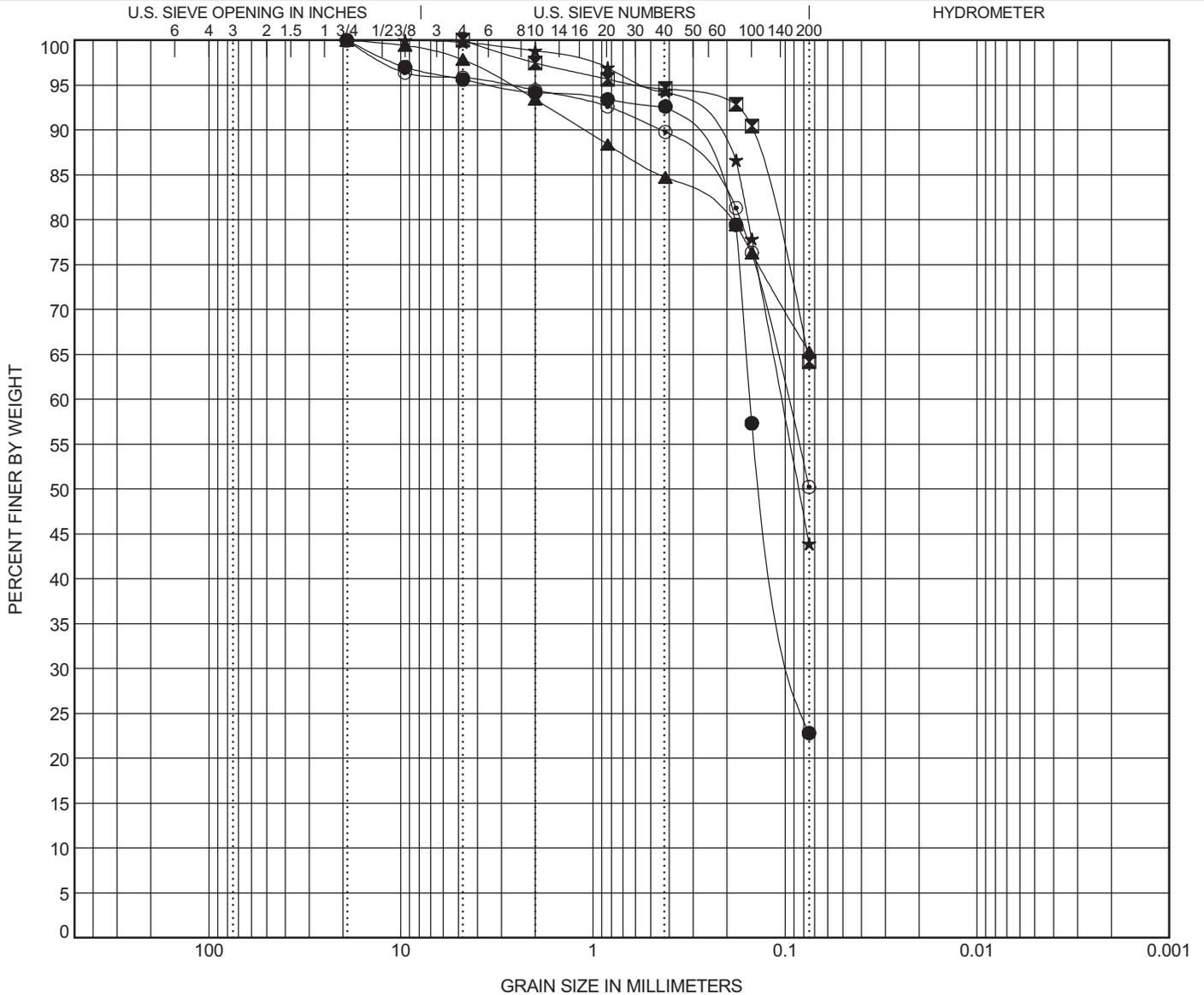


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                 | LL | PL | PI | Cc | Cu |
|----------|-------|--------------------------------|----|----|----|----|----|
| ● B-13   | 34.0  | Silty F/M SAND (SM) A-2-4      | NP | NP | NP |    |    |
| ☒ B-13   | 44.0  | Sandy Lean CLAY (CL) A-7-6(11) | 41 | 20 | 21 |    |    |
| ▲ B-13   | 54.0  | Sandy SILT (ML) A-4(0)         | 23 | NP | NP |    |    |
| ★ B-13   | 65.0  | Clayey F/M SAND (SC) A-7-6(11) | 67 | 29 | 38 |    |    |
| ◎ B-13   | 101.0 | Sandy SILT (ML) A-4(1)         | 30 | 24 | 6  |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-13   | 34.0  | 19.1 | 3.252 | 0.129 |     | 4.4     | 72.8  |       | 22.8  |
| ☒ B-13   | 44.0  | 4.76 | 0.54  |       |     | 0.0     | 35.8  |       | 64.2  |
| ▲ B-13   | 54.0  | 19.1 | 2.717 |       |     | 2.1     | 32.6  |       | 65.3  |
| ★ B-13   | 65.0  | 9.52 | 0.501 | 0.085 |     | 0.2     | 55.9  |       | 43.9  |
| ◎ B-13   | 101.0 | 19.1 | 2.809 |       |     | 4.2     | 45.6  |       | 50.2  |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





|            |                                            |              |            |
|------------|--------------------------------------------|--------------|------------|
| Client:    | F&ME Consultants                           |              |            |
| Project:   | US-21 Replacement Bridge over Harbor River |              |            |
| Location:  | ---                                        | Project No:  | GTX-305005 |
| Boring ID: | ---                                        | Sample Type: | ---        |
| Sample ID: | ---                                        | Test Date:   | 08/09/16   |
| Depth :    | ---                                        | Test Id:     | 386279     |
|            |                                            | Tested By:   | GA         |
|            |                                            | Checked By:  | mcm        |

**pH of Soil by ASTM D4972**

| Boring ID | Sample ID | Depth      | Visual Description           | pH of Soil in Distilled Water | pH of Soil in Calcium Chloride |
|-----------|-----------|------------|------------------------------|-------------------------------|--------------------------------|
| B-13      | ---       | 58-59.5 ft | Moist, dark olive silty sand | 7.2                           | 7.0                            |

Notes: Sample Preparation: screened through #10 sieve  
Method A, pH meter used





|             |                                            |
|-------------|--------------------------------------------|
| Client:     | F&ME Consultants                           |
| Project:    | US-21 Replacement Bridge over Harbor River |
| Location:   | ---                                        |
| GTX#:       | 305005                                     |
| Test Date:  | 08/09/16                                   |
| Tested By:  | jm                                         |
| Checked By: | mcm                                        |

**Laboratory Measurement of Soil Resistivity Using  
the Wenner Four-Electrode Method by ASTM G57  
(Laboratory Measurement)**

| Boring ID | Sample ID | Depth, ft. | Sample Description           | Electrical Resistivity, ohm-cm | Electrical Conductivity, (ohm-cm) <sup>-1</sup> |
|-----------|-----------|------------|------------------------------|--------------------------------|-------------------------------------------------|
| B-13      | ---       | 58-59.5    | Moist, dark olive silty sand | 76                             | 1.31E-02                                        |

Notes: Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box  
Water added to sample to create a thick slurry prior to testing (saturated condition).  
Electrical Conductivity is calculated as inverse of Electrical Resistivity (per ASTM G57)  
Test conducted in standard laboratory atmosphere: 68-73 F

**Project Name:** US-21 REP. BRIDGE OVER HARBOR  
**Project Number:** 305005

**Lab Number:** L1623916  
**Report Date:** 08/08/16

**SAMPLE RESULTS**

**Lab ID:** L1623916-03  
**Client ID:** B-13 / 58.0-59.5 FT  
**Sample Location:** Not Specified  
**Matrix:** Soil

**Date Collected:** 08/01/16 12:04  
**Date Received:** 08/02/16  
**Field Prep:** Not Specified

| Parameter                           | Result | Qualifier | Units | RL    | MDL | Dilution Factor | Date Prepared | Date Analyzed  | Analytical Method | Analyst |
|-------------------------------------|--------|-----------|-------|-------|-----|-----------------|---------------|----------------|-------------------|---------|
| General Chemistry - Westborough Lab |        |           |       |       |     |                 |               |                |                   |         |
| Solids, Total                       | 67.4   |           | %     | 0.100 | NA  | 1               | -             | 08/03/16 02:46 | 121,2540G         | VB      |
| Chloride                            | 7600   |           | mg/kg | 140   | --  | 10              | -             | 08/05/16 17:55 | 1,9251            |         |
| Sulfate                             | 1700   |           | mg/kg | 740   | --  | 5               | -             | 08/04/16 11:30 | 1,9038            | AW      |





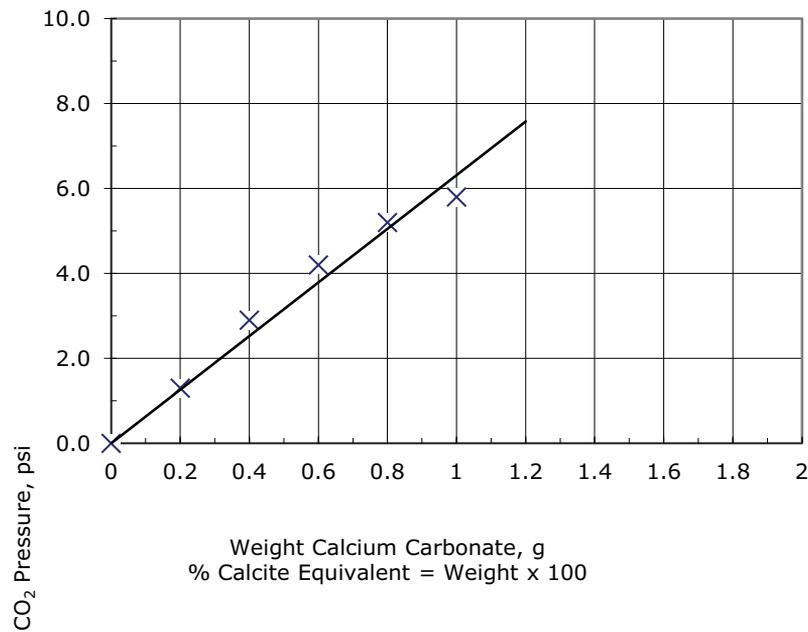
|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 08/23/16                                   |
| Tested By:        | jbr                                        |
| Checked By:       | jdt                                        |

## Rapid Determination of Carbonate Content of Soils by ASTM D4373

| Boring ID | Sample ID | Depth, ft | *CO <sub>2</sub> Pressure, psi | Weight of Sample used, g | Weight CaCO <sub>3</sub> , grams | Calcite Equivalent, % |
|-----------|-----------|-----------|--------------------------------|--------------------------|----------------------------------|-----------------------|
| B-13      | ---       | 94.5-96   | 5.60                           | 1.00                     | 4.60                             | 460                   |

Notes: Calcium Carbonate content precise to +/- 1.5%  
 \*CO<sub>2</sub> Pressure is based on the weight of sample as indicated in the table.  
 The reported Calcite Equivalent (%) is based on one gram

Figure 1: Calibration Curve



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1008 **DATE SAMPLE RECEIVED:** 7/6/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** MB **DATE OF TESTING:** 7/6/2016  
**DATE OF WEIGHING:** 7/7/2016

|                          |           |            |            |            |            |
|--------------------------|-----------|------------|------------|------------|------------|
| <b>BORING NO.</b>        | B-14      | B-14       | B-14       | B-14       | B-14       |
| <b>SAMPLE NO.</b>        | 16-1008C  | 16-1008F   | 16-1008I   | 16-1008L   | 16-1008O   |
| <b>SAMPLE DEPTH</b>      | 8.0-10.0' | 23.5-25.0' | 28.5-30.0' | 38.5-40.0' | 48.5-50.0' |
| <b>WATER CONTENT, W%</b> | 32.4      | 38.6       | 50.9       | 56.1       | 46.2       |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

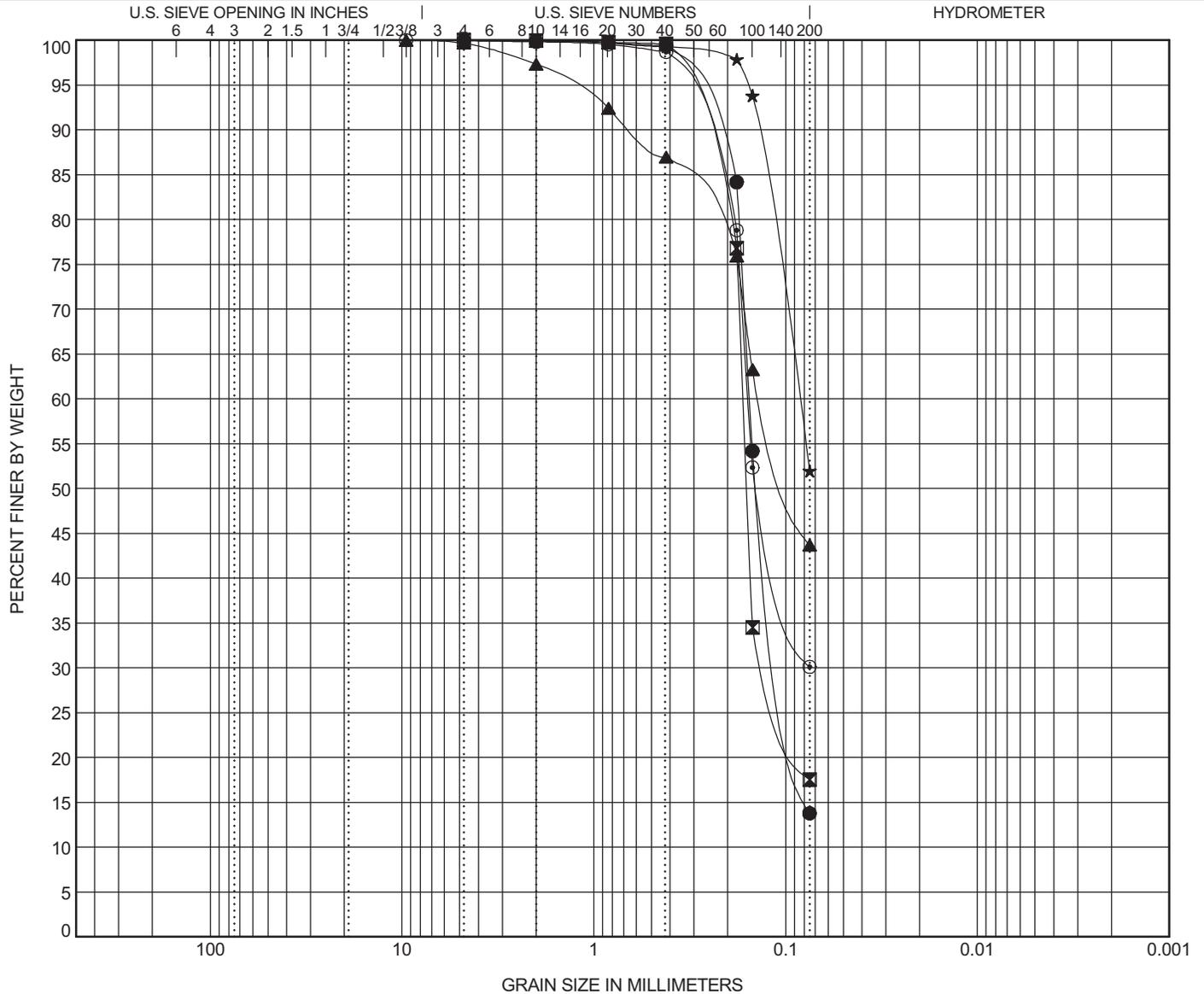


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification             |  |  |  |  | LL | PL | PI | Cc | Cu |
|----------|-------|----------------------------|--|--|--|--|----|----|----|----|----|
| ● B-14   | 10.0  | Silty Fine SAND (SM) A-2-4 |  |  |  |  | NP | NP | NP |    |    |
| ⊠ B-14   | 25.0  | Silty Fine SAND (SM) A-2-4 |  |  |  |  | NP | NP | NP |    |    |
| ▲ B-14   | 30.0  | Silty F/M SAND (SM) A-4(1) |  |  |  |  | 31 | 24 | 7  |    |    |
| ★ B-14   | 40.0  | Sandy SILT (ML) A-7-5(4)   |  |  |  |  | 47 | 36 | 11 |    |    |
| ⊙ B-14   | 50.0  | Silty Fine SAND (SM) A-2-4 |  |  |  |  | NP | NP | NP |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● B-14   | 10.0  | 4.76 | 0.328 | 0.139 |     | 0.0     | 86.2  | 13.8  |       |
| ⊠ B-14   | 25.0  | 4.76 | 0.354 | 0.16  |     | 0.0     | 82.4  | 17.6  |       |
| ▲ B-14   | 30.0  | 9.52 | 1.321 | 0.094 |     | 0.3     | 56.0  | 43.7  |       |
| ★ B-14   | 40.0  | 4.76 | 0.157 |       |     | 0.0     | 48.0  | 52.0  |       |
| ⊙ B-14   | 50.0  | 9.52 | 0.359 | 0.139 |     | 0.0     | 69.8  | 30.1  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





|            |                                            |              |            |
|------------|--------------------------------------------|--------------|------------|
| Client:    | F&ME Consultants                           |              |            |
| Project:   | US-21 Replacement Bridge over Harbor River |              |            |
| Location:  | ---                                        | Project No:  | GTX-305005 |
| Boring ID: | ---                                        | Sample Type: | ---        |
| Sample ID: | ---                                        | Test Date:   | 08/09/16   |
| Depth :    | ---                                        | Test Id:     | 386279     |
|            |                                            | Tested By:   | GA         |
|            |                                            | Checked By:  | mcm        |

**pH of Soil by ASTM D4972**

| Boring ID | Sample ID | Depth      | Visual Description               | pH of Soil in Distilled Water | pH of Soil in Calcium Chloride |
|-----------|-----------|------------|----------------------------------|-------------------------------|--------------------------------|
| B-14      | ---       | 33.5-35 ft | Moist, olive gray clay with sand | 7.4                           | 7.1                            |

Notes: Sample Preparation: screened through #10 sieve  
Method A, pH meter used



|             |                                            |
|-------------|--------------------------------------------|
| Client:     | F&ME Consultants                           |
| Project:    | US-21 Replacement Bridge over Harbor River |
| Location:   | ---                                        |
| GTX#:       | 305005                                     |
| Test Date:  | 08/09/16                                   |
| Tested By:  | jm                                         |
| Checked By: | mcm                                        |

**Laboratory Measurement of Soil Resistivity Using  
 the Wenner Four-Electrode Method by ASTM G57  
 (Laboratory Measurement)**

| Boring ID | Sample ID | Depth, ft. | Sample Description               | Electrical Resistivity, ohm-cm | Electrical Conductivity, (ohm-cm) <sup>-1</sup> |
|-----------|-----------|------------|----------------------------------|--------------------------------|-------------------------------------------------|
| B-14      | ---       | 33.5-35    | Moist, olive gray clay with sand | 71                             | 1.40E-02                                        |

Notes: Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box  
 Water added to sample to create a thick slurry prior to testing (saturated condition).  
 Electrical Conductivity is calculated as inverse of Electrical Resistivity (per ASTM G57)  
 Test conducted in standard laboratory atmosphere: 68-73 F



**Project Name:** US-21 REP. BRIDGE OVER HARBOR  
**Project Number:** 305005

**Lab Number:** L1623916  
**Report Date:** 08/08/16

**SAMPLE RESULTS**

**Lab ID:** L1623916-04  
**Client ID:** B-14 / 33.5-35.0 FT  
**Sample Location:** Not Specified  
**Matrix:** Soil

**Date Collected:** 08/01/16 12:11  
**Date Received:** 08/02/16  
**Field Prep:** Not Specified

| Parameter                           | Result | Qualifier | Units | RL    | MDL | Dilution Factor | Date Prepared | Date Analyzed  | Analytical Method | Analyst |
|-------------------------------------|--------|-----------|-------|-------|-----|-----------------|---------------|----------------|-------------------|---------|
| General Chemistry - Westborough Lab |        |           |       |       |     |                 |               |                |                   |         |
| Solids, Total                       | 73.8   |           | %     | 0.100 | NA  | 1               | -             | 08/03/16 02:46 | 121,2540G         | VB      |
| Chloride                            | 6900   |           | mg/kg | 130   | --  | 10              | -             | 08/05/16 17:59 | 1,9251            |         |
| Sulfate                             | 1600   |           | mg/kg | 660   | --  | 4.9             | -             | 08/04/16 11:30 | 1,9038            | AW      |





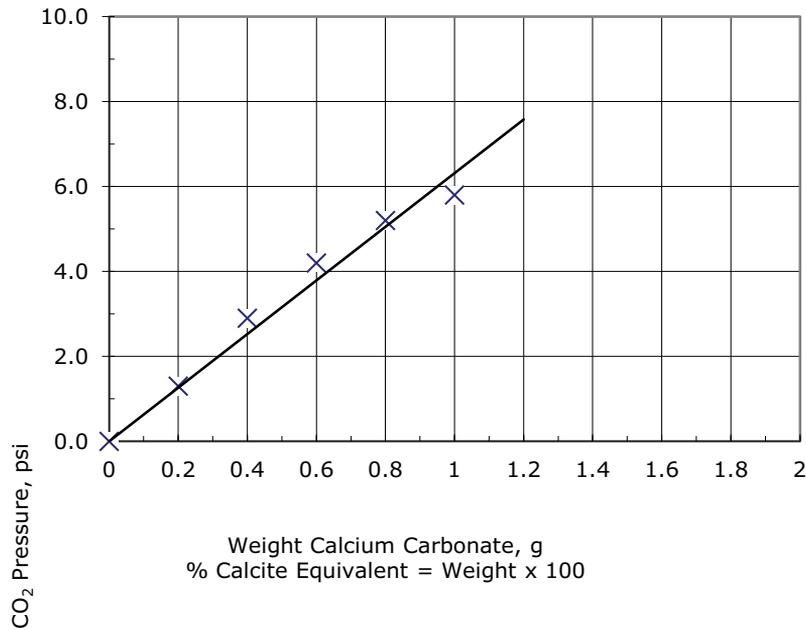
|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 08/23/16                                   |
| Tested By:        | jbr                                        |
| Checked By:       | jdt                                        |

## Rapid Determination of Carbonate Content of Soils by ASTM D4373

| Boring ID | Sample ID | Depth, ft | *CO <sub>2</sub> Pressure, psi | Weight of Sample used, g | Weight CaCO <sub>3</sub> , grams | Calcite Equivalent, % |
|-----------|-----------|-----------|--------------------------------|--------------------------|----------------------------------|-----------------------|
| B-14      | ---       | 72.5-74   | 4.90                           | 10.00                    | 0.40                             | 40                    |

Notes: Calcium Carbonate content precise to +/- 1.5%  
 \*CO<sub>2</sub> Pressure is based on the weight of sample as indicated in the table.  
 The reported Calcite Equivalent (%) is based on one gram

Figure 1: Calibration Curve



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1285 **DATE SAMPLE RECEIVED:** 8/5/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** MB **DATE OF TESTING:** 8/9/2016  
**DATE OF WEIGHING:** 8/10/2016

|                          |          |          |            |            |            |
|--------------------------|----------|----------|------------|------------|------------|
| <b>BORING NO.</b>        | B-15     | B-15     | B-15       | B-15       | B-15       |
| <b>SAMPLE NO.</b>        | 16-1285C | 16-1285F | 16-1285I   | 16-1285L   | 16-1285P   |
| <b>SAMPLE DEPTH</b>      | 4.0-6.0' | 6.0-8.0' | 13.5-15.0' | 18.5-20.0' | 43.5-45.0' |
| <b>WATER CONTENT, W%</b> | 26.2     | 23.5     | 23.8       | 33.2       | 31.6       |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

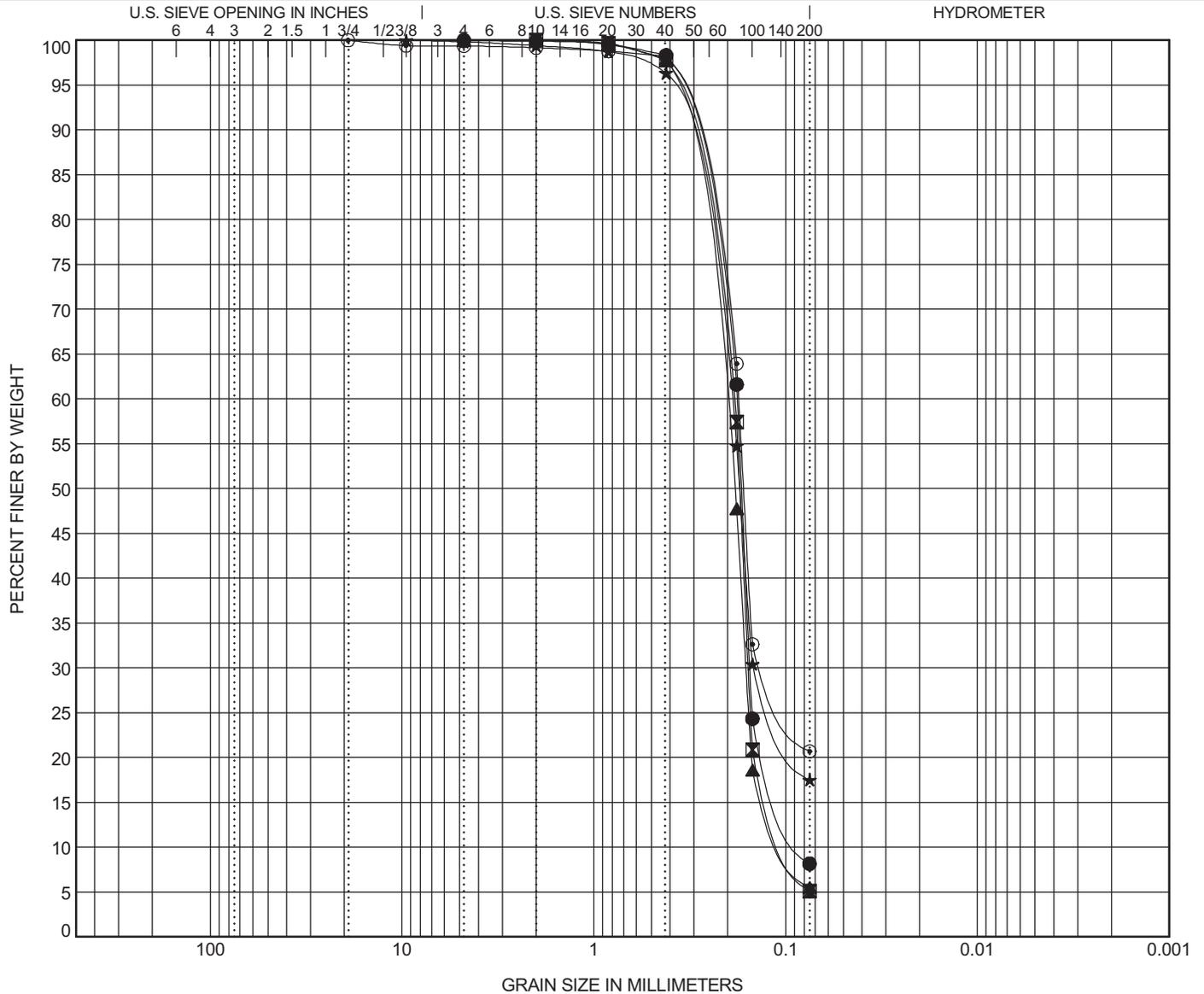


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                | LL | PL | PI | Cc   | Cu   |
|----------|-------|-----------------------------------------------|----|----|----|------|------|
| ● B-15   | 6.0   | Poorly Graded Fine SAND (SP-SM) with Silt A-3 | NP | NP | NP | 1.62 | 2.20 |
| ⊠ B-15   | 8.0   | Poorly Graded Fine SAND (SP-SM) with Silt A-3 | NP | NP | NP | 1.38 | 2.05 |
| ▲ B-15   | 15.0  | Poorly Graded Fine SAND (SP-SM) with Silt A-3 | NP | NP | NP | 1.23 | 2.33 |
| ★ B-15   | 20.0  | Silty Fine SAND (SM) A-2-4                    | NP | NP | NP |      |      |
| ◎ B-15   | 45.0  | Silty Fine SAND (SM) A-2-4                    | NP | NP | NP |      |      |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-------|---------|-------|-------|-------|
| ● B-15   | 6.0   | 4.76 | 0.389 | 0.17  | 0.081 | 0.0     | 91.8  | 8.2   |       |
| ⊠ B-15   | 8.0   | 2    | 0.396 | 0.173 | 0.093 | 0.0     | 94.9  | 5.1   |       |
| ▲ B-15   | 15.0  | 4.76 | 0.4   | 0.187 | 0.095 | 0.0     | 94.5  | 5.5   |       |
| ★ B-15   | 20.0  | 9.52 | 0.409 | 0.173 |       | 0.2     | 82.3  | 17.5  |       |
| ◎ B-15   | 45.0  | 19.1 | 0.388 | 0.165 |       | 0.6     | 78.7  | 20.7  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**ORGANIC IMPURITIES DETERMINATION**  
**(AASHTO T267)**

**PROJECT:** US 21 Bridge Replacement over Harbor River  
**SAMPLE NUMBER:** 16-1285  
**DESCRIPTION OF SOIL:** \_\_\_\_\_  
**TESTED BY:** MB

**PROJECT NO.:** G5396  
**DATE SAMPLE RECEIVED:** 8/8/2016  
**DATE OF TESTING:** 8/10/2016  
**DATE OF WEIGHING:** 8/10/2016

|                                                             |            |  |  |  |  |
|-------------------------------------------------------------|------------|--|--|--|--|
| <b>BORING NO.</b>                                           | B-15       |  |  |  |  |
| <b>SAMPLE NO.</b>                                           | 16-1285M   |  |  |  |  |
| <b>SAMPLE DEPTH</b>                                         | 38.5-40.0' |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (BEFORE IGNITION) (GRAMS)</b> | 177.48     |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (AFTER IGNITION) (GRAMS)</b>  | 175.82     |  |  |  |  |
| <b>WT. OF CRUCIBLE (GRAMS)</b>                              | 137.48     |  |  |  |  |
| <b>WT. OF DRY SOIL (BEFORE IGNITION) (GRAMS)</b>            | 40.00      |  |  |  |  |
| <b>WT. OF DRY SOIL (AFTER IGNITION) (GRAMS)</b>             | 38.34      |  |  |  |  |
| <b>IGNITION LOSS (GRAMS)</b>                                | 1.66       |  |  |  |  |
| <b>ORGANIC IMPURITIES %</b>                                 | 4.15       |  |  |  |  |



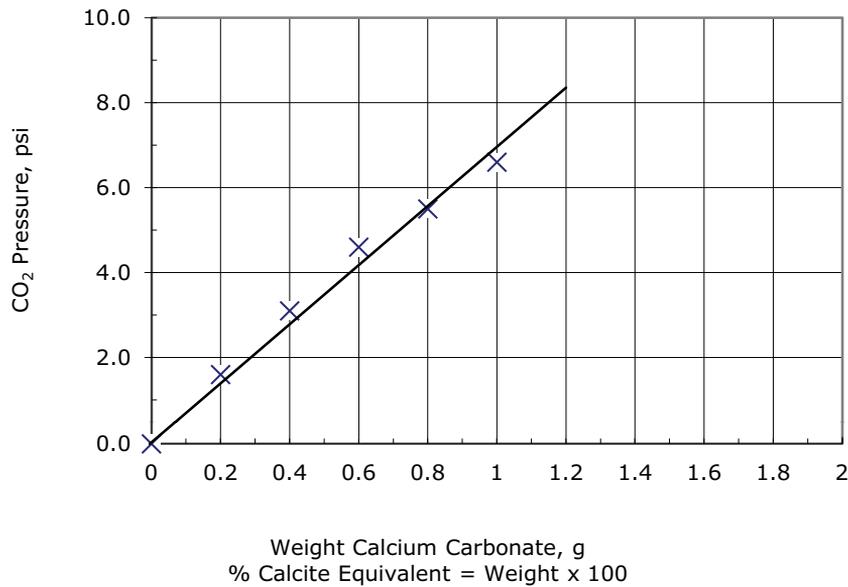
|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 08/23/16                                   |
| Tested By:        | jbr                                        |
| Checked By:       | jdt                                        |

## Rapid Determination of Carbonate Content of Soils by ASTM D4373

| Boring ID | Sample ID | Depth, ft | *CO <sub>2</sub> Pressure, psi | Weight of Sample used, g | Weight CaCO <sub>3</sub> , grams | Calcite Equivalent, % |
|-----------|-----------|-----------|--------------------------------|--------------------------|----------------------------------|-----------------------|
| B-15      | 16-1285Q  | 58.5-60   | 0.20                           | 2.00                     | 0.08                             | 8                     |

Notes: Calcium Carbonate content precise to +/- 1.5%  
 \*CO<sub>2</sub> Pressure is based on the weight of sample as indicated in the table.  
 The reported Calcite Equivalent (%) is based on one gram

Figure 1: Calibration Curve



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1286 **DATE SAMPLE RECEIVED:** 8/5/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** MB **DATE OF TESTING:** 8/9/2016  
**DATE OF WEIGHING:** 8/10/2016

|                          |          |            |            |            |            |
|--------------------------|----------|------------|------------|------------|------------|
| <b>BORING NO.</b>        | B-16     | B-16       | B-16       | B-16       | B-16       |
| <b>SAMPLE NO.</b>        | 16-1286C | 16-1286F   | 16-1286I   | 16-1286L   | 16-1286O   |
| <b>SAMPLE DEPTH</b>      | 6.0-8.0' | 13.5-15.0' | 23.5-25.0' | 38.5-40.0' | 48.5-50.0' |
| <b>WATER CONTENT, W%</b> | 24.5     | 24.3       | 37.4       | 56.7       | 84.8       |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |



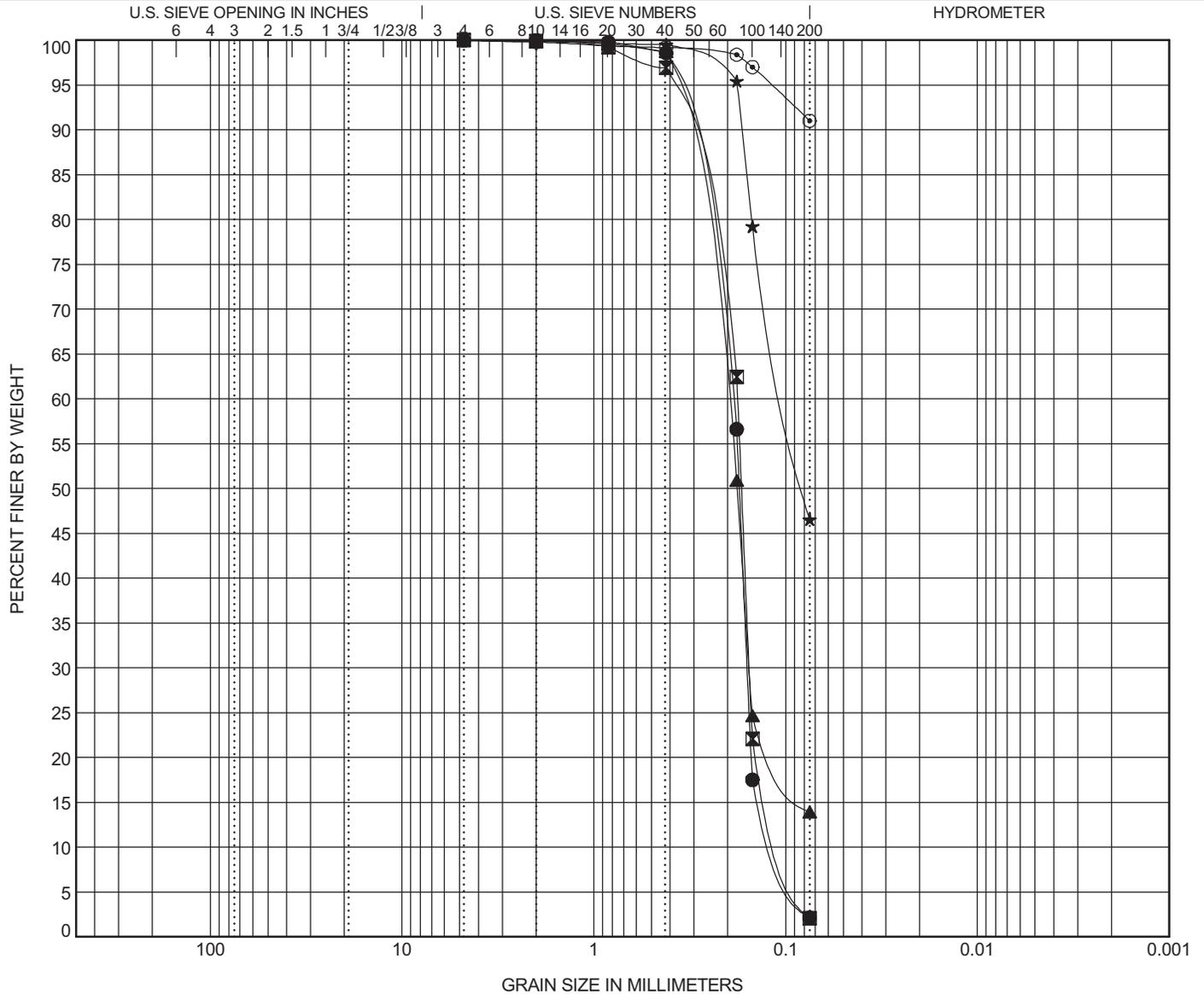


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                   | LL | PL | PI | Cc   | Cu   |
|----------|-------|----------------------------------|----|----|----|------|------|
| ● B-16   | 8.0   | Poorly Graded Fine SAND (SP) A-3 | NP | NP | NP | 1.22 | 1.81 |
| ■ B-16   | 15.0  | Poorly Graded Fine SAND (SP) A-3 | NP | NP | NP | 1.37 | 1.81 |
| ▲ B-16   | 25.0  | Silty Fine SAND (SM) A-2-4       | NP | NP | NP |      |      |
| ★ B-16   | 40.0  | Clayey Fine SAND (SC) A-6(4)     | 36 | 21 | 15 |      |      |
| ◎ B-16   | 50.0  | Elastic SILT (MH) A-7-5(25)      | 75 | 35 | 40 |      |      |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-------|---------|-------|-------|-------|
| ● B-16   | 8.0   | 4.76 | 0.391 | 0.174 | 0.107 | 0.0     | 97.9  | 2.1   |       |
| ■ B-16   | 15.0  | 4.76 | 0.4   | 0.17  | 0.098 | 0.0     | 97.9  | 2.1   |       |
| ▲ B-16   | 25.0  | 4.76 | 0.393 | 0.179 |       | 0.0     | 86.1  | 13.9  |       |
| ★ B-16   | 40.0  | 4.76 | 0.179 | 0.081 |       | 0.0     | 53.4  | 46.6  |       |
| ◎ B-16   | 50.0  | 4.76 | 0.118 |       |       | 0.0     | 9.0   | 91.0  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**ORGANIC IMPURITIES DETERMINATION**  
**(AASHTO T267)**

|                             |                                            |                              |           |
|-----------------------------|--------------------------------------------|------------------------------|-----------|
| <b>PROJECT:</b>             | US 21 Bridge Replacement over Harbor River | <b>PROJECT NO.:</b>          | G5396     |
| <b>SAMPLE NUMBER:</b>       | 16-1286                                    | <b>DATE SAMPLE RECEIVED:</b> | 8/8/2016  |
| <b>DESCRIPTION OF SOIL:</b> |                                            |                              |           |
| <b>TESTED BY:</b>           | MB                                         | <b>DATE OF TESTING:</b>      | 8/10/2016 |
|                             |                                            | <b>DATE OF WEIGHING:</b>     | 8/10/2016 |

|                                                             |            |  |  |  |  |
|-------------------------------------------------------------|------------|--|--|--|--|
| <b>BORING NO.</b>                                           | B-16       |  |  |  |  |
| <b>SAMPLE NO.</b>                                           | 16-1286P   |  |  |  |  |
| <b>SAMPLE DEPTH</b>                                         | 53.5-55.0' |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (BEFORE IGNITION) (GRAMS)</b> | 139.63     |  |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (AFTER IGNITION) (GRAMS)</b>  | 136.74     |  |  |  |  |
| <b>WT. OF CRUCIBLE (GRAMS)</b>                              | 99.63      |  |  |  |  |
| <b>WT. OF DRY SOIL (BEFORE IGNITION) (GRAMS)</b>            | 40.00      |  |  |  |  |
| <b>WT. OF DRY SOIL (AFTER IGNITION) (GRAMS)</b>             | 37.11      |  |  |  |  |
| <b>IGNITION LOSS (GRAMS)</b>                                | 2.89       |  |  |  |  |
| <b>ORGANIC IMPURITIES %</b>                                 | 7.22       |  |  |  |  |



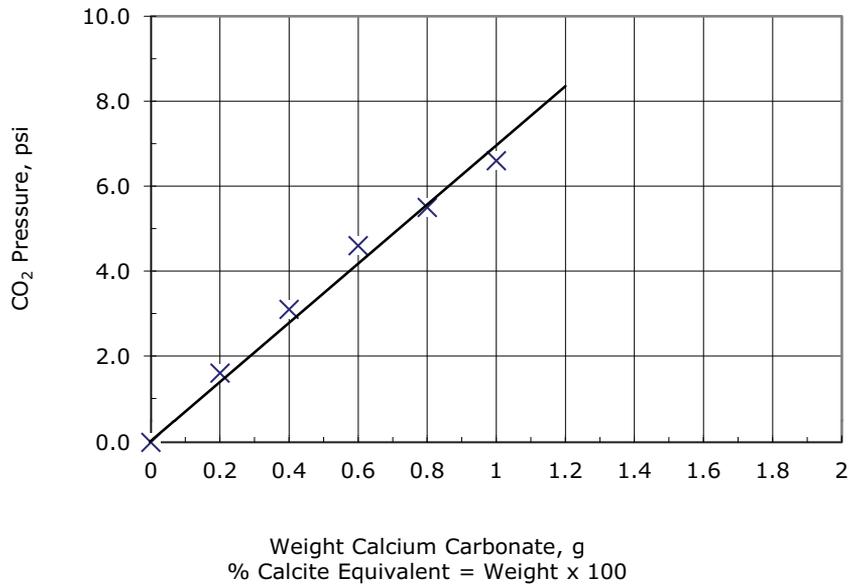
|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 08/23/16                                   |
| Tested By:        | jbr                                        |
| Checked By:       | jdt                                        |

## Rapid Determination of Carbonate Content of Soils by ASTM D4373

| Boring ID | Sample ID | Depth, ft | *CO <sub>2</sub> Pressure, psi | Weight of Sample used, g | Weight CaCO <sub>3</sub> , grams | Calcite Equivalent, % |
|-----------|-----------|-----------|--------------------------------|--------------------------|----------------------------------|-----------------------|
| B-16      | 16-1286Q  | 78.5-80   | 1.80                           | 10.00                    | 0.15                             | 15                    |

Notes: Calcium Carbonate content precise to +/- 1.5%  
 \*CO<sub>2</sub> Pressure is based on the weight of sample as indicated in the table.  
 The reported Calcite Equivalent (%) is based on one gram

Figure 1: Calibration Curve



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 15-1799 **DATE SAMPLE RECEIVED:** 12/3/2015  
**DESCRIPTION OF SOIL:** Various  
**TESTED BY:** MB **DATE OF TESTING:** 12/3/2015  
**DATE OF WEIGHING:** 12/4/2015

|                          |          |            |            |            |            |
|--------------------------|----------|------------|------------|------------|------------|
| <b>BORING NO.</b>        | TS-1     | TS-1       | TS-1       | TS-1       | TS-1       |
| <b>SAMPLE NO.</b>        | 15-1799C | 15-1799F   | 15-1799I   | 15-1799L   | 15-1799O   |
| <b>SAMPLE DEPTH</b>      | 6.0-8.0' | 16.0-18.0' | 22.0-24.0' | 26.0-28.0' | 32.0-34.0' |
| <b>WATER CONTENT, W%</b> | 25.9     | 52.2       | 26.7       | 65.5       | 40.2       |

|                          |            |            |            |            |            |
|--------------------------|------------|------------|------------|------------|------------|
| <b>BORING NO.</b>        | TS-1       | TS-1       | TS-1       | TS-1       | TS-1       |
| <b>SAMPLE NO.</b>        | 15-1799R   | 15-1799U   | 15-1799X   | 15-1799AA  | 15-1799DD  |
| <b>SAMPLE DEPTH</b>      | 44.0-46.0' | 46.0-48.0' | 56.0-58.0' | 72.0-74.0' | 76.0-78.0' |
| <b>WATER CONTENT, W%</b> | 24.0       | 20.1       | 62.4       | 61.7       | 44.5       |

|                          |            |              |              |  |  |
|--------------------------|------------|--------------|--------------|--|--|
| <b>BORING NO.</b>        | TS-1       | TS-1         | TS-1         |  |  |
| <b>SAMPLE NO.</b>        | 15-1799GG  | 15-1799JJ    | 15-1799MM    |  |  |
| <b>SAMPLE DEPTH</b>      | 80.0-82.0' | 104.0-106.0' | 120.0-122.0' |  |  |
| <b>WATER CONTENT, W%</b> | 42.6       | 33.4         | 35.4         |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

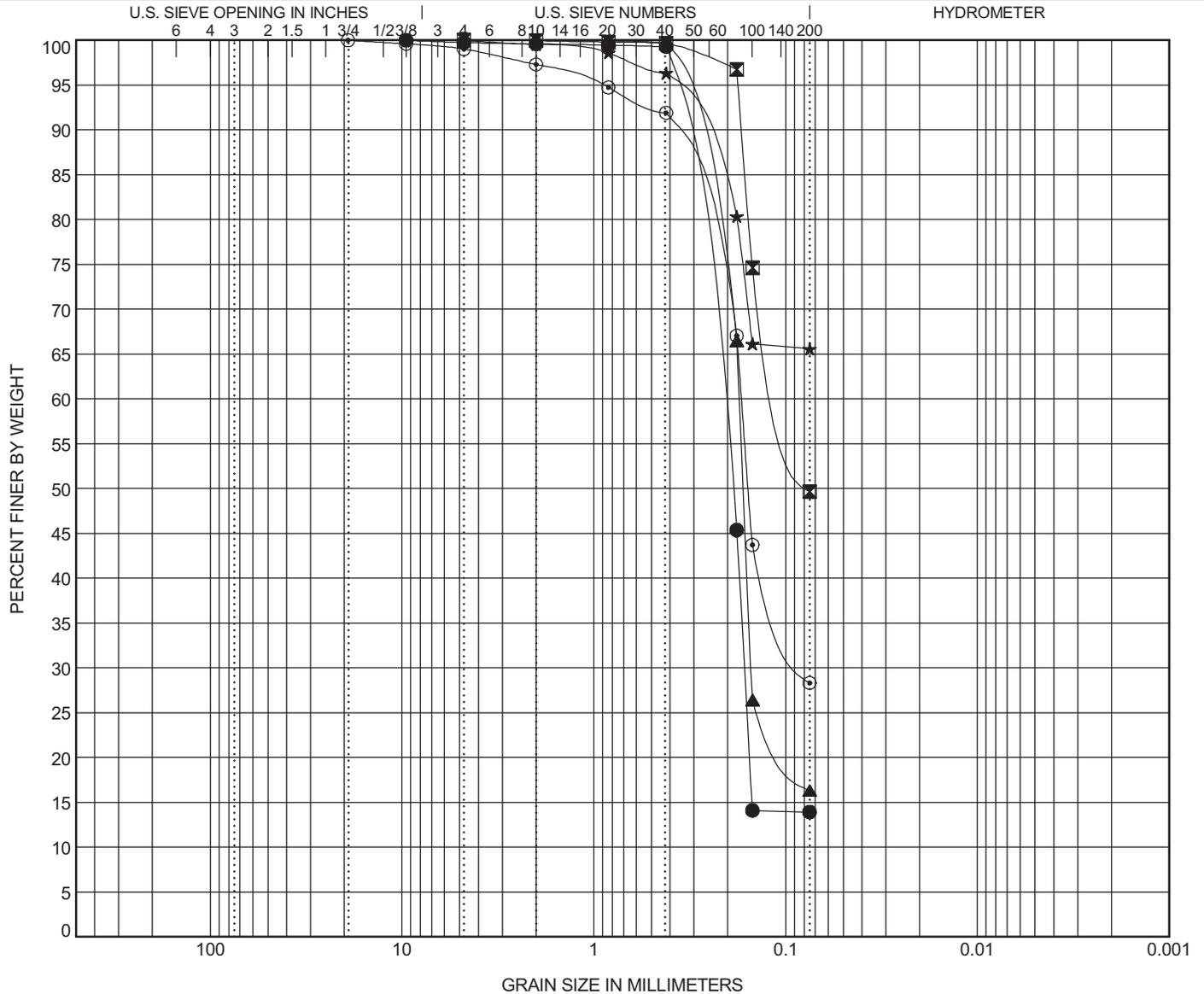


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                         |  |  |  |  | LL | PL | PI | Cc | Cu |
|----------|-------|----------------------------------------|--|--|--|--|----|----|----|----|----|
| ● TS-1   | 8.0   | Silty Fine SAND (SM) A-2-4             |  |  |  |  | NP | NP | NP |    |    |
| ⊠ TS-1   | 18.0  | Silty, Clayey Fine SAND (SC-SM) A-4(0) |  |  |  |  | 25 | 21 | 4  |    |    |
| ▲ TS-1   | 24.0  | Silty Fine SAND (SM) A-2-4             |  |  |  |  | NP | NP | NP |    |    |
| ★ TS-1   | 28.0  | Sandy SILT (ML) A-7-6(9)               |  |  |  |  | 42 | 27 | 15 |    |    |
| ⊙ TS-1   | 34.0  | Silty Fine SAND (SM) A-2-4             |  |  |  |  | NP | NP | NP |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● TS-1   | 8.0   | 9.52 | 0.393 | 0.194 |     | 0.3     | 85.8  |       | 13.9  |
| ⊠ TS-1   | 18.0  | 4.76 | 0.177 | 0.076 |     | 0.0     | 50.3  |       | 49.7  |
| ▲ TS-1   | 24.0  | 2    | 0.372 | 0.167 |     | 0.0     | 83.7  |       | 16.3  |
| ★ TS-1   | 28.0  | 4.76 | 0.391 |       |     | 0.0     | 34.4  |       | 65.6  |
| ⊙ TS-1   | 34.0  | 19.1 | 0.915 | 0.157 |     | 1.0     | 70.7  |       | 28.3  |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16

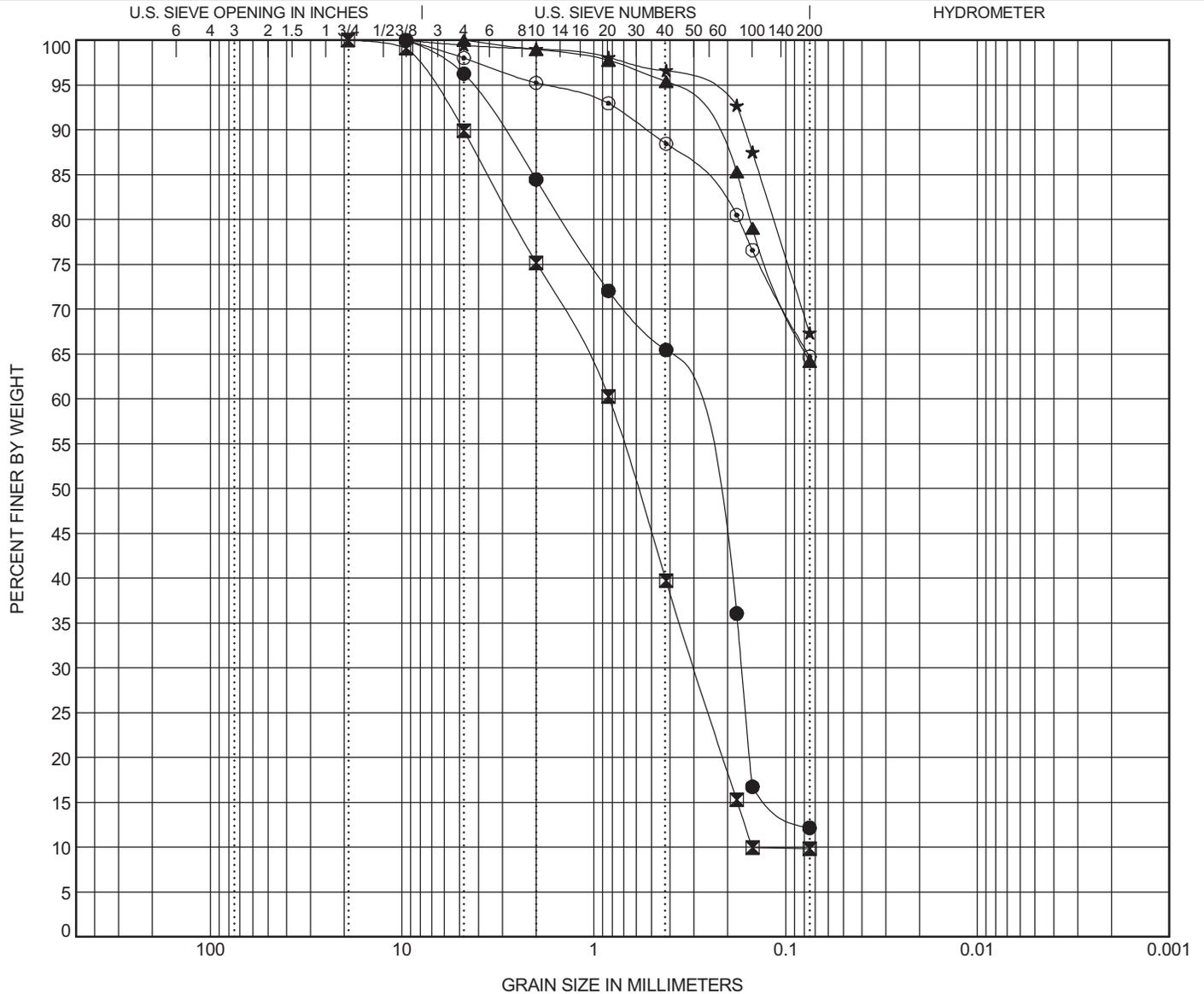


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                                | LL | PL | PI | Cc   | Cu   |
|----------|-------|-----------------------------------------------|----|----|----|------|------|
| ● TS-1   | 46.0  | Silty F/C SAND (SM) A-2-4                     | NP | NP | NP | 1.48 | 6.62 |
| ☒ TS-1   | 48.0  | Poorly Graded F/C SAND (SP-SM)with Silt A-1-b | NP | NP | NP | 0.72 | 5.57 |
| ▲ TS-1   | 58.0  | Sandy SILT (ML) A-5(4)                        | 44 | 39 | 5  |      |      |
| ★ TS-1   | 74.0  | Sandy Elastic SILT (MH) A-7-5(16)             | 55 | 32 | 23 |      |      |
| ⊙ TS-1   | 78.0  | Sandy SILT (ML) A-4(4)                        | 31 | 23 | 8  |      |      |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-------|---------|-------|-------|-------|
| ● TS-1   | 46.0  | 9.52 | 4.333 | 0.269 |       | 3.7     | 84.1  | 12.2  |       |
| ☒ TS-1   | 48.0  | 19.1 | 6.971 | 0.594 | 0.149 | 10.1    | 80.1  | 9.8   |       |
| ▲ TS-1   | 58.0  | 4.76 | 0.406 |       |       | 0.0     | 35.8  | 64.2  |       |
| ★ TS-1   | 74.0  | 9.52 | 0.293 |       |       | 0.6     | 32.1  | 67.4  |       |
| ⊙ TS-1   | 78.0  | 9.52 | 1.814 |       |       | 2.0     | 33.3  | 64.7  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16

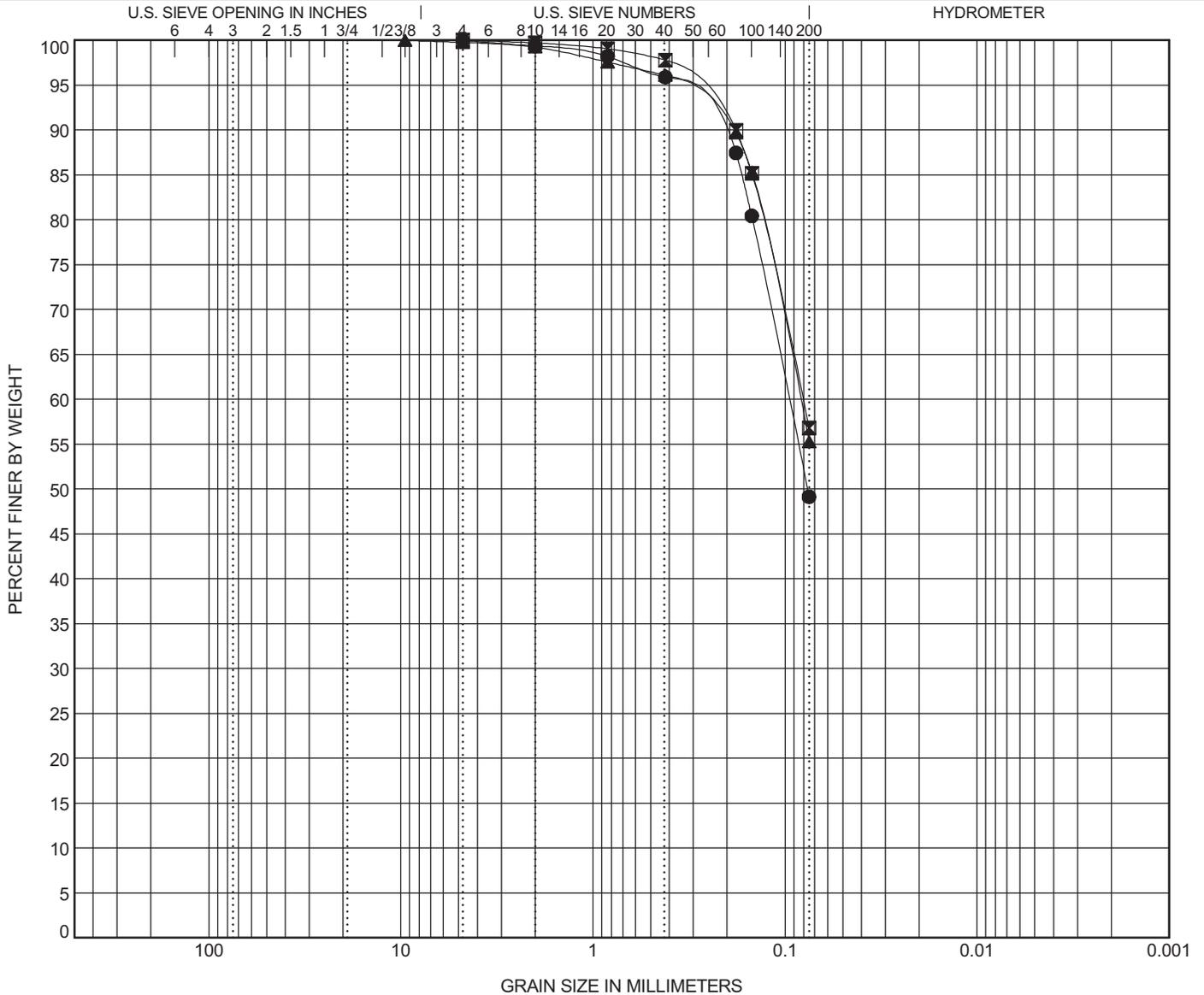


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification              |  |  |  |  | LL | PL | PI | Cc | Cu |
|----------|-------|-----------------------------|--|--|--|--|----|----|----|----|----|
| ● TS-1   | 82.0  | Silty Fine SAND (SM) A-4(0) |  |  |  |  | NP | NP | NP |    |    |
| ■ TS-1   | 106.0 | Sandy SILT (ML) A-4(0)      |  |  |  |  | NP | NP | NP |    |    |
| ▲ TS-1   | 122.0 | Sandy SILT (ML) A-4(0)      |  |  |  |  | NP | NP | NP |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● TS-1   | 82.0  | 4.76 | 0.384 | 0.076 |     | 0.0     | 50.9  | 49.1  |       |
| ■ TS-1   | 106.0 | 4.76 | 0.31  |       |     | 0.0     | 43.2  | 56.8  |       |
| ▲ TS-1   | 122.0 | 9.52 | 0.362 |       |     | 0.2     | 44.5  | 55.3  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1140 & 16-1212 **DATE SAMPLE RECEIVED:** 8/8/2016  
**DESCRIPTION OF SOIL:** Various  
**TESTED BY:** MB **DATE OF TESTING:** 8/10/2016  
**DATE OF WEIGHING:** 8/11/2016

|                          |            |            |              |              |              |
|--------------------------|------------|------------|--------------|--------------|--------------|
| <b>BORING NO.</b>        | SB-1       | SB-1       | SB-1         | SB-1         | SB-1         |
| <b>SAMPLE NO.</b>        | 16-1140A   | 16-1140D   | 16-1140G     | 16-1140J     | 16-1140M     |
| <b>SAMPLE DEPTH</b>      | 44.0-46.0' | 93.5-95.0' | 138.5-140.0' | 178.5-180.0' | 238.5-240.0' |
| <b>WATER CONTENT, W%</b> | 55.4       | 44.7       | 68.0         | 32.9         | 34.4         |

|                          |              |              |              |              |              |
|--------------------------|--------------|--------------|--------------|--------------|--------------|
| <b>BORING NO.</b>        | SB-1         | SB-1         | SB-1         | SB-1         | SB-1         |
| <b>SAMPLE NO.</b>        | 16-1212A     | 16-1212D     | 16-1212G     | 16-1212J     | 16-1212M     |
| <b>SAMPLE DEPTH</b>      | 275.0-277.0' | 303.0-308.0' | 338.0-343.0' | 358.0-363.0' | 381.0-385.0' |
| <b>WATER CONTENT, W%</b> | 30.1         | 30.3         | 25.9         | 17.4         | 38.3         |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

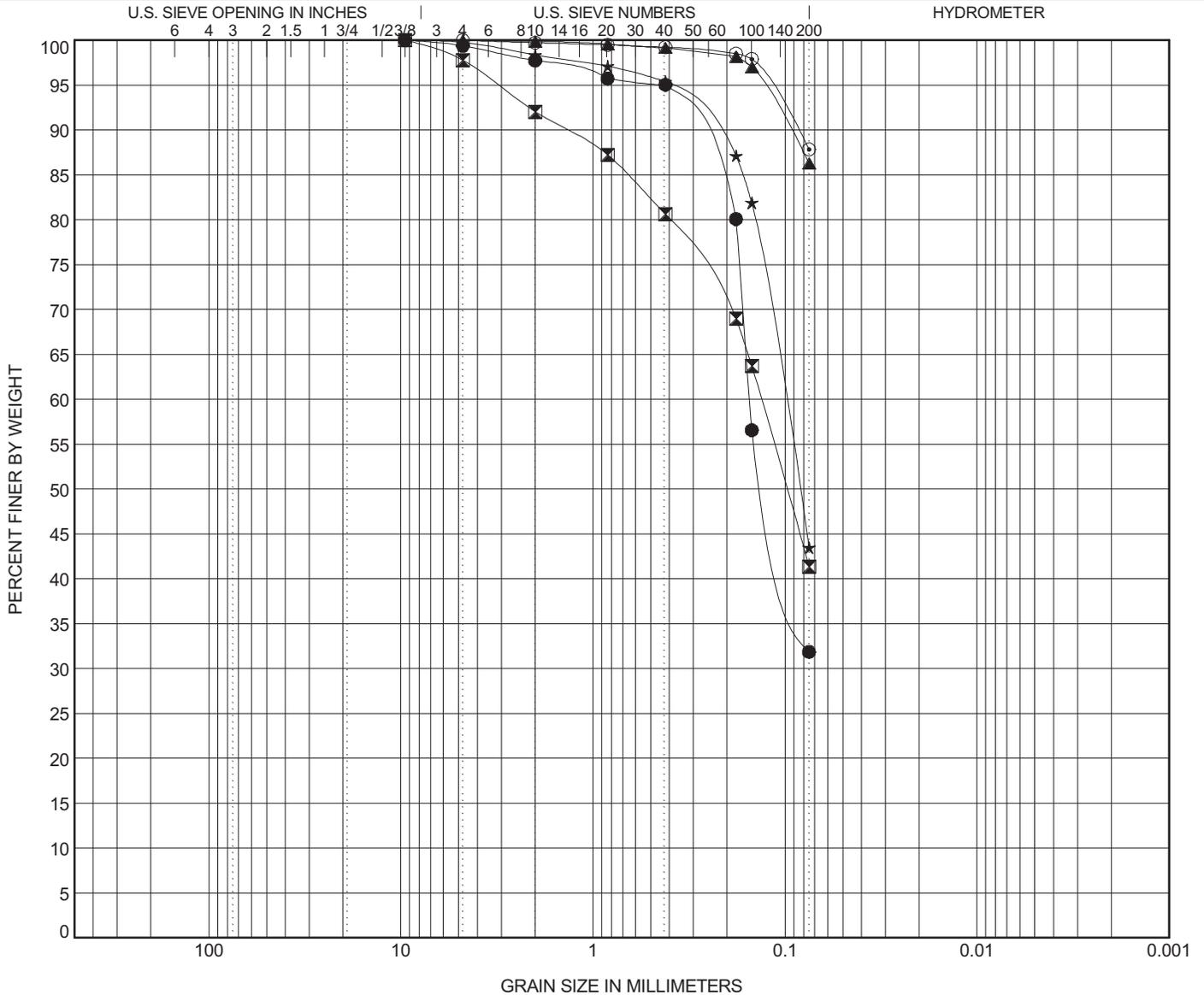


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                 | LL | PL | PI | Cc | Cu |
|----------|-------|--------------------------------|----|----|----|----|----|
| ● SB-1   | 46.0  | Clayey Fine SAND (SC) A-2-7(2) | 42 | 20 | 22 |    |    |
| ☒ SB-1   | 95.0  | Silty Fine SAND (SM) A-4(0)    | NP | NP | NP |    |    |
| ▲ SB-1   | 140.0 | Fat CLAY (CH) A-7-6(33)        | 63 | 29 | 34 |    |    |
| ★ SB-1   | 180.0 | Silty Fine SAND (SM) A-4(0)    | NP | NP | NP |    |    |
| ◎ SB-1   | 240.0 | Lean CLAY (CL) A-6(16)         | 40 | 23 | 17 |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-----|---------|-------|-------|-------|
| ● SB-1   | 46.0  | 9.52 | 0.419 | 0.124 |     | 0.6     | 67.5  | 31.9  |       |
| ☒ SB-1   | 95.0  | 9.52 | 3.117 | 0.098 |     | 2.2     | 56.5  | 41.3  |       |
| ▲ SB-1   | 140.0 | 4.76 | 0.131 |       |     | 0.0     | 13.7  | 86.3  |       |
| ★ SB-1   | 180.0 | 9.52 | 0.402 | 0.084 |     | 0.2     | 56.3  | 43.5  |       |
| ◎ SB-1   | 240.0 | 4.76 | 0.122 |       |     | 0.0     | 12.2  | 87.8  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 11/2/16

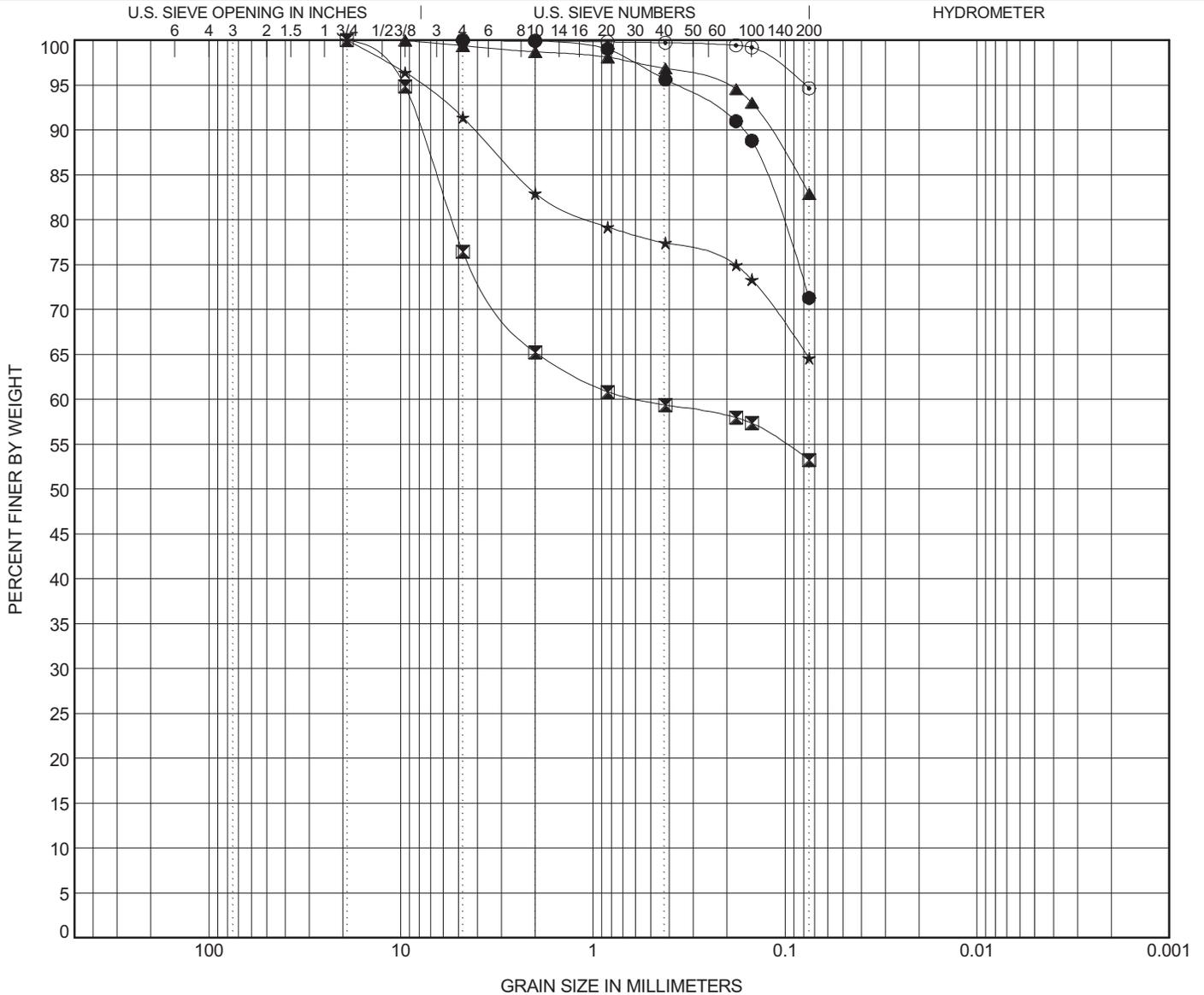


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                      | LL | PL | PI | Cc | Cu |
|----------|-------|-------------------------------------|----|----|----|----|----|
| ● SB-1   | 277.0 | SILT (ML) with Sand A-4(1)          | 32 | 30 | 2  |    |    |
| ☒ SB-1   | 308.0 | Gravelly SILT (ML) with Sand A-4(1) | 37 | 34 | 3  |    |    |
| ▲ SB-1   | 343.0 | SILT (ML) with Sand A-6(12)         | 40 | 26 | 14 |    |    |
| ★ SB-1   | 363.0 | Sandy SILT (ML) A-4(4)              | 33 | 24 | 9  |    |    |
| ⊙ SB-1   | 385.0 | Elastic SILT (MH) A-7-5(31)         | 63 | 38 | 25 |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50 | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-----|-----|---------|-------|-------|-------|
| ● SB-1   | 277.0 | 4.76 | 0.374 |     |     | 0.0     | 28.7  | 71.3  |       |
| ☒ SB-1   | 308.0 | 19.1 | 9.69  |     |     | 23.6    | 23.2  | 53.3  |       |
| ▲ SB-1   | 343.0 | 9.52 | 0.21  |     |     | 0.6     | 16.5  | 82.9  |       |
| ★ SB-1   | 363.0 | 19.1 | 7.814 |     |     | 8.6     | 26.8  | 64.6  |       |
| ⊙ SB-1   | 385.0 | 4.76 | 0.079 |     |     | 0.0     | 5.3   | 94.7  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 11/2/16



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**ORGANIC IMPURITIES DETERMINATION**  
**(AASHTO T267)**

|                             |                                           |                              |           |
|-----------------------------|-------------------------------------------|------------------------------|-----------|
| <b>PROJECT:</b>             | US 21 Bridge Replacment over Harbor River | <b>PROJECT NO.:</b>          | G5396     |
| <b>SAMPLE NUMBER:</b>       | 16-1140                                   | <b>DATE SAMPLE RECEIVED:</b> | 8/8/2016  |
| <b>DESCRIPTION OF SOIL:</b> | VARIOUS                                   |                              |           |
| <b>TESTED BY:</b>           | MB                                        | <b>DATE OF TESTING:</b>      | 8/10/2016 |
|                             |                                           | <b>DATE OF WEIGHING:</b>     | 8/10/2016 |

|                                                             |                |                |  |  |  |
|-------------------------------------------------------------|----------------|----------------|--|--|--|
| <b>BORING NO.</b>                                           | SB-1           | SB-1           |  |  |  |
| <b>SAMPLE NO.</b>                                           | 16-1140R/SS-10 | 16-1140S/SS-19 |  |  |  |
| <b>SAMPLE DEPTH</b>                                         | 18.0-20.0'     | 36.0-38.0'     |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (BEFORE IGNITION) (GRAMS)</b> | 169.95         | 175.57         |  |  |  |
| <b>WT. OF CRUCIBLE + DRY SOIL (AFTER IGNITION) (GRAMS)</b>  | 169.18         | 175.00         |  |  |  |
| <b>WT. OF CRUCIBLE (GRAMS)</b>                              | 129.95         | 135.57         |  |  |  |
| <b>WT. OF DRY SOIL (BEFORE IGNITION) (GRAMS)</b>            | 40.00          | 40.00          |  |  |  |
| <b>WT. OF DRY SOIL (AFTER IGNITION) (GRAMS)</b>             | 39.23          | 39.43          |  |  |  |
| <b>IGNITION LOSS (GRAMS)</b>                                | 0.77           | 0.57           |  |  |  |
| <b>ORGANIC IMPURITIES %</b>                                 | 1.92           | 1.42           |  |  |  |



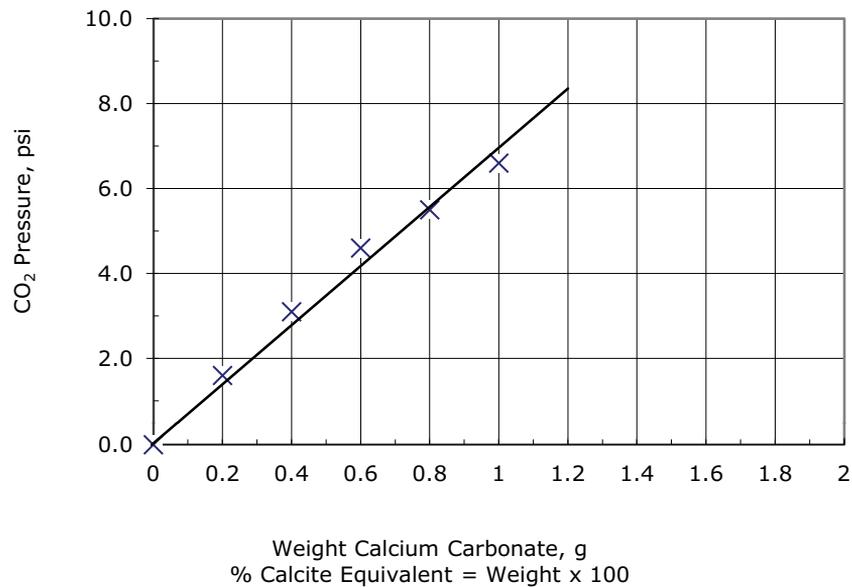
|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 08/23/16                                   |
| Tested By:        | jbr                                        |
| Checked By:       | jdt                                        |

## Rapid Determination of Carbonate Content of Soils by ASTM D4373

| Boring ID | Sample ID | Depth, ft | *CO <sub>2</sub> Pressure, psi | Weight of Sample used, g | Weight CaCO <sub>3</sub> , grams | Calcite Equivalent, % |
|-----------|-----------|-----------|--------------------------------|--------------------------|----------------------------------|-----------------------|
| SB-1      | 16-1140P  | 168.5-170 | 6.20                           | 1.00                     | 5.09                             | 509                   |
| SB-1      | 16-1140Q  | 198.5-200 | 5.40                           | 1.00                     | 4.43                             | 443                   |
| SB-1      | 16-1212U  | 255-257   | 4.40                           | 1.00                     | 3.61                             | 361                   |
| SB-1      | 16-1212V  | 308-313   | 3.90                           | 1.00                     | 3.20                             | 320                   |
| SB-1      | 16-1212W  | 373-378   | 2.70                           | 1.00                     | 2.22                             | 222                   |

Notes: Calcium Carbonate content precise to +/- 1.5%  
 \*CO<sub>2</sub> Pressure is based on the weight of sample as indicated in the table.  
 The reported Calcite Equivalent (%) is based on one gram

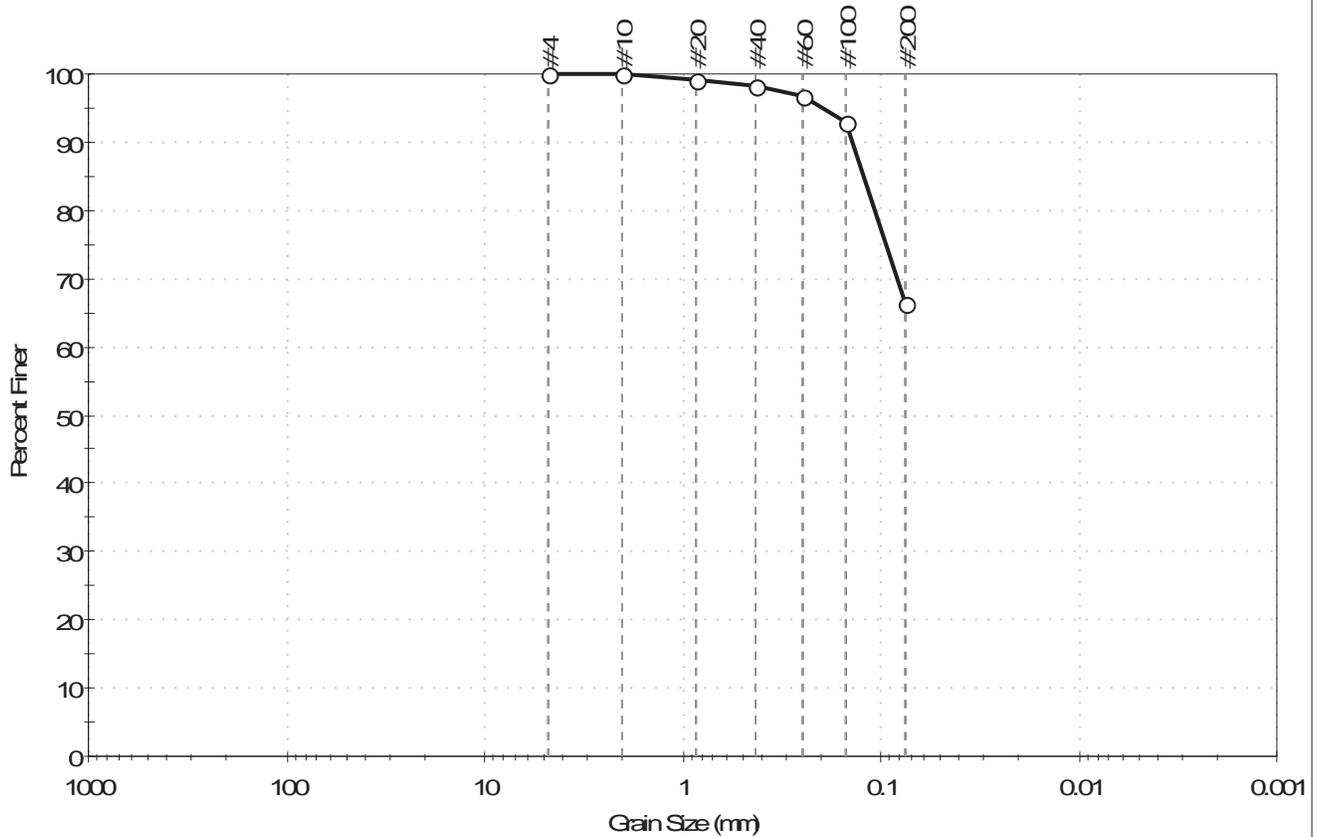
Figure 1: Calibration Curve





|                     |                                            |              |             |             |        |
|---------------------|--------------------------------------------|--------------|-------------|-------------|--------|
| Client:             | F&ME Consultants                           |              | Project No: | GTX-305005  |        |
| Project:            | US-21 Replacement Bridge over Harbor River |              |             |             |        |
| Location:           | ---                                        |              | Tested By:  | GA          |        |
| Boring ID:          | SB-1                                       | Sample Type: | tube        | Checked By: | mcm    |
| Sample ID:          | UD-1                                       | Test Date:   | 11/04/16    | Test Id:    | 397424 |
| Depth:              | 130.0-133.5 ft                             |              |             |             |        |
| Test Comment:       | ---                                        |              |             |             |        |
| Visual Description: | Moist, olive sandy silt                    |              |             |             |        |
| Sample Comment:     | ---                                        |              |             |             |        |

## Particle Size Analysis - ASTM D422



|         |         |       |                   |
|---------|---------|-------|-------------------|
| %Cobble | %Gravel | %Sand | %Silt & Clay Size |
| —       | 0.0     | 33.7  | 66.3              |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 100           |               |          |
| #20        | 0.85           | 99            |               |          |
| #40        | 0.42           | 98            |               |          |
| #60        | 0.25           | 97            |               |          |
| #100       | 0.15           | 93            |               |          |
| #200       | 0.075          | 66            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.1220 mm | 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  |

| <u>Classification</u> |                          |
|-----------------------|--------------------------|
| <u>ASTM</u>           | Sandy Silt (ML)          |
| <u>AASHTO</u>         | Clayey Soils (A-7-5 (8)) |

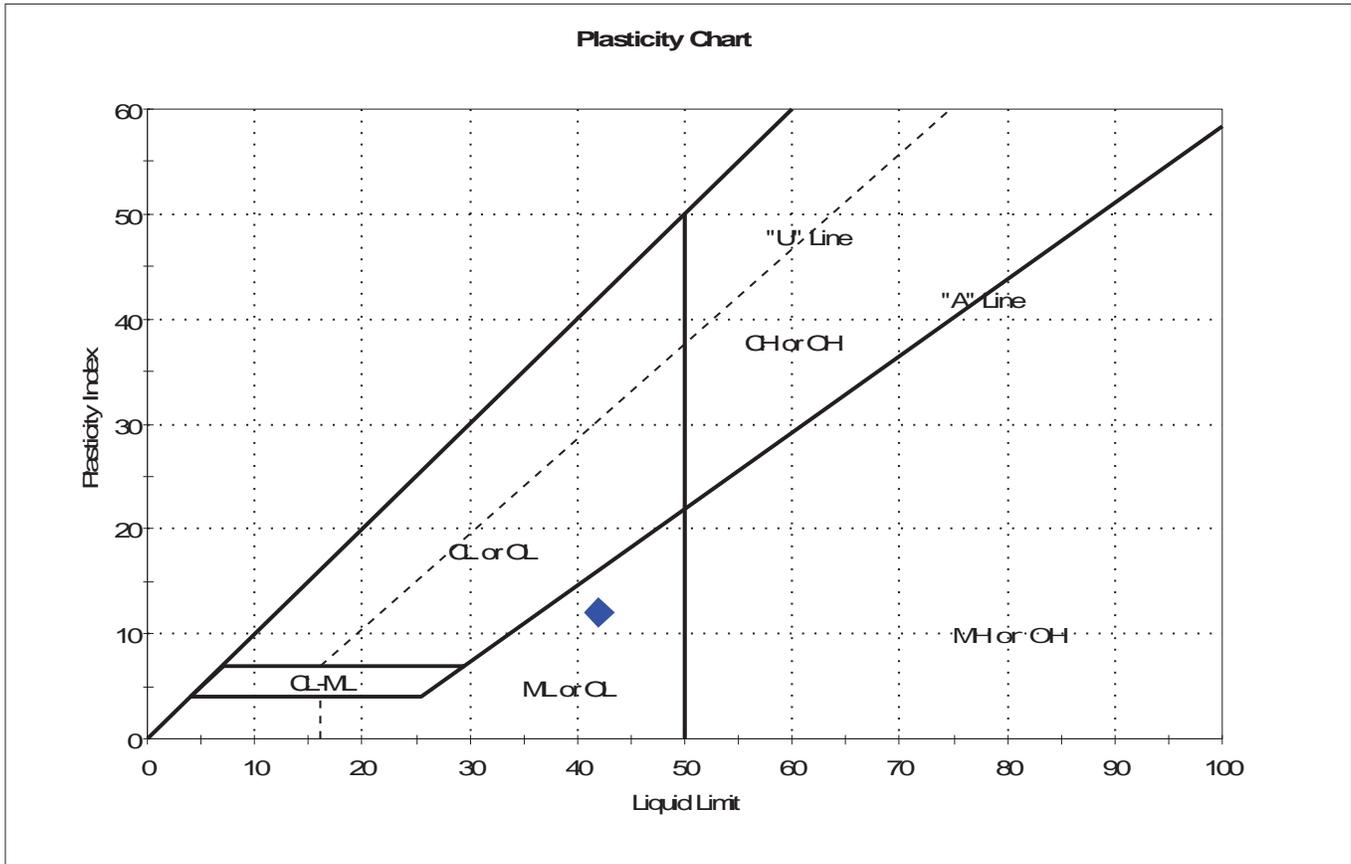
| <u>Sample/Test Description</u> |     |
|--------------------------------|-----|
| Sand/Gravel Particle Shape :   | --- |
| Sand/Gravel Hardness :         | --- |





|                     |                                            |              |             |             |     |
|---------------------|--------------------------------------------|--------------|-------------|-------------|-----|
| Client:             | F&ME Consultants                           |              | Project No: | GTX-305005  |     |
| Project:            | US-21 Replacement Bridge over Harbor River |              |             |             |     |
| Location:           | ---                                        | Sample Type: | tube        | Tested By:  | GA  |
| Boring ID:          | SB-1                                       | Test Date:   | 11/04/16    | Checked By: | mcm |
| Sample ID:          | UD-1                                       | Test Id:     | 397422      |             |     |
| Depth :             | 130.0-133.5 ft                             |              |             |             |     |
| Test Comment:       | ---                                        |              |             |             |     |
| Visual Description: | Moist, olive sandy silt                    |              |             |             |     |
| Sample Comment:     | ---                                        |              |             |             |     |

## Atterberg Limits - ASTM D4318



| Symbol | Sample ID | Boring | Depth         | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification |
|--------|-----------|--------|---------------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | UD-1      | SB-1   | 30.0-133.5 ft | 38                          | 42           | 30            | 12               | 0.6             | Sandy Silt (ML)     |

Sample Prepared using the WET method  
 2% Retained on #40 Sieve  
 Dry Strength: HIGH  
 Dilatancy: SLOW  
 Toughness: LOW



|            |                                            |              |            |
|------------|--------------------------------------------|--------------|------------|
| Client:    | F&ME Consultants                           |              |            |
| Project:   | US-21 Replacement Bridge over Harbor River |              |            |
| Location:  | ---                                        | Project No:  | GTX-305005 |
| Boring ID: | ---                                        | Sample Type: | ---        |
| Sample ID: | ---                                        | Test Date:   | 08/30/16   |
| Depth :    | ---                                        | Test Id:     | 387124     |
|            |                                            | Tested By:   | jbr        |
|            |                                            | Checked By:  | mcm        |

## Moisture Content of Soil and Rock - ASTM D2216

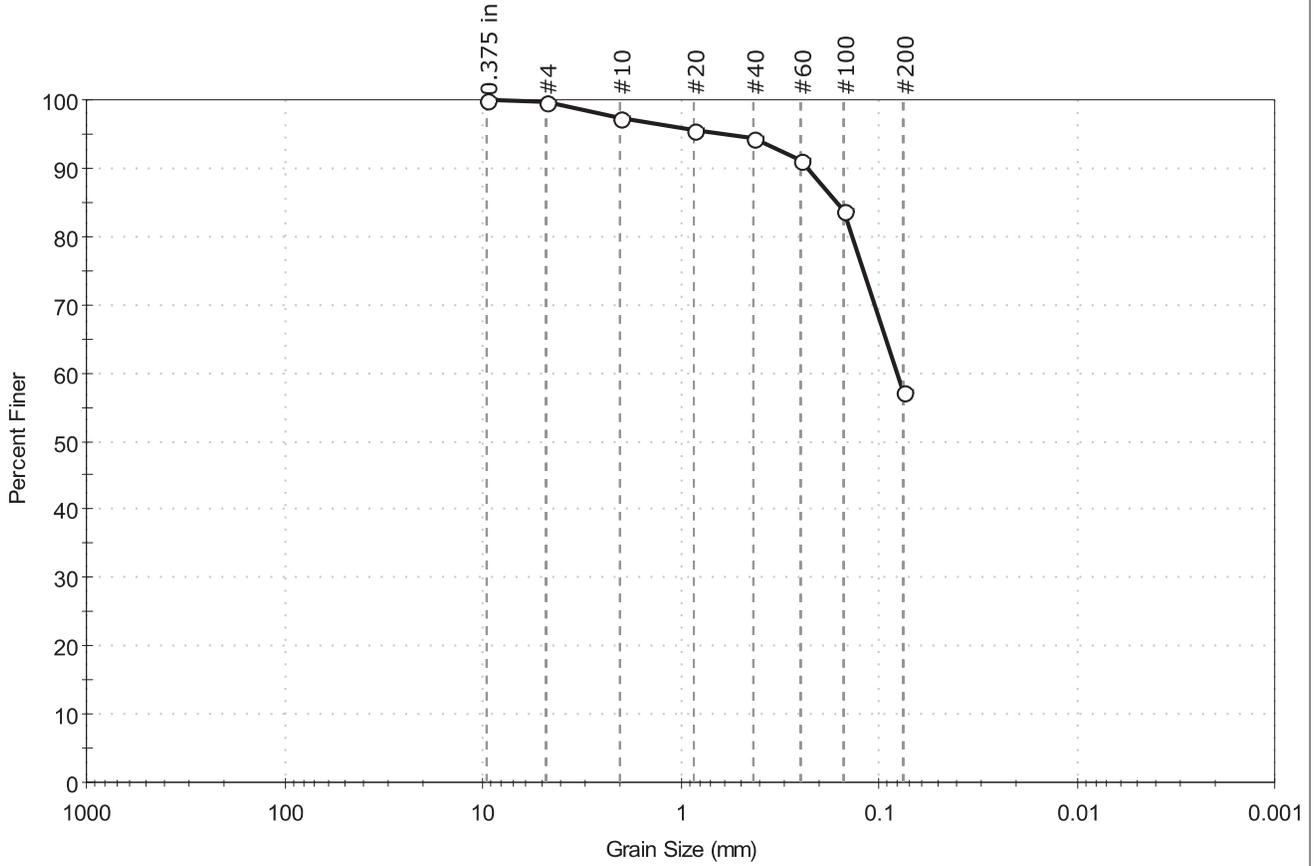
| Boring ID | Sample ID | Depth          | Description             | Moisture Content, % |
|-----------|-----------|----------------|-------------------------|---------------------|
| SB-1      | UD- 2     | 145.0-148.0 ft | Moist, olive sandy silt | 33.1                |

Notes: Temperature of Drying : 110° Celsius



|                          |                                                     |                        |
|--------------------------|-----------------------------------------------------|------------------------|
| Client: F&ME Consultants | Project: US-21 Replacement Bridge over Harbor River | Project No: GTX-305005 |
| Location: ---            | Boring ID: SB-1                                     | Sample Type: tube      |
| Sample ID: UD-2          | Test Date: 08/31/16                                 | Tested By: jbr         |
| Depth: 145.0-148.0 ft    | Test Id: 387107                                     | Checked By: mcm        |
| Test Comment: ---        | Visual Description: Moist, olive sandy silt         | Sample Comment: ---    |

## Particle Size Analysis - ASTM D422



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 0.2      | 42.5   | 57.3               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| 0.375 in   | 9.50           | 100           |               |          |
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 97            |               |          |
| #20        | 0.85           | 96            |               |          |
| #40        | 0.42           | 94            |               |          |
| #60        | 0.25           | 91            |               |          |
| #100       | 0.15           | 84            |               |          |
| #200       | 0.075          | 57            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <b>Coefficients</b>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.1641 mm | D <sub>30</sub> = N/A |
| D <sub>60</sub> = 0.0805 mm | 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  |

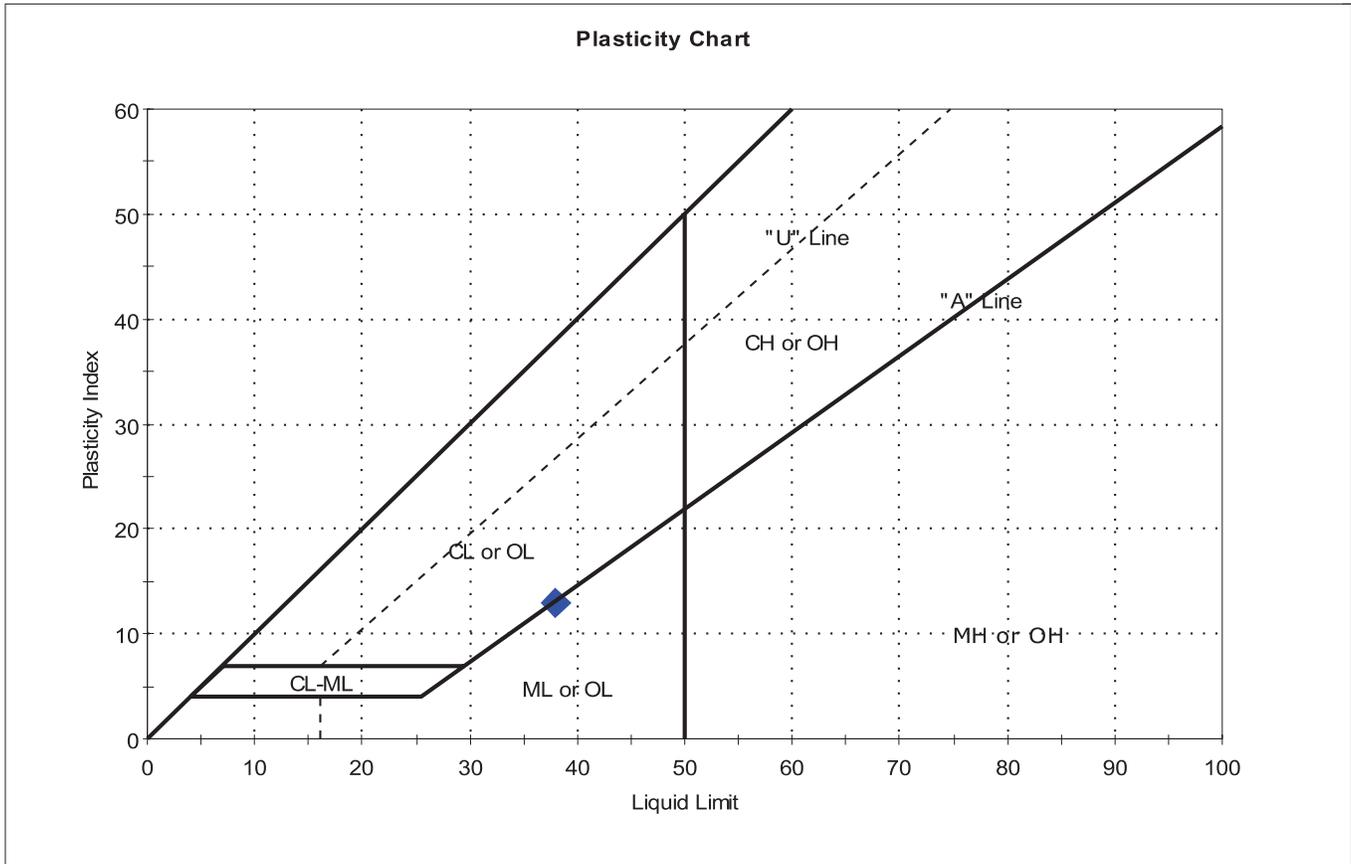
| <b>Classification</b> |                        |
|-----------------------|------------------------|
| <b>ASTM</b>           | Sandy Silt (ML)        |
| <b>AASHTO</b>         | Clayey Soils (A-6 (6)) |

| <b>Sample/Test Description</b> |       |
|--------------------------------|-------|
| Sand/Gravel Particle Shape     | : --- |
| Sand/Gravel Hardness           | : --- |



|                     |                                            |              |            |
|---------------------|--------------------------------------------|--------------|------------|
| Client:             | F&ME Consultants                           | Project No:  | GTX-305005 |
| Project:            | US-21 Replacement Bridge over Harbor River | Tested By:   | GA         |
| Location:           | ---                                        | Checked By:  | mcm        |
| Boring ID:          | SB-1                                       | Sample Type: | tube       |
| Sample ID:          | UD-2                                       | Test Date:   | 08/31/16   |
| Depth :             | 145.0-148.0 ft                             | Test Id:     | 387115     |
| Test Comment:       | ---                                        |              |            |
| Visual Description: | Moist, olive sandy silt                    |              |            |
| Sample Comment:     | ---                                        |              |            |

## Atterberg Limits - ASTM D4318

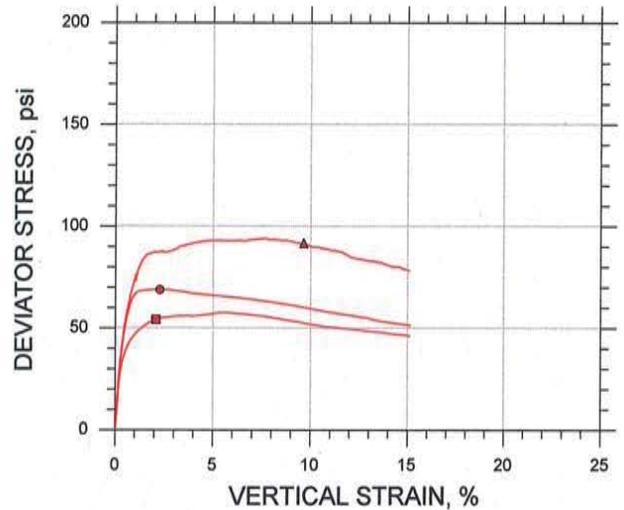
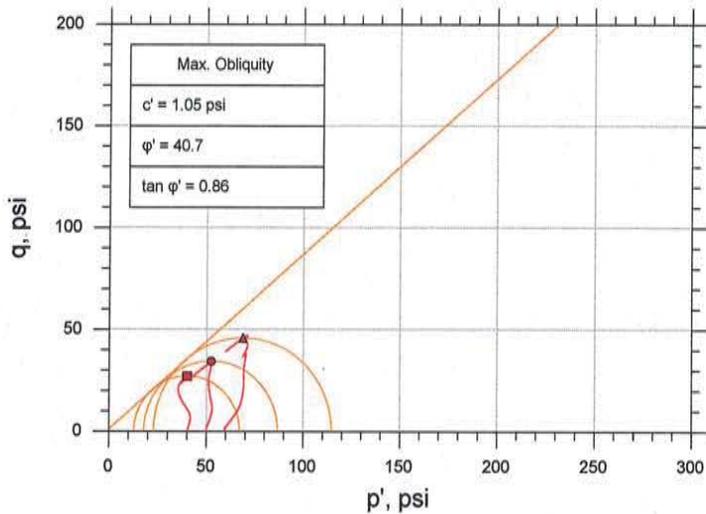


| Symbol | Sample ID | Boring | Depth          | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification |
|--------|-----------|--------|----------------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | UD-2      | SB-1   | 145.0-148.0 ft | 33                          | 38           | 25            | 13               | 0.6             | Sandy Silt (ML)     |

Sample Prepared using the WET method  
 6% Retained on #40 Sieve  
 Dry Strength: VERY HIGH  
 Dilatancy: RAPID  
 Toughness: LOW

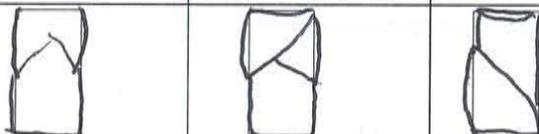
|                                        |                                 |
|----------------------------------------|---------------------------------|
| Client: F&ME Consultants               |                                 |
| Project Name: US-21 Replacement Bridge |                                 |
| Project Location: ---                  |                                 |
| Project Number: GTX-305005             |                                 |
| Tested By: md                          | Checked By: mcm                 |
| Boring ID: SB-1                        |                                 |
| Preparation: intact                    |                                 |
| Description: Moist, olive sandy silt   |                                 |
| Classification: Sandy silt             |                                 |
| Group Symbol: ML                       |                                 |
| Liquid Limit: 38                       | Plastic Limit: 25               |
| Plasticity Index: 13                   | Estimated Specific Gravity: 2.7 |

**CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767**



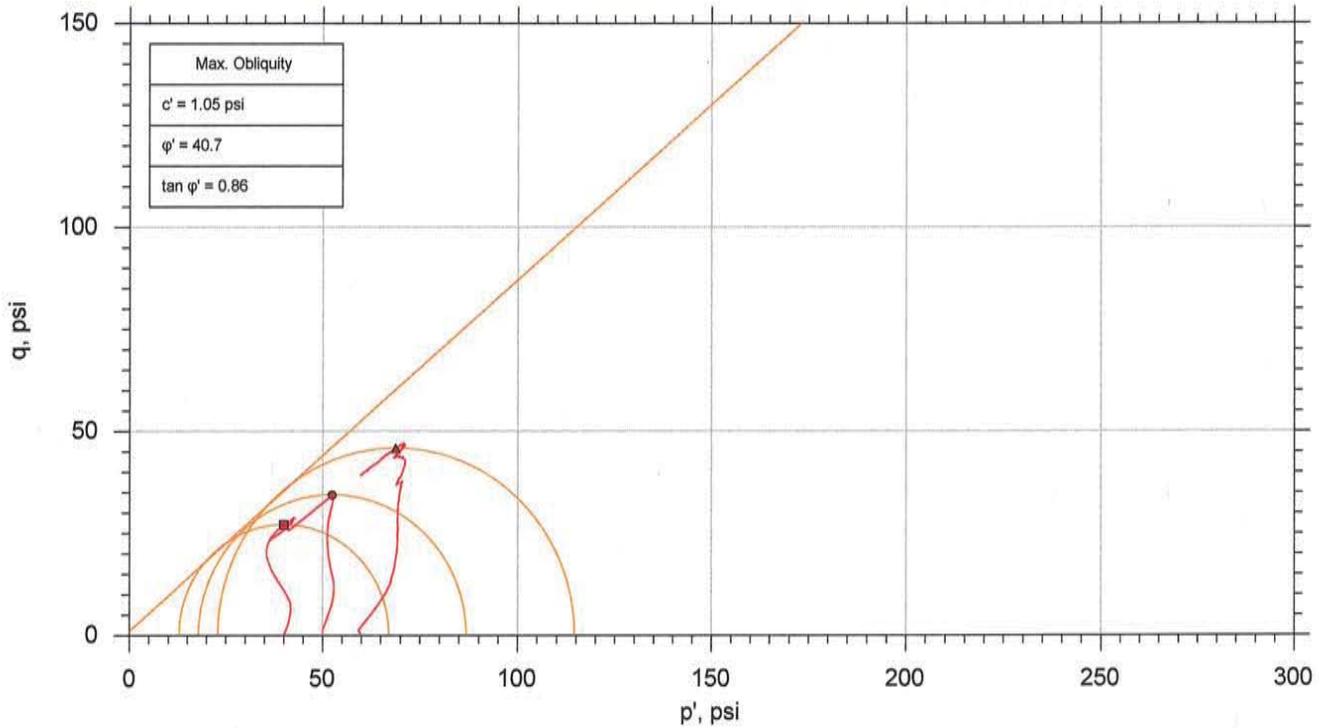
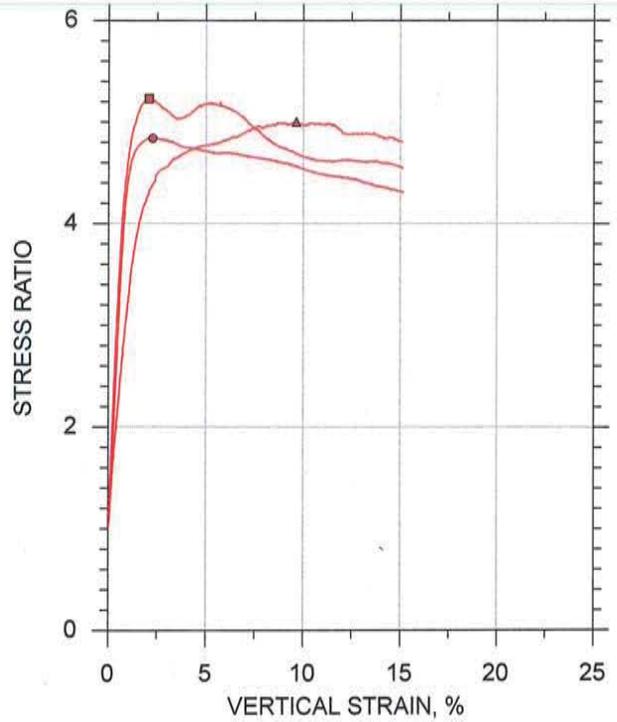
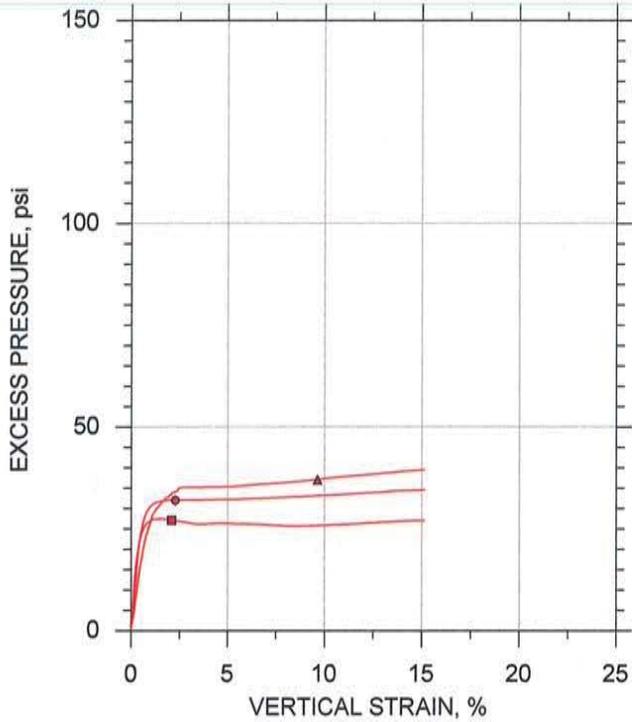
| Symbol                                           | ■              | ●              | ▲              |  |
|--------------------------------------------------|----------------|----------------|----------------|--|
| Sample ID                                        | UD-2           | UD-2           | UD-2           |  |
| Depth, ft                                        | 145.0-148.0 ft | 145.0-148.0 ft | 145.0-148.0 ft |  |
| Test Number                                      | CU-8-1         | CU-8-2         | CU-8-3         |  |
| Initial                                          |                |                |                |  |
| Height, in                                       | 6.100          | 5.890          | 6.200          |  |
| Diameter, in                                     | 2.860          | 2.850          | 2.850          |  |
| Moisture Content (from Cuttings), %              | 33.8           | 33.2           | 29.9           |  |
| Dry Density, pcf                                 | 85.9           | 88.2           | 93.1           |  |
| Saturation (Wet Method), %                       | 94.8           | 98.2           | 99.7           |  |
| Void Ratio                                       | 0.963          | 0.912          | 0.810          |  |
| Before Shear                                     |                |                |                |  |
| Moisture Content, %                              | 33.3           | 31.2           | 25.8           |  |
| Dry Density, pcf                                 | 88.8           | 91.5           | 99.3           |  |
| Cross-sectional Area (Method A), in <sup>2</sup> | 6.273          | 6.205          | 6.049          |  |
| Saturation, %                                    | 100.0          | 100.0          | 100.0          |  |
| Void Ratio                                       | 0.898          | 0.842          | 0.698          |  |
| Back Pressure, psi                               | 131.0          | 121.0          | 33.00          |  |
| Vertical Effective Consolidation Stress, psi     | 39.97          | 49.98          | 59.94          |  |
| Horizontal Effective Consolidation Stress, psi   | 40.00          | 50.00          | 59.99          |  |
| Vertical Strain after Consolidation, %           | 0.7774         | 0.7386         | 0.8643         |  |
| Volumetric Strain after Consolidation, %         | 2.735          | 3.028          | 5.571          |  |
| Time to 50% Consolidation, min                   | 1.000          | 0.6400         | 1.000          |  |
| Shear Strength, psi                              | 27.13          | 34.45          | 45.85          |  |
| Strain at Failure, %                             | 2.08           | 2.27           | 9.63           |  |
| Strain Rate, %/min                               | 0.01600        | 0.01600        | 0.01600        |  |
| Deviator Stress at Failure, psi                  | 54.25          | 68.90          | 91.70          |  |
| Effective Minor Principal Stress at Failure, psi | 12.82          | 17.93          | 22.91          |  |
| Effective Major Principal Stress at Failure, psi | 67.07          | 86.84          | 114.6          |  |
| B-Value                                          | 0.96           | 0.95           | 1.00           |  |

**Notes:**  
 - Before Shear Saturation set to 100% for phase calculation.  
 - Moisture Content determined by ASTM D2216.  
 - Atterberg Limits determined by ASTM D4318.  
 - Deviator Stress includes membrane correction.  
 - Values for c and phi 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



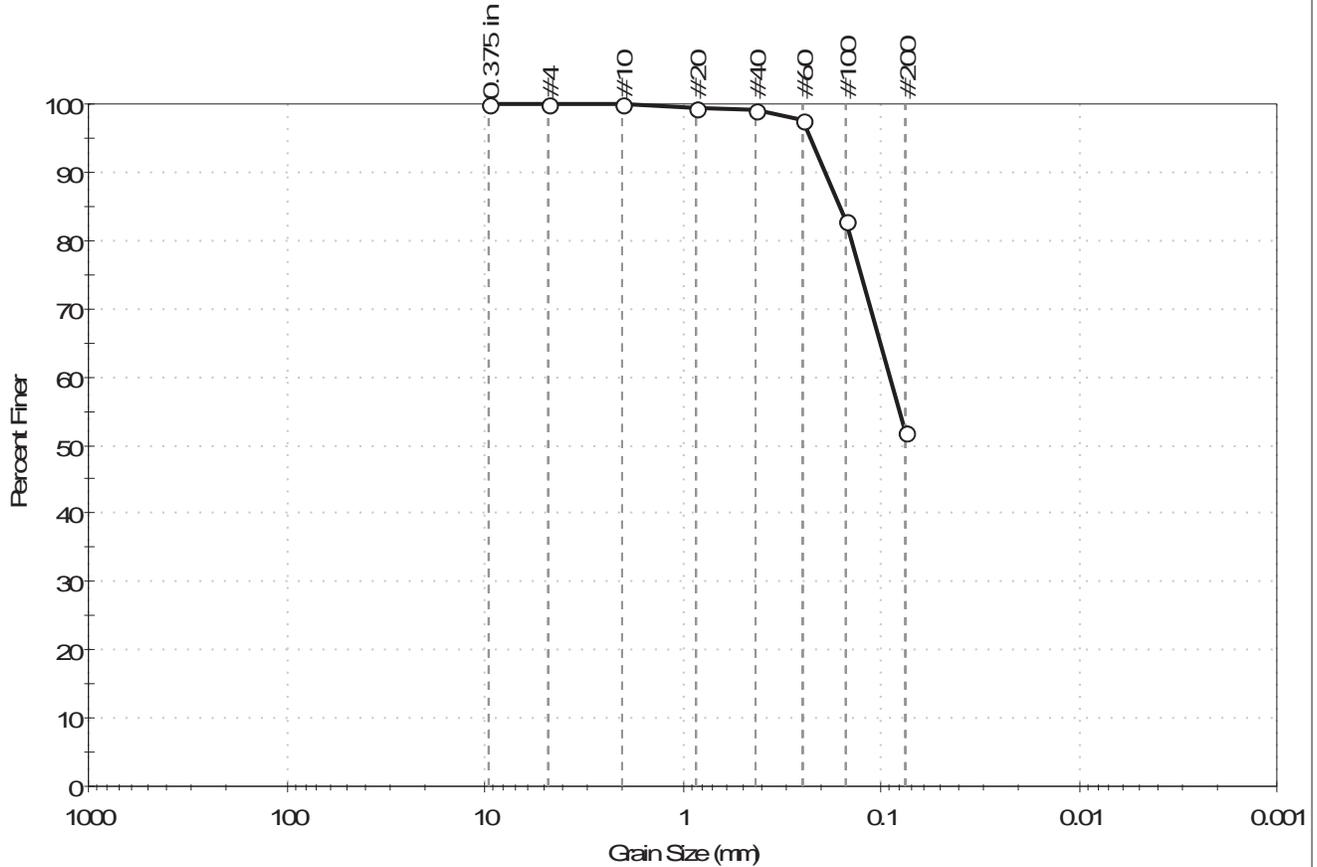
| Sample No. | Test No. | Depth          | Tested By | Test Date | Checked By | Check Date | Test File          |
|------------|----------|----------------|-----------|-----------|------------|------------|--------------------|
| ■ UD-2     | CU-8-1   | 145.0-148.0 ft | md        | 8/28/16   | mcm        | 9/9/16     | 305005-CU-8-1m.dat |
| ● UD-2     | CU-8-2   | 145.0-148.0 ft | md        | 8/28/16   | mcm        | 9/8/16     | 305005-CU-8-2m.dat |
| ▲ UD-2     | CU-8-3   | 145.0-148.0 ft | md        | 8/28/16   | mm         | 9/9/16     | 305005-CU-8-3m.dat |

|  |                                      |  |                     |  |                         |  |
|--|--------------------------------------|--|---------------------|--|-------------------------|--|
|  | Project: US-21 Replacement Bridge    |  | Location: ---       |  | Project No.: GTX-305005 |  |
|  | Boring No.: SB-1                     |  | Sample Type: intact |  |                         |  |
|  | Description: Moist, olive sandy silt |  |                     |  |                         |  |
|  | Remarks: System O                    |  |                     |  |                         |  |



|                     |                                            |              |             |             |     |
|---------------------|--------------------------------------------|--------------|-------------|-------------|-----|
| Client:             | F&ME Consultants                           |              | Project No: | GTX-305005  |     |
| Project:            | US-21 Replacement Bridge over Harbor River |              |             |             |     |
| Location:           | ---                                        |              | Tested By:  | GA          |     |
| Boring ID:          | SB-1                                       | Sample Type: | tube        | Checked By: | mcm |
| Sample ID:          | UD-4                                       | Test Date:   | 11/04/16    |             |     |
| Depth:              | 200.0-203.0 ft                             | Test Id:     | 397425      |             |     |
| Test Comment:       | ---                                        |              |             |             |     |
| Visual Description: | Moist, olive sandy silt                    |              |             |             |     |
| Sample Comment:     | ---                                        |              |             |             |     |

## Particle Size Analysis - ASTM D422



|         |         |       |                   |
|---------|---------|-------|-------------------|
| %Cobble | %Gravel | %Sand | %Silt & Clay Size |
| —       | 0.1     | 47.8  | 52.1              |

| 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           | 100           |               |          |
| #40        | 0.42           | 99            |               |          |
| #60        | 0.25           | 98            |               |          |
| #100       | 0.15           | 83            |               |          |
| #200       | 0.075          | 52            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.1611 mm | D <sub>30</sub> = N/A |
| D <sub>60</sub> = 0.0896 mm | 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  |

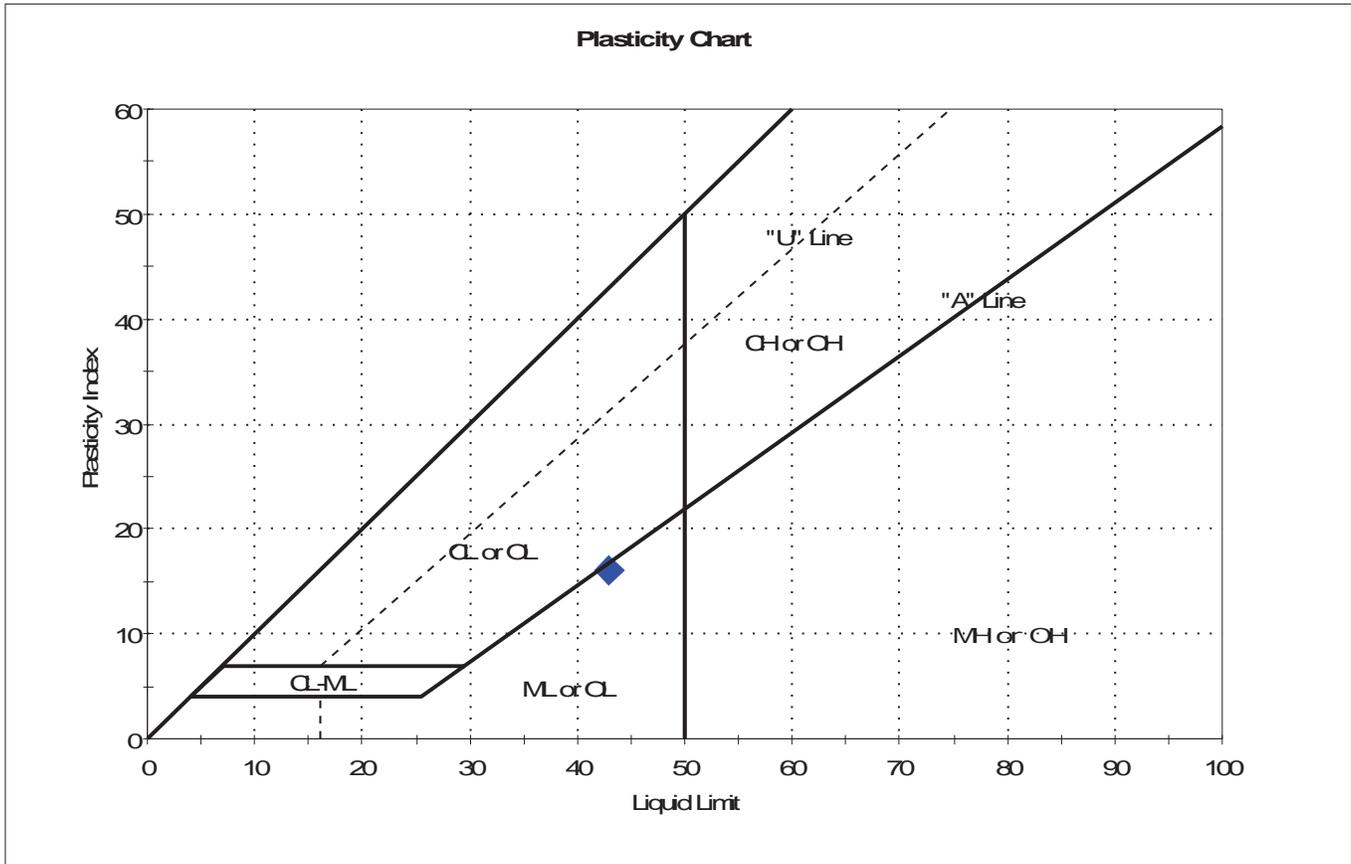
| <u>Classification</u> |                          |
|-----------------------|--------------------------|
| <u>ASTM</u>           | Sandy Silt (ML)          |
| <u>AASHTO</u>         | Clayey Soils (A-7-6 (6)) |

| <u>Sample/Test Description</u>   |
|----------------------------------|
| Sand/Gravel Particle Shape : --- |
| Sand/Gravel Hardness : ---       |



|                     |                                            |              |             |             |     |
|---------------------|--------------------------------------------|--------------|-------------|-------------|-----|
| Client:             | F&ME Consultants                           |              | Project No: | GTX-305005  |     |
| Project:            | US-21 Replacement Bridge over Harbor River |              |             |             |     |
| Location:           | ---                                        | Sample Type: | tube        | Tested By:  | GA  |
| Boring ID:          | SB-1                                       | Test Date:   | 11/04/16    | Checked By: | mcm |
| Sample ID:          | UD-4                                       | Test Id:     | 397423      |             |     |
| Depth :             | 200.0-203.0 ft                             |              |             |             |     |
| Test Comment:       | ---                                        |              |             |             |     |
| Visual Description: | Moist, olive sandy silt                    |              |             |             |     |
| Sample Comment:     | ---                                        |              |             |             |     |

## Atterberg Limits - ASTM D4318



| Symbol | Sample ID | Boring | Depth          | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification |
|--------|-----------|--------|----------------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | UD-4      | SB-1   | 200.0-203.0 ft | 32                          | 43           | 27            | 16               | 0.3             | Sandy Silt (ML)     |

Sample Prepared using the WET method  
 1% Retained on #40 Sieve  
 Dry Strength: HIGH  
 Dilatancy: SLOW  
 Toughness: LOW





|            |                                            |              |            |
|------------|--------------------------------------------|--------------|------------|
| Client:    | F&ME Consultants                           |              |            |
| Project:   | US-21 Replacement Bridge over Harbor River |              |            |
| Location:  | ---                                        | Project No:  | GTX-305005 |
| Boring ID: | ---                                        | Sample Type: | ---        |
| Sample ID: | ---                                        | Test Date:   | 08/30/16   |
| Depth :    | ---                                        | Test Id:     | 387124     |
|            |                                            | Tested By:   | jbr        |
|            |                                            | Checked By:  | mcm        |

## Moisture Content of Soil and Rock - ASTM D2216

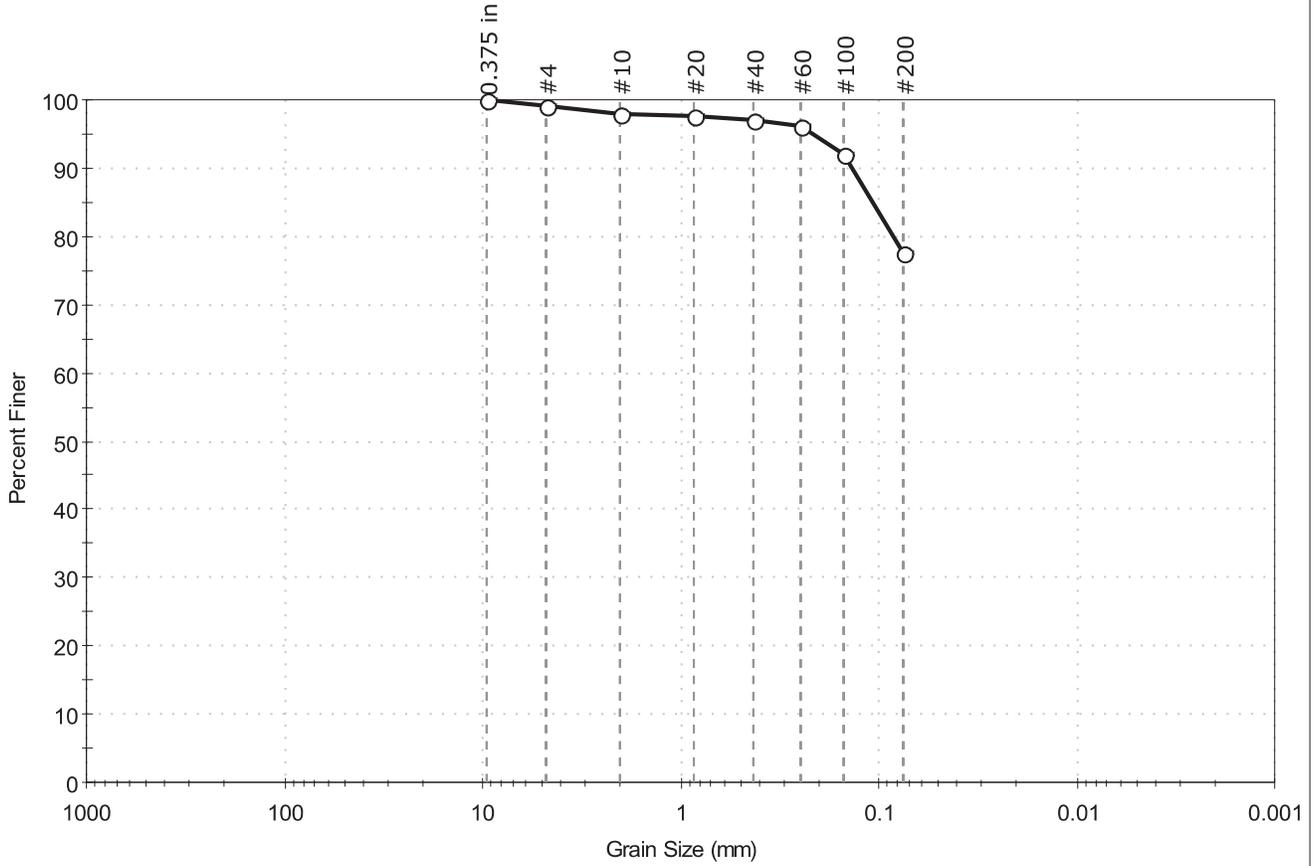
| Boring ID | Sample ID | Depth          | Description                 | Moisture Content, % |
|-----------|-----------|----------------|-----------------------------|---------------------|
| SB-1      | UD-5      | 230.0-233.0 ft | Moist, olive silt with sand | 32.6                |

Notes: Temperature of Drying : 110° Celsius



|                          |                                                     |                        |
|--------------------------|-----------------------------------------------------|------------------------|
| Client: F&ME Consultants | Project: US-21 Replacement Bridge over Harbor River | Project No: GTX-305005 |
| Location: ---            | Boring ID: SB-1                                     | Sample Type: tube      |
| Sample ID: UD-5          | Test Date: 08/31/16                                 | Tested By: jbr         |
| Depth: 230.0-233.0 ft    | Test Id: 387108                                     | Checked By: mcm        |
| Test Comment: ---        | Visual Description: Moist, olive silt with sand     | Sample Comment: ---    |

## Particle Size Analysis - ASTM D422



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 1.0      | 21.3   | 77.7               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| 0.375 in   | 9.50           | 100           |               |          |
| #4         | 4.75           | 99            |               |          |
| #10        | 2.00           | 98            |               |          |
| #20        | 0.85           | 98            |               |          |
| #40        | 0.42           | 97            |               |          |
| #60        | 0.25           | 96            |               |          |
| #100       | 0.15           | 92            |               |          |
| #200       | 0.075          | 78            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <b>Coefficients</b>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.1069 mm | 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  |

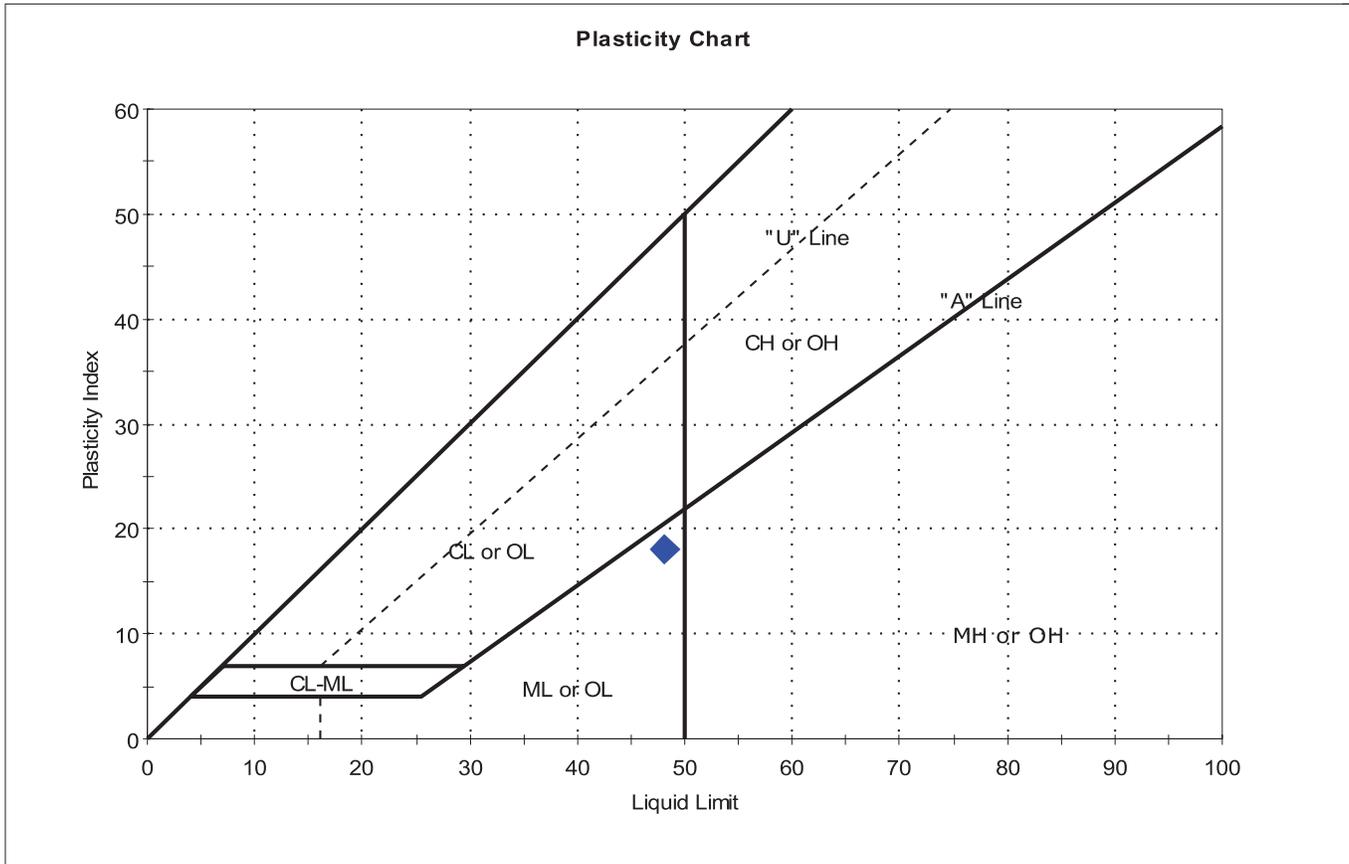
| <b>Classification</b> |                           |
|-----------------------|---------------------------|
| <b>ASTM</b>           | Silt with sand (ML)       |
| <b>AASHTO</b>         | Clayey Soils (A-7-5 (15)) |

| <b>Sample/Test Description</b> |       |
|--------------------------------|-------|
| Sand/Gravel Particle Shape     | : --- |
| Sand/Gravel Hardness           | : --- |



|                     |                                            |            |              |            |  |
|---------------------|--------------------------------------------|------------|--------------|------------|--|
| Client:             | F&ME Consultants                           |            | Project No:  | GTX-305005 |  |
| Project:            | US-21 Replacement Bridge over Harbor River |            |              |            |  |
| Location:           | ---                                        |            | Sample Type: | tube       |  |
| Boring ID:          | SB-1                                       | Tested By: | GA           |            |  |
| Sample ID:          | UD-5                                       | Test Date: | 08/31/16     |            |  |
| Depth :             | 230.0-233.0 ft                             | Test Id:   | 387116       |            |  |
| Test Comment:       | ---                                        |            |              |            |  |
| Visual Description: | Moist, olive silt with sand                |            |              |            |  |
| Sample Comment:     | ---                                        |            |              |            |  |

## Atterberg Limits - ASTM D4318

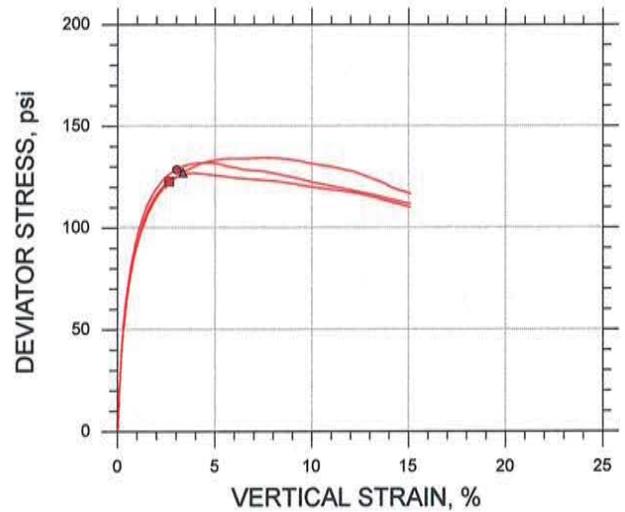
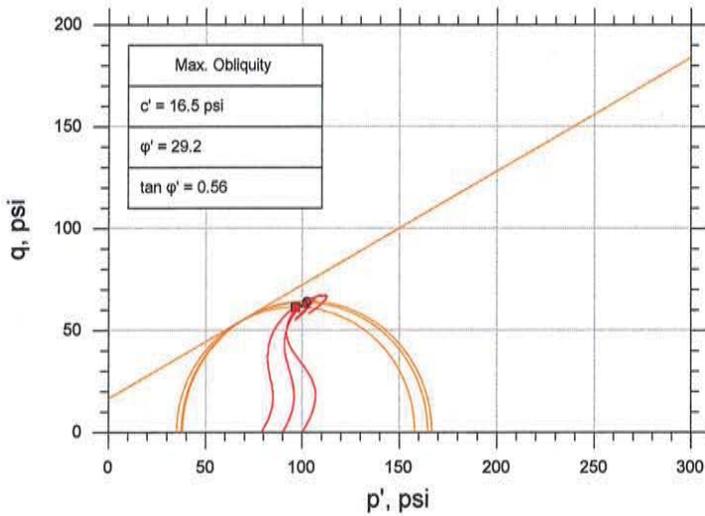


| Symbol | Sample ID | Boring | Depth         | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification |
|--------|-----------|--------|---------------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | UD-5      | SB-1   | 30.0-233.0 ft | 33                          | 48           | 30            | 18               | 0.1             | Silt with sand (ML) |

Sample Prepared using the WET method  
 3% Retained on #40 Sieve  
 Dry Strength: VERY HIGH  
 Dilatancy: RAPID  
 Toughness: LOW

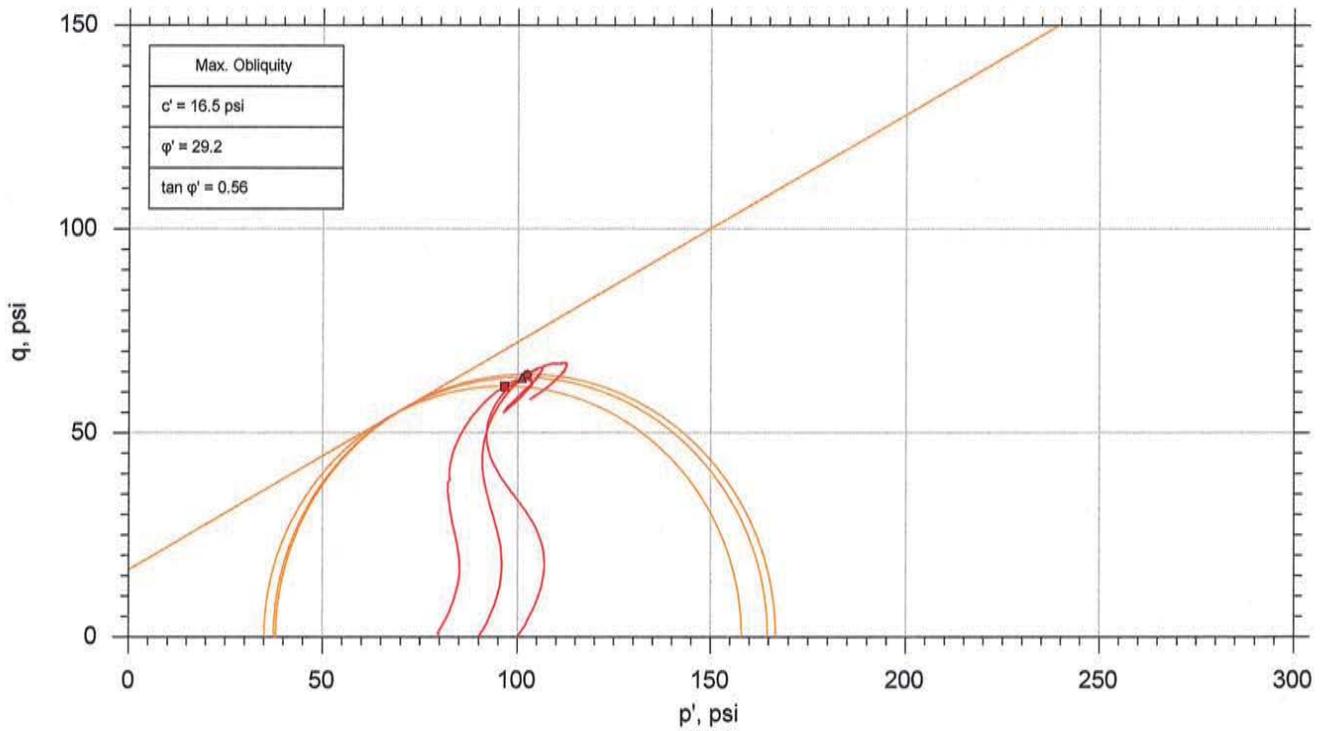
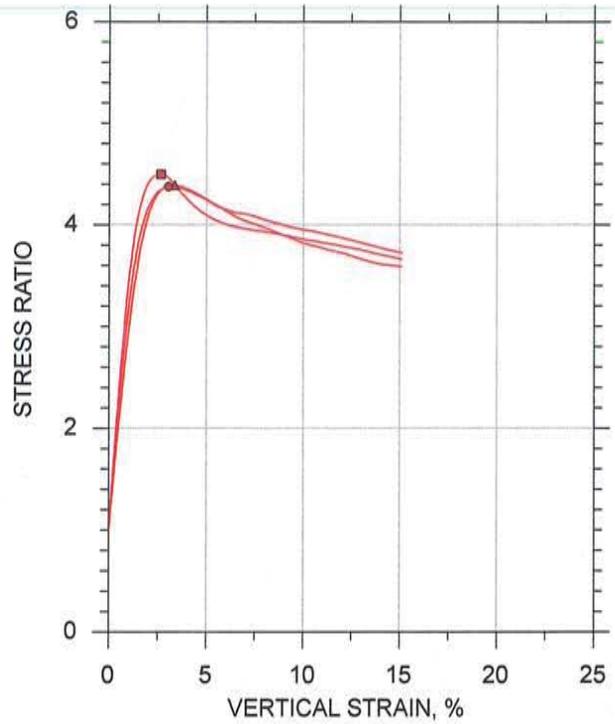
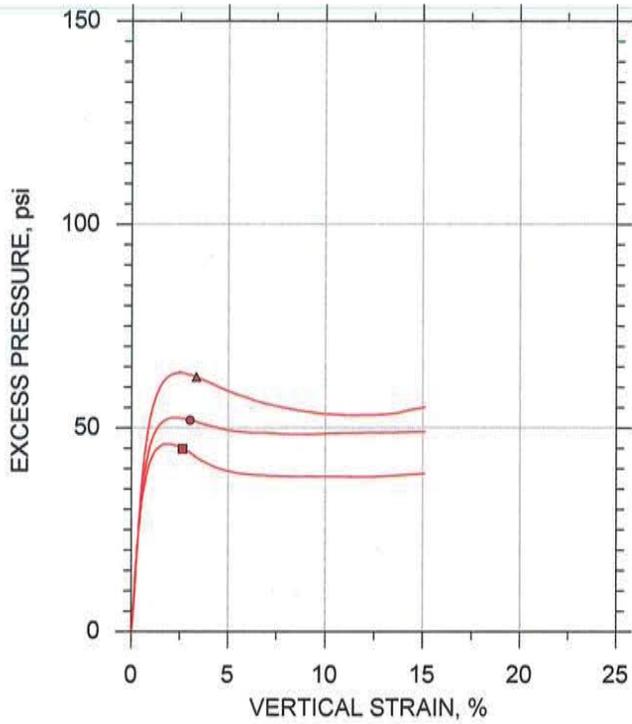
|                                          |                                 |
|------------------------------------------|---------------------------------|
| Client: F&ME Consultants                 |                                 |
| Project Name: US-21 Replacement Bridge   |                                 |
| Project Location: ---                    |                                 |
| Project Number: GTX-305005               |                                 |
| Tested By: md                            | Checked By: mcm                 |
| Boring ID: SB-1                          |                                 |
| Preparation: intact                      |                                 |
| Description: Moist, olive silt with sand |                                 |
| Classification: Silt with sand           |                                 |
| Group Symbol: ML                         |                                 |
| Liquid Limit: 48                         | Plastic Limit: 30               |
| Plasticity Index: 18                     | Estimated Specific Gravity: 2.7 |

**CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767**



| Symbol                                                                                                                                                                                           | ■              | ●              | ▲              |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|----------------|--|
| Sample ID                                                                                                                                                                                        | UD-5           | UD-5           | UD-5           |  |
| Depth, ft                                                                                                                                                                                        | 230.0-233.0 ft | 230.0-233.0 ft | 230.0-233.0 ft |  |
| Test Number                                                                                                                                                                                      | CU-7-1         | CU-7-2         | CU-7-3         |  |
| Initial                                                                                                                                                                                          |                |                |                |  |
| Height, in                                                                                                                                                                                       | 6.150          | 6.150          | 6.100          |  |
| Diameter, in                                                                                                                                                                                     | 2.850          | 2.840          | 2.830          |  |
| Moisture Content (from Cuttings), %                                                                                                                                                              | 31.0           | 29.5           | 29.4           |  |
| Dry Density, pcf                                                                                                                                                                                 | 89.8           | 89.9           | 90.8           |  |
| Saturation (Wet Method), %                                                                                                                                                                       | 95.5           | 91.2           | 92.6           |  |
| Void Ratio                                                                                                                                                                                       | 0.876          | 0.875          | 0.857          |  |
| Before Shear                                                                                                                                                                                     |                |                |                |  |
| Moisture Content, %                                                                                                                                                                              | 31.5           | 29.1           | 27.8           |  |
| Dry Density, pcf                                                                                                                                                                                 | 91.1           | 94.4           | 96.3           |  |
| Cross-sectional Area (Method A), in <sup>2</sup>                                                                                                                                                 | 6.371          | 6.129          | 6.058          |  |
| Saturation, %                                                                                                                                                                                    | 100.0          | 100.0          | 100.0          |  |
| Void Ratio                                                                                                                                                                                       | 0.849          | 0.785          | 0.750          |  |
| Back Pressure, psi                                                                                                                                                                               | 141.0          | 121.0          | 123.0          |  |
| Vertical Effective Consolidation Stress, psi                                                                                                                                                     | 79.96          | 89.91          | 99.90          |  |
| Horizontal Effective Consolidation Stress, psi                                                                                                                                                   | 80.02          | 90.00          | 100.0          |  |
| Vertical Strain after Consolidation, %                                                                                                                                                           | 1.201          | 1.611          | 2.136          |  |
| Volumetric Strain after Consolidation, %                                                                                                                                                         | 1.133          | 4.820          | 5.775          |  |
| Time to 50% Consolidation, min                                                                                                                                                                   | 0.2500         | 13.39          | 42.25          |  |
| Shear Strength, psi                                                                                                                                                                              | 61.43          | 64.32          | 63.57          |  |
| Strain at Failure, %                                                                                                                                                                             | 2.64           | 3.03           | 3.35           |  |
| Strain Rate, %/min                                                                                                                                                                               | 0.01600        | 0.01600        | 0.01600        |  |
| Deviator Stress at Failure, psi                                                                                                                                                                  | 122.9          | 128.6          | 127.1          |  |
| Effective Minor Principal Stress at Failure, psi                                                                                                                                                 | 35.12          | 38.10          | 37.52          |  |
| Effective Major Principal Stress at Failure, psi                                                                                                                                                 | 158.0          | 166.7          | 164.7          |  |
| B-Value                                                                                                                                                                                          | 0.95           | 0.95           | 0.95           |  |
| Notes:                                                                                                                                                                                           |                |                |                |  |
| - Before Shear Saturation set to 100% for phase calculation.                                                                                                                                     |                |                |                |  |
| - Moisture Content determined by ASTM D2216.                                                                                                                                                     |                |                |                |  |
| - Atterberg Limits determined by ASTM D4318.                                                                                                                                                     |                |                |                |  |
| - Deviator Stress includes membrane correction.                                                                                                                                                  |                |                |                |  |
| - Values for c and phi 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          |
|------------|----------|----------------|-----------|-----------|------------|------------|--------------------|
| ■ UD-5     | CU-7-1   | 230.0-233.0 ft | md        | 8/28/16   | mcm        | 9/8/16     | 305005-CU-7-1m.dat |
| ● UD-5     | CU-7-2   | 230.0-233.0 ft | md        | 8/26/16   | mcm        | 9/8/16     | 305005-CU-7-2m.dat |
| ▲ UD-5     | CU-7-3   | 230.0-233.0 ft | md        | 8/26/16   | mcm        | 9/8/16     | 305005-CU-7-3m.dat |

|  |                                          |  |                     |  |                         |  |
|--|------------------------------------------|--|---------------------|--|-------------------------|--|
|  | Project: US-21 Replacement Bridge        |  | Location: ---       |  | Project No.: GTX-305005 |  |
|  | Boring No.: SB-1                         |  | Sample Type: intact |  |                         |  |
|  | Description: Moist, olive silt with sand |  |                     |  |                         |  |
|  | Remarks: System K                        |  |                     |  |                         |  |

**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1208D **DATE SAMPLE RECEIVED:** \_\_\_\_\_  
**DESCRIPTION OF SOIL:** Sandy Fat Clay (CH) A-7-6(34)  
**TESTED BY:** Fugro **DATE OF TESTING:** \_\_\_\_\_  
**DATE OF WEIGHING:** \_\_\_\_\_

|                          |              |  |  |  |  |
|--------------------------|--------------|--|--|--|--|
| <b>BORING NO.</b>        | SB-1/UD-6    |  |  |  |  |
| <b>SAMPLE NO.</b>        | 16-1208D     |  |  |  |  |
| <b>SAMPLE DEPTH</b>      | 257.0-260.0' |  |  |  |  |
| <b>WATER CONTENT, W%</b> | 31.6         |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

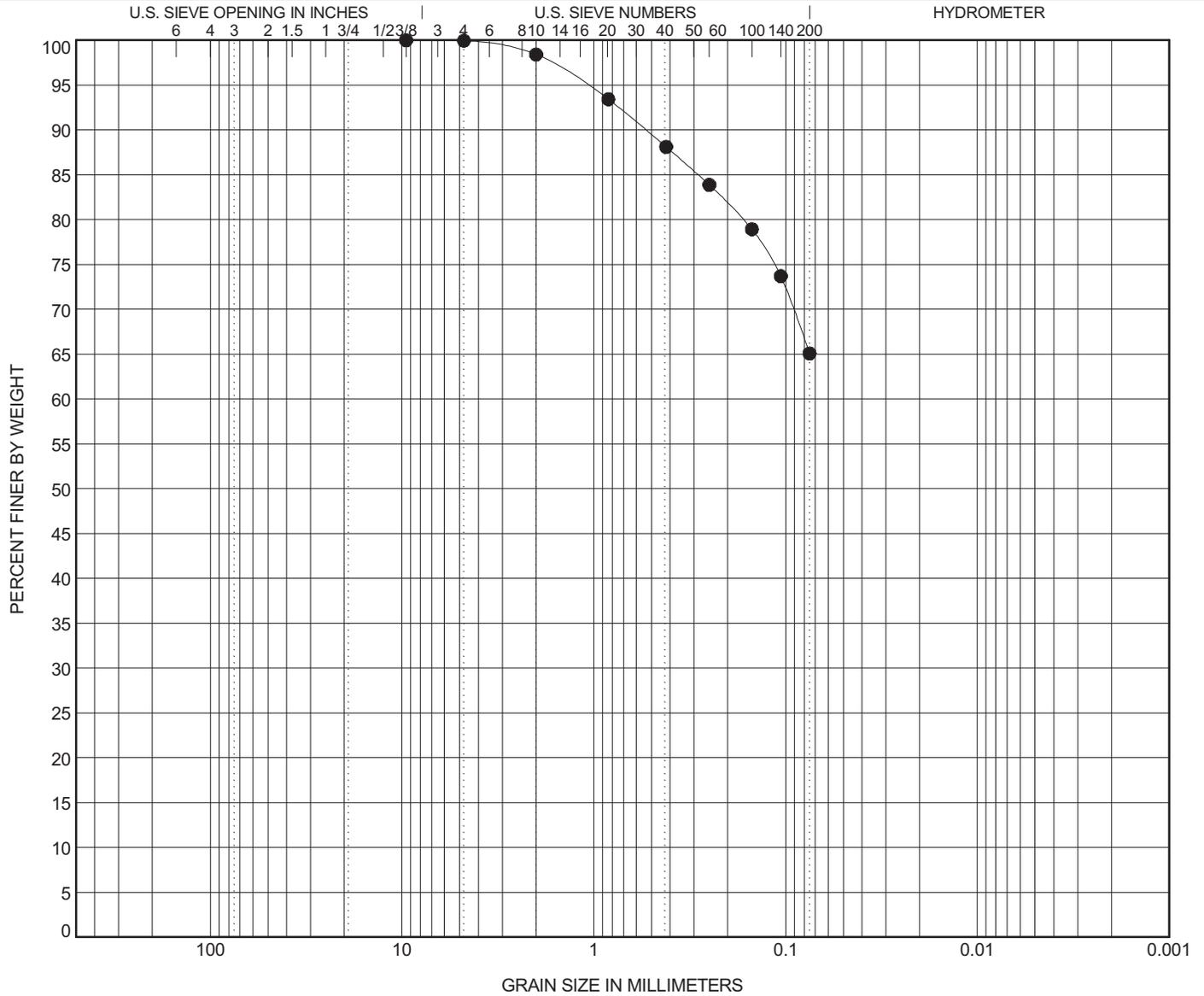


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                       | LL | PL | PI | Cc | Cu |
|----------|-------|--------------------------------------|----|----|----|----|----|
| ● SB-1   | 260.0 | <b>Sandy Fat CLAY (CH) A-7-6(34)</b> | 76 | 21 | 55 |    |    |

| BOREHOLE | DEPTH | D100 | D95   | D50 | D10 | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-----|-----|---------|-------|-------|-------|
| ● SB-1   | 260.0 | 9.52 | 1.102 |     |     | 0.0     | 34.9  | 65.1  |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 11/2/16





**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River

**PROJECT NO.:** G5396

**SAMPLE NUMBER:** \_\_\_\_\_

**DATE SAMPLE RECEIVED:** \_\_\_\_\_

**DESCRIPTION OF SOIL:** Fat Clay (CH) A-7-6(104)

**TESTED BY:** Fugro

**DATE OF TESTING:** \_\_\_\_\_

**DATE OF WEIGHING:** \_\_\_\_\_

|                          |              |  |  |  |  |
|--------------------------|--------------|--|--|--|--|
| <b>BORING NO.</b>        | SB-1/UD-9    |  |  |  |  |
| <b>SAMPLE NO.</b>        | 16-1211D     |  |  |  |  |
| <b>SAMPLE DEPTH</b>      | 378.0-381.0' |  |  |  |  |
| <b>WATER CONTENT, W%</b> | 39.3         |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

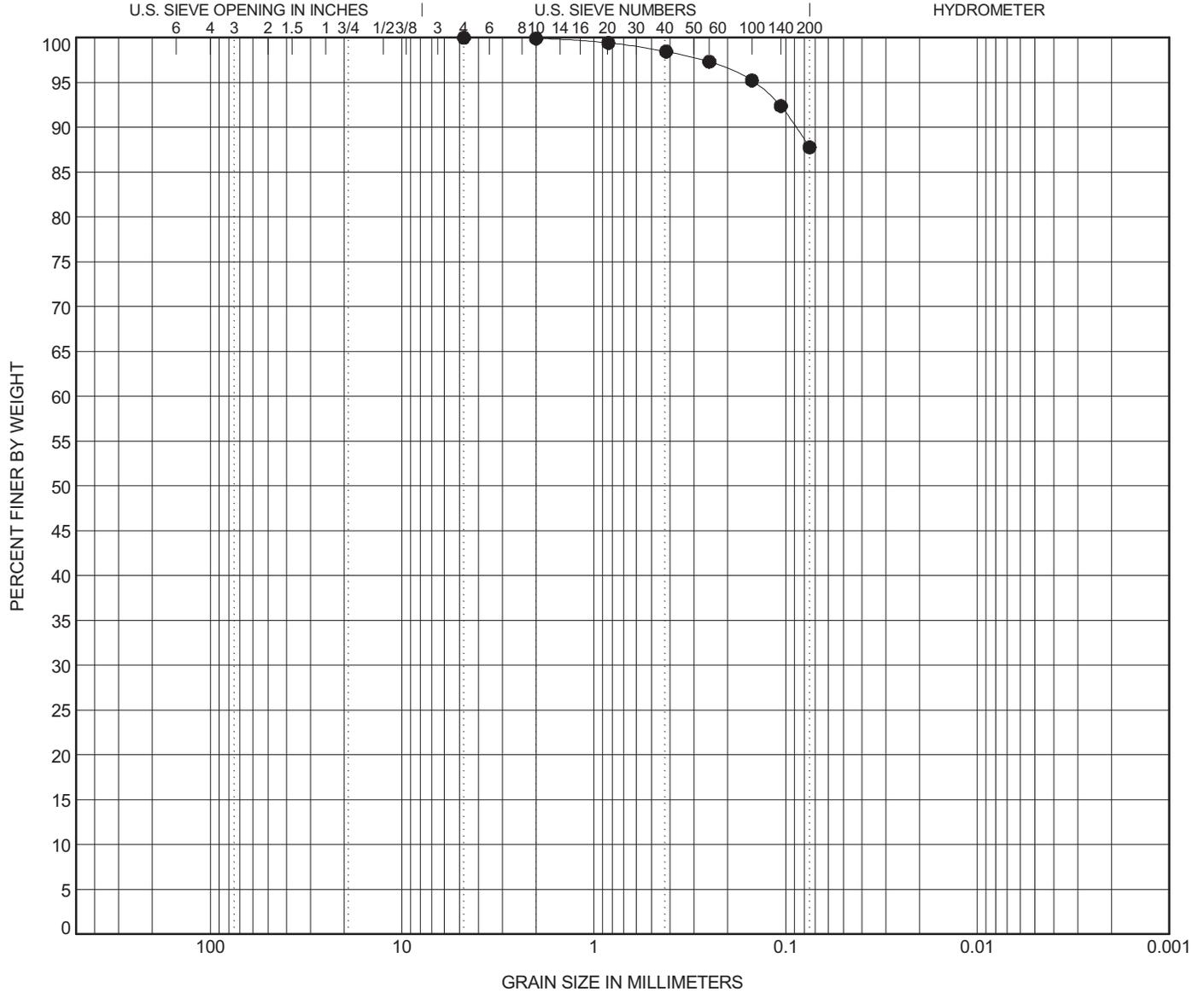


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                  |  |  |  |  | LL         | PL        | PI         | Cc | Cu |
|----------|-------|---------------------------------|--|--|--|--|------------|-----------|------------|----|----|
| ● SB-1   | 381.0 | <b>Fat CLAY (CH) A-7-6(104)</b> |  |  |  |  | <b>133</b> | <b>29</b> | <b>104</b> |    |    |

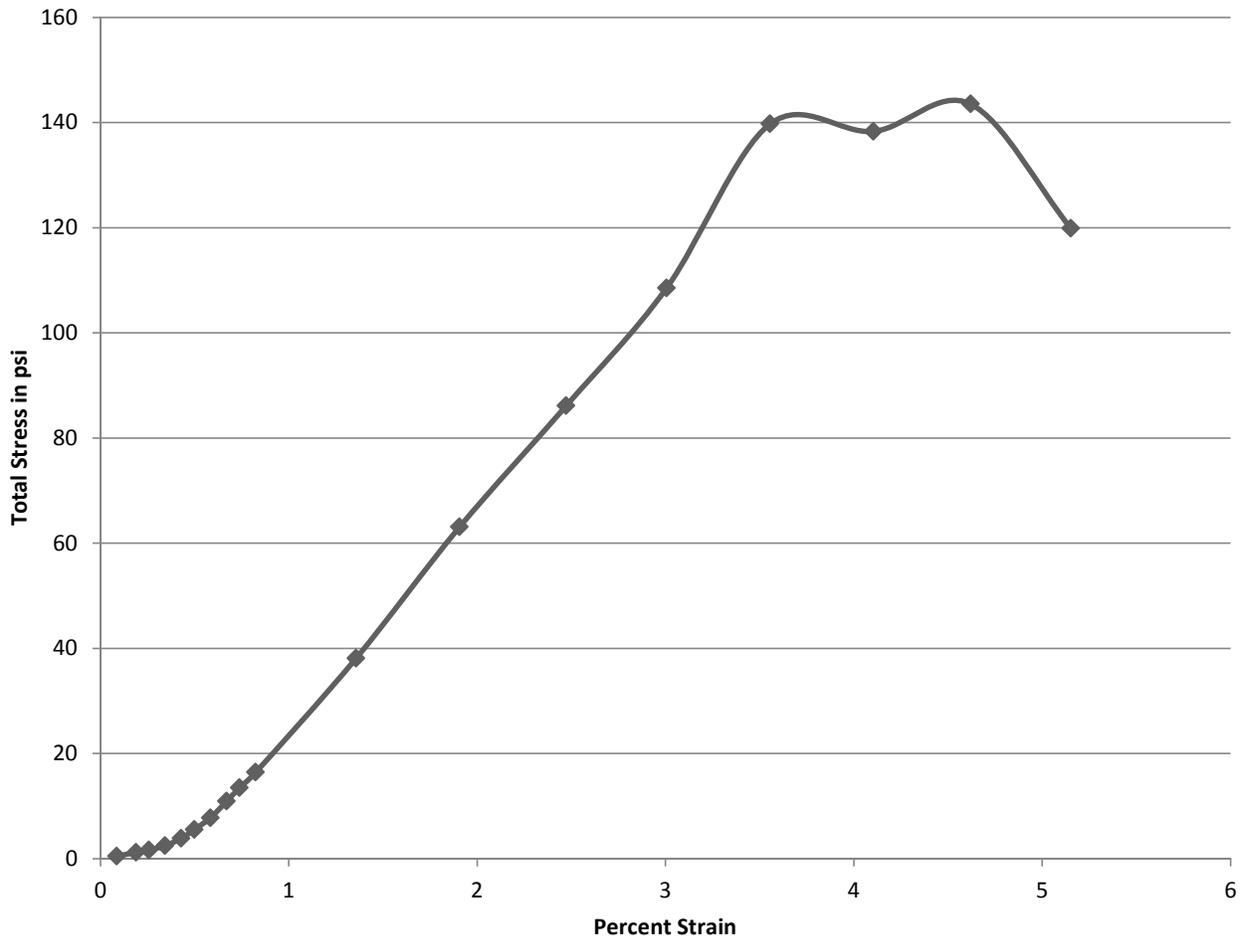
| BOREHOLE | DEPTH | D100        | D95          | D50 | D10 | %Gravel    | %Sand       | %Silt       | %Clay |
|----------|-------|-------------|--------------|-----|-----|------------|-------------|-------------|-------|
| ● SB-1   | 381.0 | <b>4.76</b> | <b>0.146</b> |     |     | <b>0.0</b> | <b>12.2</b> | <b>87.8</b> |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 11/2/16



**UNCONFINED COMPRESSIVE STRENGTH TEST REPORT**  
**ASTM D2166 / AASHTO T208**

**Stress/Strain Curve - Sample 16-1212P**



|                                |                             |                          |                              |
|--------------------------------|-----------------------------|--------------------------|------------------------------|
| Average Initial Diameter (Do): | <u>2.328 in.</u>            | Sample Volume:           | <u>21.142 in<sup>3</sup></u> |
| Average Initial Height (Lo):   | <u>4.967 in.</u>            | Sample Volume:           | <u>0.012 ft<sup>3</sup></u>  |
| Average Initial Area (Ao):     | <u>4.257 in<sup>2</sup></u> | Moist Sample Weight:     | <u>1.47 lbs.</u>             |
| In-Situ Moist Unit Weight:     | <u>119.7 pcf</u>            | In-Situ Dry Unit Weight: | <u>92.8 pcf</u>              |
| Failure Mode:                  | <u>                    </u> |                          |                              |

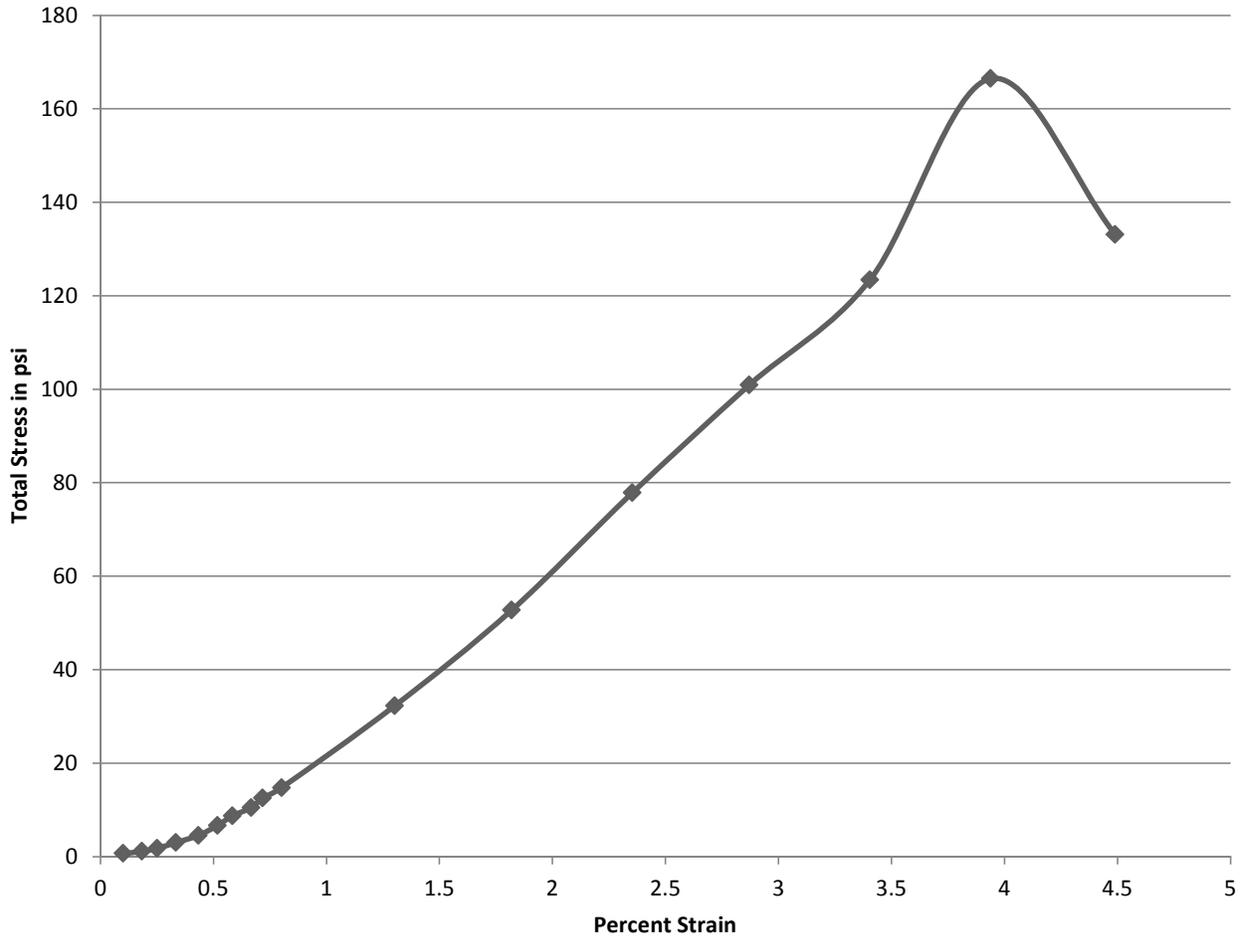
|                 |                                                   |       |                             |
|-----------------|---------------------------------------------------|-------|-----------------------------|
| Project Name    | <u>US-21 Bridge Replacement over Harbor River</u> |       |                             |
| Project Number  | <u>G5396.00</u>                                   | Date  | <u>8/11/2016</u>            |
| SCDOT File #    | <u>P026862</u>                                    | PIN # | <u>                    </u> |
| Sample/Location | <u>SB-1 / NQ-1</u>                                |       |                             |
| Depth/Elevation | <u>250.0' - 255.0'</u>                            |       |                             |

|                                         |                         |
|-----------------------------------------|-------------------------|
| Sample Type : Undisturbed - Shelby Tube |                         |
| Target Strain Rate : 1% per minute      |                         |
| Description:                            |                         |
| PI=                                     | % Fines=                |
| NMC = 29.0%                             | L/D Ratio = 2.13        |
| $\sigma_{c-ULT}$ = 143.5                | $\epsilon_{ULT}$ = 4.6% |



**UNCONFINED COMPRESSIVE STRENGTH TEST REPORT**  
**ASTM D2166 / AASHTO T208**

**Stress/Strain Curve - Sample 16-1212Q**



|                                |                             |                          |                              |
|--------------------------------|-----------------------------|--------------------------|------------------------------|
| Average Initial Diameter (Do): | <u>2.395 in.</u>            | Sample Volume:           | <u>23.025 in<sup>3</sup></u> |
| Average Initial Height (Lo):   | <u>5.111 in.</u>            | Sample Volume:           | <u>0.013 ft<sup>3</sup></u>  |
| Average Initial Area (Ao):     | <u>4.505 in<sup>2</sup></u> | Moist Sample Weight:     | <u>1.56 lbs.</u>             |
| In-Situ Moist Unit Weight:     | <u>116.8 pcf</u>            | In-Situ Dry Unit Weight: | <u>88.7 pcf</u>              |
| Failure Mode:                  | <u>                    </u> |                          |                              |

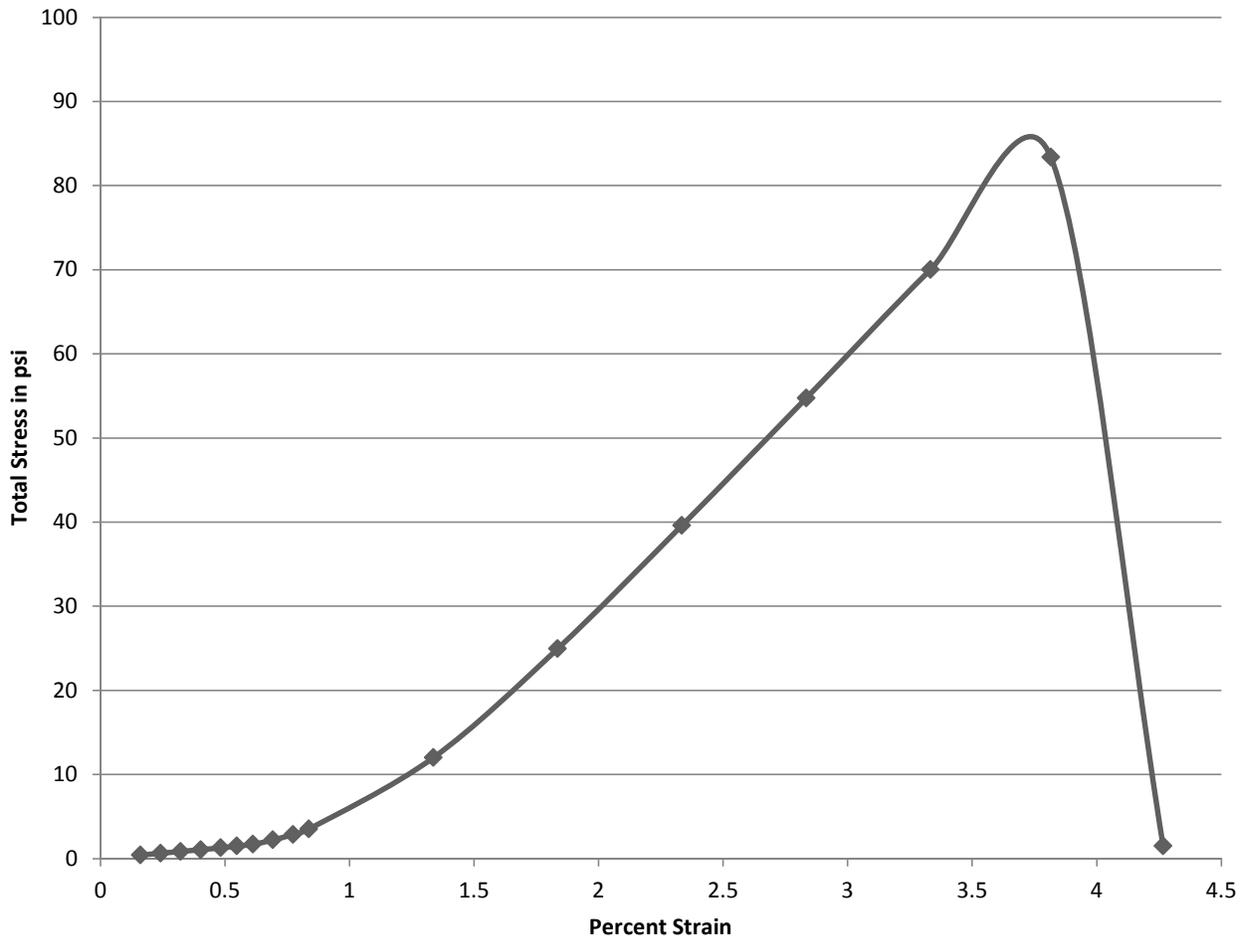
|                 |                                                   |       |                                                  |
|-----------------|---------------------------------------------------|-------|--------------------------------------------------|
| Project Name    | <u>US-21 Bridge Replacement over Harbor River</u> |       | Sample Type : Undisturbed - Shelby Tube          |
| Project Number  | <u>G5396.00</u>                                   | Date  | <u>8/11/2016</u>                                 |
| SCDOT File #    | <u>P026862</u>                                    | PIN # | <u>                    </u>                      |
| Sample/Location | <u>SB-1 / NQ-11</u>                               |       | Target Strain Rate : 1% per minute               |
| Depth/Elevation | <u>298.0' - 303.0'</u>                            |       | Description:                                     |
|                 |                                                   |       | PI=                      % Fines=                |
|                 |                                                   |       | NMC = 31.7%        L/D Ratio = 2.13              |
|                 |                                                   |       | $\sigma_{c-ULT}$ = 166.5 $\epsilon_{ULT}$ = 3.9% |



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**UNCONFINED COMPRESSIVE STRENGTH TEST REPORT**  
**ASTM D2166 / AASHTO T208**

**Stress/Strain Curve - Sample 16-1212R**



Average Initial Diameter (Do): 2.445 in.  
 Average Initial Height (Lo): 5.298 in.  
 Average Initial Area (Ao): 4.695 in<sup>2</sup>  
 In-Situ Moist Unit Weight: 112.9 pcf  
 Failure Mode: \_\_\_\_\_

Sample Volume: 24.875 in<sup>3</sup>  
 Sample Volume: 0.014 ft<sup>3</sup>  
 Moist Sample Weight: 1.63 lbs.  
 In-Situ Dry Unit Weight: 92.3 pcf

Project Name US-21 Bridge Replacement over Harbor River  
 Project Number G5396.00 Date 8/11/2016  
 SCDOT File # P026862 PIN # \_\_\_\_\_  
 Sample/Location SB-1 / NQ-16  
 Depth/Elevation 323.0' - 328.0'

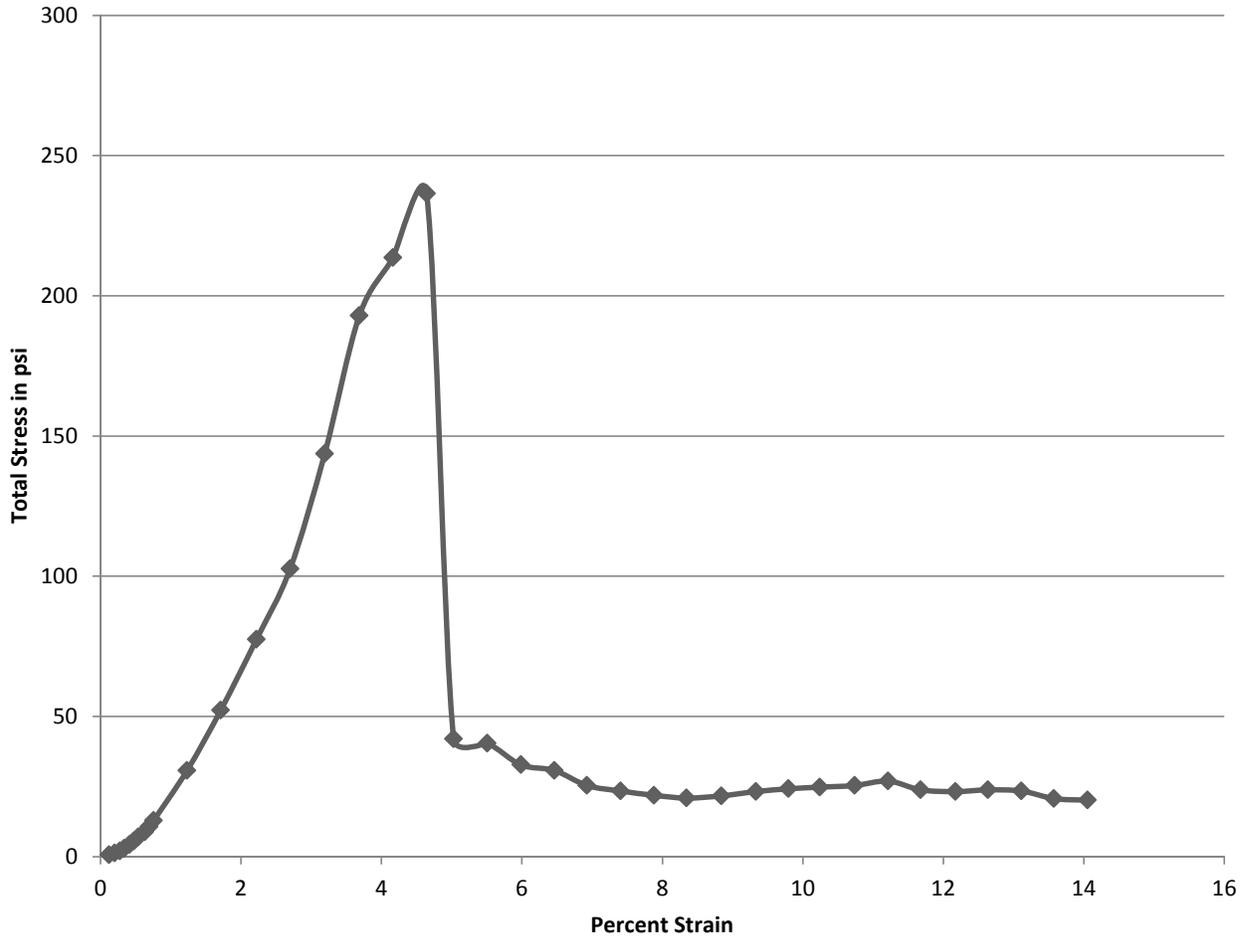
Sample Type : Undisturbed - Shelby Tube  
 Target Strain Rate : 1% per minute  
 Description:  
 PI= \_\_\_\_\_ % Fines=  
 NMC = 22.3% L/D Ratio = 2.17  
 $\sigma_{c-ULT}$  = 85.9  $\epsilon_{ULT}$  = 3.7%



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**UNCONFINED COMPRESSIVE STRENGTH TEST REPORT**  
**ASTM D2166 / AASHTO T208**

**Stress/Strain Curve - Sample 16-1212S**



Average Initial Diameter (Do): 2.416 in.  
 Average Initial Height (Lo): 5.53 in.  
 Average Initial Area (Ao): 4.584 in<sup>2</sup>  
 In-Situ Moist Unit Weight: 121.5 pcf  
 Failure Mode: \_\_\_\_\_

Sample Volume: 25.352 in<sup>3</sup>  
 Sample Volume: 0.0147 ft<sup>3</sup>  
 Moist Sample Weight: 1.78 lbs.  
 In-Situ Dry Unit Weight: 95.9 pcf

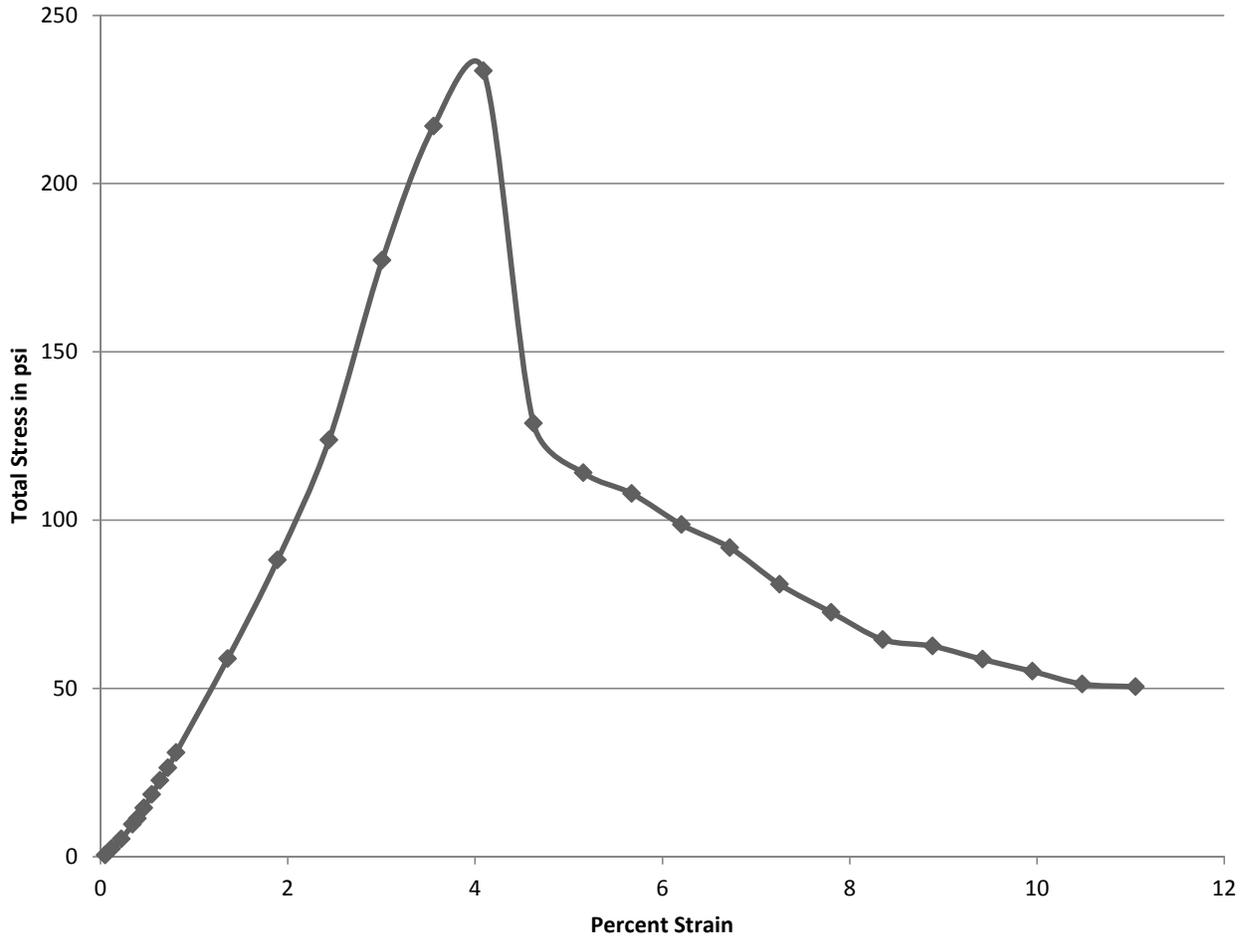
Project Name US-21 Bridge Replacement over Harbor River  
 Project Number G5396.00 Date 8/11/2016  
 SCDOT File # P026862 PIN # \_\_\_\_\_  
 Sample/Location SB-1 / NQ-23  
 Depth/Elevation 358.0' - 363.0'

Sample Type : Undisturbed - Shelby Tube  
 Target Strain Rate : 1% per minute  
 Description:  
 PI= \_\_\_\_\_ % Fines=  
 NMC = 26.8% L/D Ratio = 2.29  
 $\sigma_{c-ULT}$  = 236.4  $\epsilon_{ULT}$  = 4.8%



**UNCONFINED COMPRESSIVE STRENGTH TEST REPORT**  
**ASTM D2166 / AASHTO T208**

**Stress/Strain Curve - Sample 16-1212T**



|                                                        |                                             |
|--------------------------------------------------------|---------------------------------------------|
| Average Initial Diameter (Do): <u>2.391 in.</u>        | Sample Volume: <u>22.284 in<sup>3</sup></u> |
| Average Initial Height (Lo): <u>4.963 in.</u>          | Sample Volume: <u>0.0129 ft<sup>3</sup></u> |
| Average Initial Area (Ao): <u>4.490 in<sup>2</sup></u> | Moist Sample Weight: <u>1.50 lbs.</u>       |
| In-Situ Moist Unit Weight: <u>116.4 pcf</u>            | In-Situ Dry Unit Weight: <u>88.0 pcf</u>    |
| Failure Mode: _____                                    |                                             |

|                 |                                                   |       |                  |
|-----------------|---------------------------------------------------|-------|------------------|
| Project Name    | <u>US-21 Bridge Replacement over Harbor River</u> |       |                  |
| Project Number  | <u>G5396.00</u>                                   | Date  | <u>8/11/2016</u> |
| SCDOT File #    | <u>P026862</u>                                    | PIN # | _____            |
| Sample/Location | <u>SB-1 / NQ-27</u>                               |       |                  |
| Depth/Elevation | <u>381.0' - 385.0'</u>                            |       |                  |

|                                         |                         |
|-----------------------------------------|-------------------------|
| Sample Type : Undisturbed - Shelby Tube |                         |
| Target Strain Rate : 1% per minute      |                         |
| Description:                            |                         |
| PI= _____                               | % Fines= _____          |
| NMC = 32.3%                             | L/D Ratio = 2.08        |
| $\sigma_{c-ULT}$ = 233.5                | $\epsilon_{ULT}$ = 4.1% |

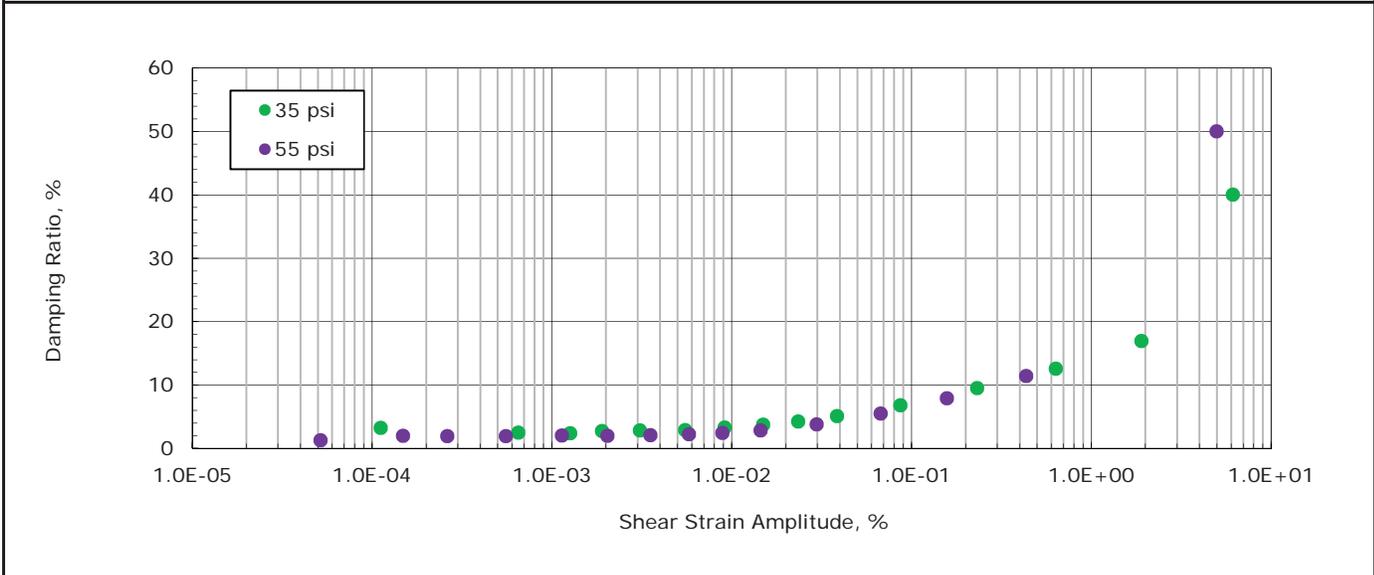
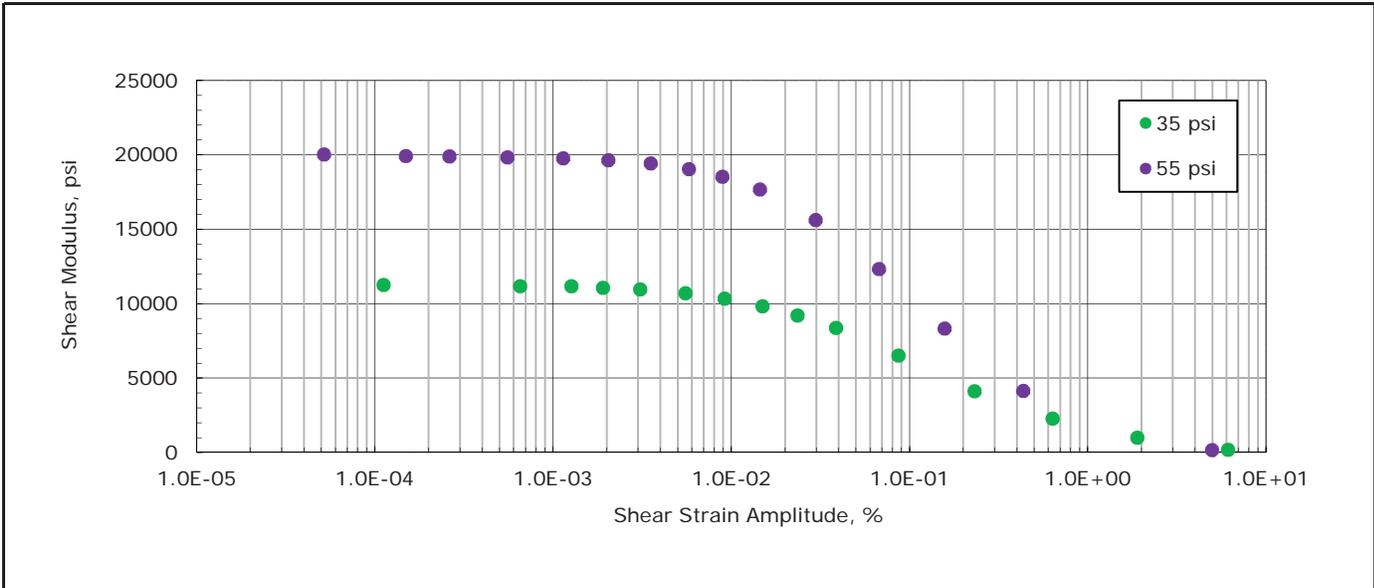






|                                      |                                                                                                             |           |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------|-----------|
| Client:                              | F&ME Consultants                                                                                            |           |
| Project Name:                        | US-21 Replacement Bridge over Harbor River                                                                  |           |
| Project Location:                    | ---                                                                                                         |           |
| GTX #:                               | 305005                                                                                                      |           |
| Test Date:                           | 10/28/16, 11/3/16                                                                                           |           |
| Tested By:                           | sg                                                                                                          |           |
| Checked By:                          | jdt                                                                                                         |           |
| Boring ID:                           | SB-1                                                                                                        |           |
| Sample ID:                           | UD-1                                                                                                        |           |
| Depth, ft:                           | 130.0-133.5                                                                                                 |           |
| <b>Test Confining Pressure, psi:</b> | <b>35</b>                                                                                                   | <b>55</b> |
| Visual Description:                  | Moist, olive sandy silt                                                                                     |           |
| Preparation:                         | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content. |           |

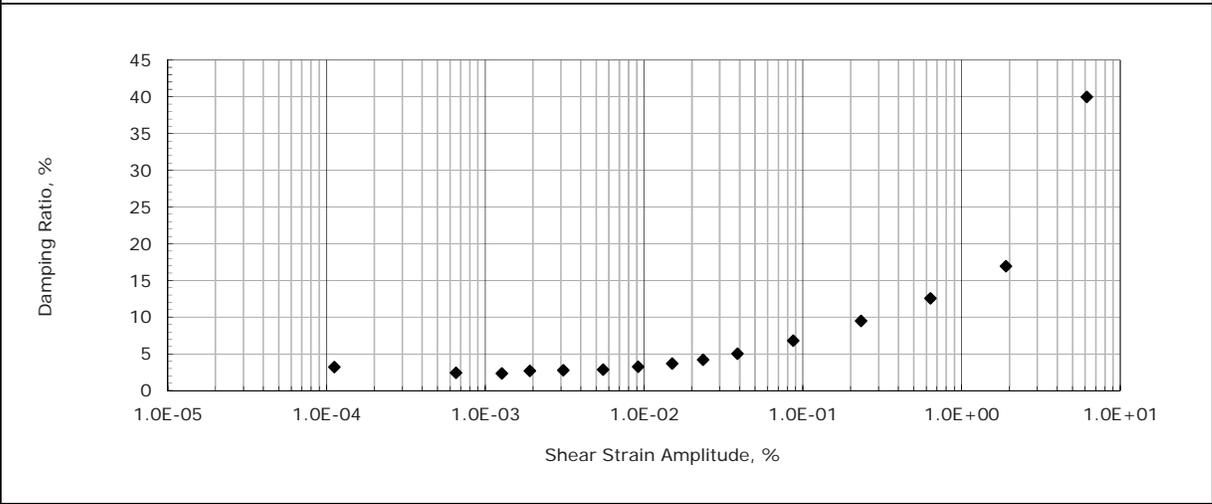
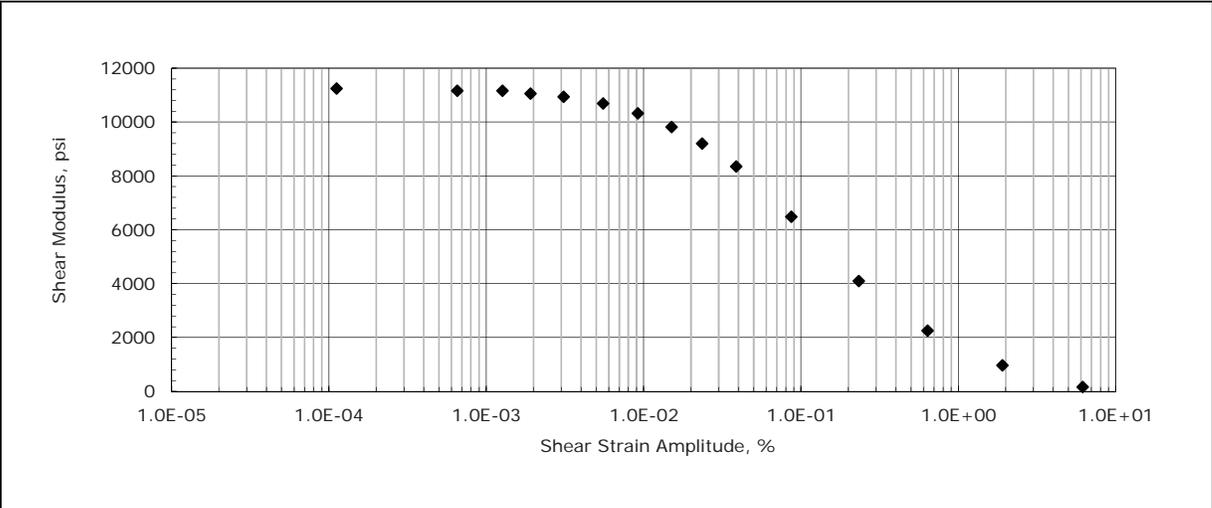
## Modulus and Damping of Soils by Resonant-Column Method by ASTM D4015



Notes: Data from two tests, each at a different confining pressure, plotted together on the same graph.

|                                      |                                                                                                             |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Client:                              | F&ME Consultants                                                                                            |
| Project Name:                        | US-21 Replacement Bridge over Harbor River                                                                  |
| Project Location:                    | ---                                                                                                         |
| GTX #:                               | 305005                                                                                                      |
| Test Date:                           | 11/03/16                                                                                                    |
| Tested By:                           | sg                                                                                                          |
| Checked By:                          | jdt                                                                                                         |
| Boring ID:                           | SB-1                                                                                                        |
| Sample ID:                           | UD-1                                                                                                        |
| Depth, ft:                           | 130.0-133.5                                                                                                 |
| <b>Test Confining Pressure, psi:</b> | <b>35</b>                                                                                                   |
| Visual Description:                  | Moist, olive sandy silt                                                                                     |
| Preparation:                         | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content. |

## Modulus and Damping of Soils by Resonant-Column Method by ASTM D4015



|                               |       |
|-------------------------------|-------|
| Initial Diameter, in:         | 2.49  |
| Initial Height, in:           | 5.00  |
| Initial Mass, grams:          | 699   |
| Initial Moisture Content, %:  | 38.0  |
| Initial Dry Density, pcf:     | 79.3  |
| Initial Bulk Density, pcf:    | 109.4 |
| Initial Degree of Saturation: | 92.2  |
| Initial Void Ratio:           | 1.10  |

|                             |        |
|-----------------------------|--------|
| Final Diameter, in:         | 2.45   |
| Final Height, in:           | 4.90   |
| Final Mass, grams:          | 698.39 |
| Final Moisture Content, %:  | 36.6   |
| Final Dry Density, pcf:     | 83.7   |
| Final Bulk Density, pcf:    | 114.4  |
| Final Degree of Saturation: | 99.1   |
| Final Void Ratio:           | 0.99   |

Notes: Moisture content obtained from sample trimmings  
Isotropic stress conditions



|                                         |                                                                                                               |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Client:                                 | F&ME Consultants                                                                                              |
| Project Name:                           | US-21 Replacement Bridge over Harbor River                                                                    |
| Project Location:                       | ---                                                                                                           |
| GTX #:                                  | 305005                                                                                                        |
| Test Date:                              | 11/03/16                                                                                                      |
| Tested By:                              | sg                                                                                                            |
| Checked By:                             | jdt                                                                                                           |
| Boring ID:                              | SB-1                                                                                                          |
| Sample ID:                              | UD-1                                                                                                          |
| Depth, ft:                              | 130.0-133.5                                                                                                   |
| <b>Test Confining Pressure, psi: 35</b> |                                                                                                               |
| Visual Description:                     | Moist, olive sandy silt                                                                                       |
| Test Conditions:                        | Confining Stress of 35 psi over a range of strains from 0.000112 to 6.15% with a forced sinusoidal vibration. |
| Preparation:                            | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content.   |

**Modulus and Damping of Soils by Resonant-Column Method  
by ASTM D4015**

|                                                                                             |                                                               |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Apparatus Used: Geocomp Corp. quasi-fixed/free boundry condition automated RCTS Test System |                                                               |
| Active Mass, g: 2144.75                                                                     | Torque Calibration Factor, N-m/V: 12.9                        |
| Passive Mass, g: 1053.2                                                                     | Accelerometer Calibration Factor, rad/s <sup>2</sup> /V: 3293 |
| Active Inertia, kg-m <sup>2</sup> : 1.66E-03                                                |                                                               |
| Passive Inertia, kg-m <sup>2</sup> : 0.0012425                                              |                                                               |

| Elapsed Time | Excitation | Frequency | Axial Strain | Volumetric Strain | * Pore Pressure | Effective Confining Stress | Average Strain Amplitude | Shear Modulus, G | Damping Ratio, D |
|--------------|------------|-----------|--------------|-------------------|-----------------|----------------------------|--------------------------|------------------|------------------|
| min          | %          | Hz        | %            | %                 | psi             | psi                        | %                        | psi              | %                |
| 0.31         | 0.040      | 116       | 2.91E-02     | 0.029             | ---             | 35                         | 1.12E-04                 | 1.12E+04         | 3.19             |
| 0.52         | 0.100      | 115       | 2.91E-02     | 0.029             | ---             | 35                         | 6.53E-04                 | 1.12E+04         | 2.43             |
| 0.62         | 0.158      | 115       | 2.91E-02     | 0.029             | ---             | 35                         | 1.27E-03                 | 1.12E+04         | 2.32             |
| 0.73         | 0.251      | 115       | 2.91E-02     | 0.029             | ---             | 35                         | 1.91E-03                 | 1.11E+04         | 2.68             |
| 0.83         | 0.398      | 114       | 2.91E-02     | 0.029             | ---             | 35                         | 3.09E-03                 | 1.09E+04         | 2.77             |
| 0.93         | 0.631      | 113       | 2.91E-02     | 0.029             | ---             | 35                         | 5.53E-03                 | 1.07E+04         | 2.86             |
| 1.04         | 1.000      | 111       | 2.91E-02     | 0.029             | ---             | 35                         | 9.17E-03                 | 1.03E+04         | 3.23             |
| 1.14         | 1.586      | 109       | 2.91E-02     | 0.029             | ---             | 35                         | 1.50E-02                 | 9.81E+03         | 3.68             |
| 1.24         | 2.515      | 106       | 2.91E-02     | 0.029             | ---             | 35                         | 2.35E-02                 | 9.20E+03         | 4.20             |
| 1.35         | 3.989      | 101       | 2.91E-02     | 0.029             | ---             | 35                         | 3.87E-02                 | 8.35E+03         | 5.03             |
| 1.56         | 6.338      | 90        | 2.91E-02     | 0.029             | ---             | 35                         | 8.69E-02                 | 6.49E+03         | 6.77             |
| 1.87         | 10.087     | 72        | 2.91E-02     | 0.029             | ---             | 35                         | 2.33E-01                 | 4.10E+03         | 9.48             |
| 2.18         | 16.021     | 54        | 2.91E-02     | 0.029             | ---             | 35                         | 6.36E-01                 | 2.25E+03         | 12.54            |
| 2.49         | 25.446     | 36        | 2.91E-02     | 0.029             | ---             | 35                         | 1.91E+00                 | 9.70E+02         | 16.91            |
| 2.80         | 40.386     | 20        | 2.91E-02     | 0.029             | ---             | 35                         | 6.15E+00                 | 1.66E+02         | 40.01            |

The Shear Wave Velocity can be determined by the following equation:

$$V_s = \sqrt{G \cdot g / \text{bulk density}}$$

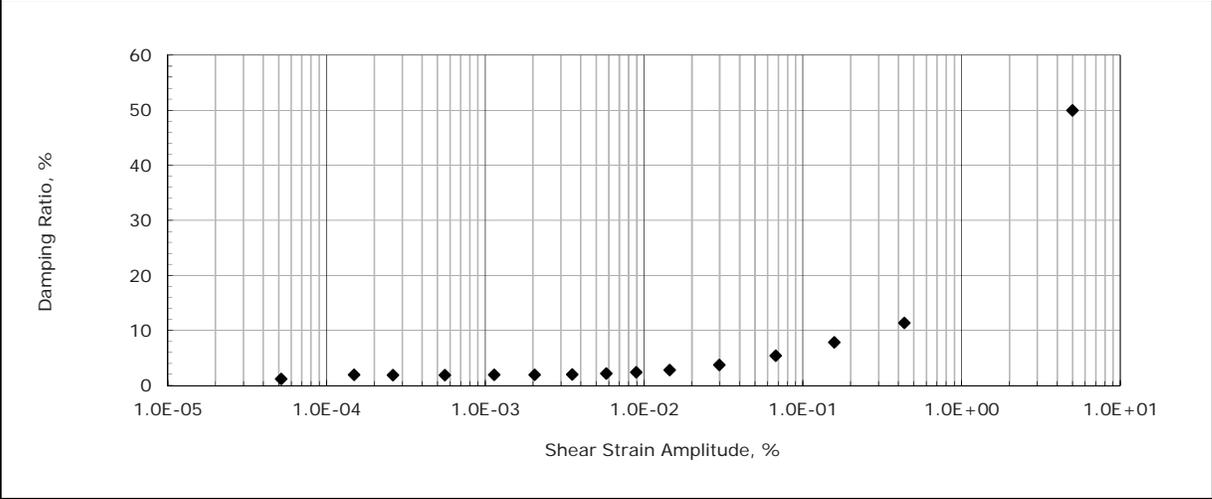
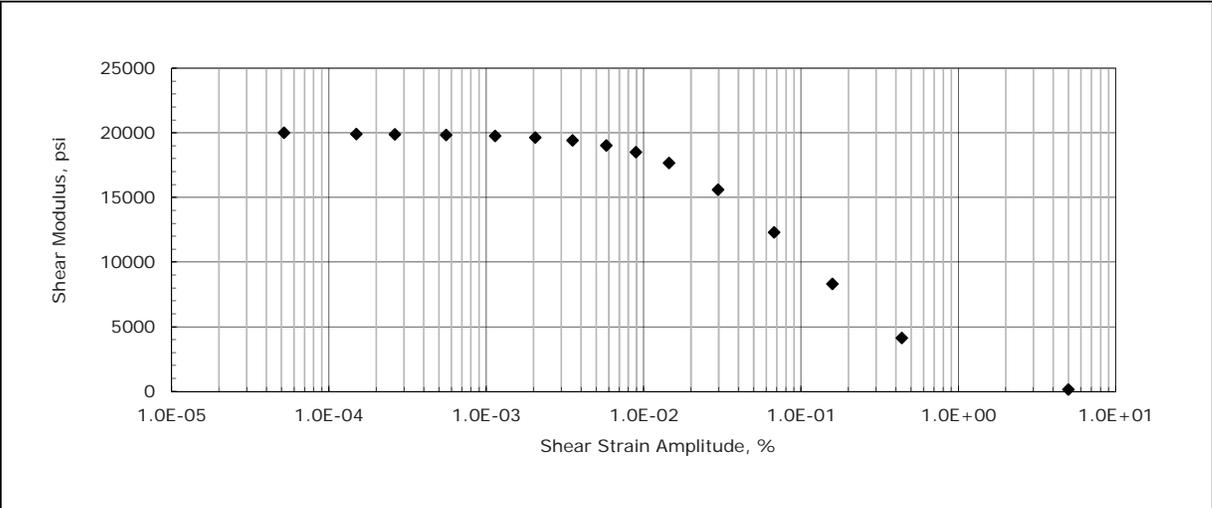
where:  $V_s$  = shear wave velocity  
 $G$  = shear modulus  
 $g$  = acceleration due to gravity, 9.81 m/sec<sup>2</sup>  
 final bulk density

\* Test is run with drainage valve open, but speed of test is such that excess pore pressure could develop, at higher shear strains within specimen.



|                                      |                                                                                                             |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Client:                              | F&ME Consultants                                                                                            |
| Project Name:                        | US-21 Replacement Bridge over Harbor River                                                                  |
| Project Location:                    | ---                                                                                                         |
| GTX #:                               | 305005                                                                                                      |
| Test Date:                           | 10/28/16                                                                                                    |
| Tested By:                           | sg                                                                                                          |
| Checked By:                          | jdt                                                                                                         |
| Boring ID:                           | SB-1                                                                                                        |
| Sample ID:                           | UD-1                                                                                                        |
| Depth, ft:                           | 130.0-133.5                                                                                                 |
| <b>Test Confining Pressure, psi:</b> | <b>55</b>                                                                                                   |
| Visual Description:                  | Moist, olive sandy silt                                                                                     |
| Preparation:                         | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content. |

## Modulus and Damping of Soils by Resonant-Column Method by ASTM D4015



|                               |       |
|-------------------------------|-------|
| Initial Diameter, in:         | 2.85  |
| Initial Height, in:           | 6.00  |
| Initial Mass, grams:          | 1106  |
| Initial Moisture Content, %:  | 40.1  |
| Initial Dry Density, pcf:     | 78.6  |
| Initial Bulk Density, pcf:    | 110.1 |
| Initial Degree of Saturation: | 95.7  |
| Initial Void Ratio:           | 1.12  |

|                             |       |
|-----------------------------|-------|
| Final Diameter, in:         | 2.79  |
| Final Height, in:           | 5.87  |
| Final Mass, grams:          | 1092  |
| Final Moisture Content, %:  | 37.1  |
| Final Dry Density, pcf:     | 83.5  |
| Final Bulk Density, pcf:    | 114.5 |
| Final Degree of Saturation: | 99.9  |
| Final Void Ratio:           | 0.99  |

Notes: Moisture content obtained from sample trimmings  
Isotropic stress conditions



|                                         |                                                                                                                |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Client:                                 | F&ME Consultants                                                                                               |
| Project Name:                           | US-21 Replacement Bridge over Harbor River                                                                     |
| Project Location:                       | ---                                                                                                            |
| GTX #:                                  | 305005                                                                                                         |
| Test Date:                              | 10/28/16                                                                                                       |
| Tested By:                              | sg                                                                                                             |
| Checked By:                             | jdt                                                                                                            |
| Boring ID:                              | SB-1                                                                                                           |
| Sample ID:                              | UD-1                                                                                                           |
| Depth, ft:                              | 130.0-133.5                                                                                                    |
| <b>Test Confining Pressure, psi: 55</b> |                                                                                                                |
| Visual Description:                     | Moist, olive sandy silt                                                                                        |
| Test Conditions:                        | Confining Stress of 55 psi over a range of strains from 0.0000519 to 4.99% with a forced sinusoidal vibration. |
| Preparation:                            | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content.    |

**Modulus and Damping of Soils by Resonant-Column Method  
by ASTM D4015**

|                                                                                             |                                                               |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Apparatus Used: Geocomp Corp. quasi-fixed/free boundry condition automated RCTS Test System |                                                               |
| Active Mass, g: 2144.75                                                                     | Torque Calibration Factor, N-m/V: 12.9                        |
| Passive Mass, g: 1053.2                                                                     | Accelerometer Calibration Factor, rad/s <sup>2</sup> /V: 3293 |
| Active Inertia, kg-m <sup>2</sup> : 1.66E-03                                                |                                                               |
| Passive Inertia, kg-m <sup>2</sup> : 0.0012425                                              |                                                               |

| Elapsed Time | Excitation | Frequency | Axial Strain | Volumetric Strain | * Pore Pressure | Effective Confining Stress | Average Strain Amplitude | Shear Modulus, G | Damping Ratio, D |
|--------------|------------|-----------|--------------|-------------------|-----------------|----------------------------|--------------------------|------------------|------------------|
| min          | %          | Hz        | %            | %                 | psi             | psi                        | %                        | psi              | %                |
| 0.31         | 0.039      | 172       | 4.35E-02     | 0.043             | ---             | 54                         | 5.19E-05                 | 2.00E+04         | 1.22             |
| 0.52         | 0.098      | 172       | 4.35E-02     | 0.043             | ---             | 54                         | 1.49E-04                 | 1.99E+04         | 1.95             |
| 0.62         | 0.156      | 172       | 4.35E-02     | 0.043             | ---             | 54                         | 2.62E-04                 | 1.99E+04         | 1.91             |
| 0.73         | 0.247      | 171       | 4.35E-02     | 0.043             | ---             | 54                         | 5.55E-04                 | 1.98E+04         | 1.89             |
| 0.83         | 0.392      | 171       | 4.35E-02     | 0.043             | ---             | 54                         | 1.14E-03                 | 1.98E+04         | 1.97             |
| 0.93         | 0.621      | 171       | 4.35E-02     | 0.043             | ---             | 54                         | 2.05E-03                 | 1.96E+04         | 1.93             |
| 1.04         | 0.983      | 170       | 4.35E-02     | 0.043             | ---             | 54                         | 3.53E-03                 | 1.94E+04         | 2.02             |
| 1.14         | 1.558      | 168       | 4.35E-02     | 0.043             | ---             | 54                         | 5.79E-03                 | 1.90E+04         | 2.17             |
| 1.24         | 2.470      | 166       | 4.35E-02     | 0.043             | ---             | 54                         | 8.91E-03                 | 1.85E+04         | 2.41             |
| 1.35         | 3.919      | 163       | 4.35E-02     | 0.043             | ---             | 54                         | 1.45E-02                 | 1.77E+04         | 2.81             |
| 1.56         | 6.230      | 154       | 4.35E-02     | 0.043             | ---             | 54                         | 2.98E-02                 | 1.56E+04         | 3.75             |
| 1.87         | 9.925      | 137       | 4.35E-02     | 0.043             | ---             | 54                         | 6.75E-02                 | 1.23E+04         | 5.44             |
| 2.28         | 15.835     | 114       | 4.35E-02     | 0.043             | ---             | 54                         | 1.58E-01                 | 8.31E+03         | 7.87             |
| 2.80         | 25.282     | 81        | 4.35E-02     | 0.043             | ---             | 54                         | 4.36E-01                 | 4.13E+03         | 11.39            |
| 3.52         | 40.388     | 20        | 4.35E-02     | 0.043             | ---             | 54                         | 4.99E+00                 | 1.38E+02         | 49.99            |

The Shear Wave Velocity can be determined by the following equation:

$$V_s = \sqrt{G \cdot g / \text{bulk density}}$$

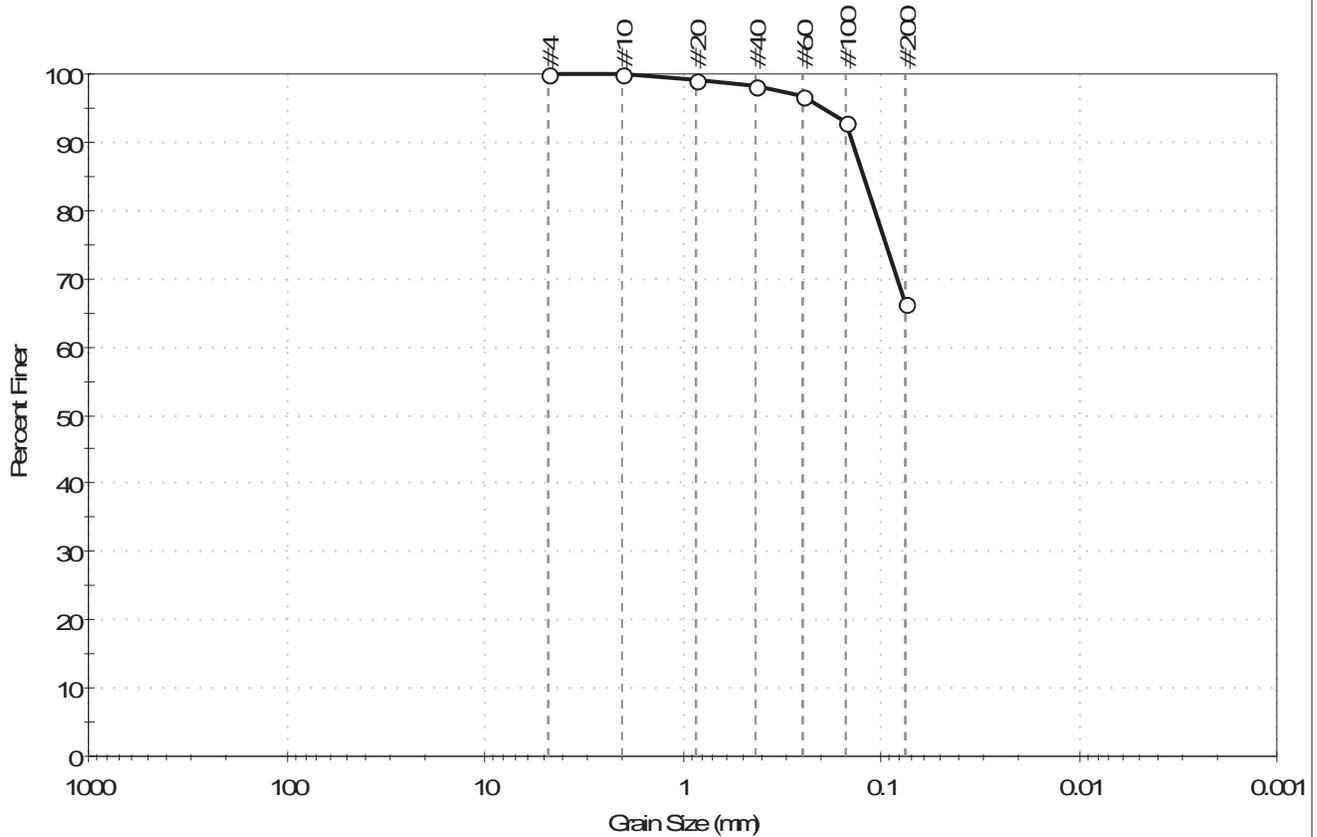
where:  $V_s$  = shear wave velocity  
 $G$  = shear modulus  
 $g$  = acceleration due to gravity, 9.81 m/sec<sup>2</sup>  
final bulk density

\* Test is run with drainage valve open, but speed of test is such that excess pore pressure could develop, at higher shear strains within specimen.



|                     |                                            |              |             |             |     |
|---------------------|--------------------------------------------|--------------|-------------|-------------|-----|
| Client:             | F&ME Consultants                           |              | Project No: | GTX-305005  |     |
| Project:            | US-21 Replacement Bridge over Harbor River |              |             |             |     |
| Location:           | ---                                        |              | Tested By:  | GA          |     |
| Boring ID:          | SB-1                                       | Sample Type: | tube        | Checked By: | mcm |
| Sample ID:          | UD-1                                       | Test Date:   | 11/04/16    |             |     |
| Depth:              | 130.0-133.5 ft                             | Test Id:     | 397424      |             |     |
| Test Comment:       | ---                                        |              |             |             |     |
| Visual Description: | Moist, olive sandy silt                    |              |             |             |     |
| Sample Comment:     | ---                                        |              |             |             |     |

## Particle Size Analysis - ASTM D422



|         |         |       |                   |
|---------|---------|-------|-------------------|
| %Cobble | %Gravel | %Sand | %Silt & Clay Size |
| —       | 0.0     | 33.7  | 66.3              |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 100           |               |          |
| #20        | 0.85           | 99            |               |          |
| #40        | 0.425          | 98            |               |          |
| #60        | 0.25           | 97            |               |          |
| #100       | 0.15           | 93            |               |          |
| #200       | 0.075          | 66            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.1220 mm | 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  |

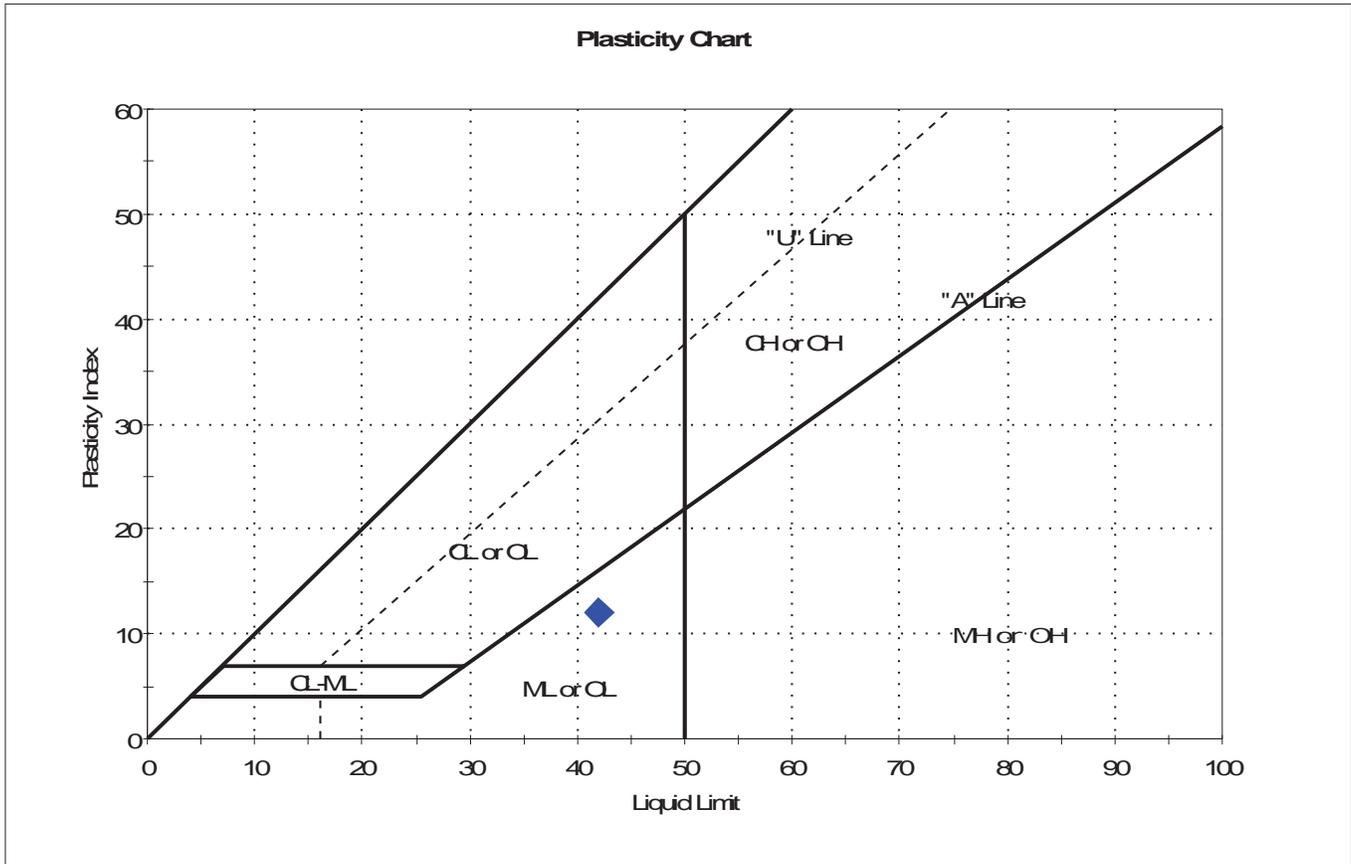
| <u>Classification</u> |                          |
|-----------------------|--------------------------|
| <u>ASTM</u>           | Sandy Silt (ML)          |
| <u>AASHTO</u>         | Clayey Soils (A-7-5 (8)) |

| <u>Sample/Test Description</u>   |
|----------------------------------|
| Sand/Gravel Particle Shape : --- |
| Sand/Gravel Hardness : ---       |



|                     |                                            |              |             |             |     |
|---------------------|--------------------------------------------|--------------|-------------|-------------|-----|
| Client:             | F&ME Consultants                           |              | Project No: | GTX-305005  |     |
| Project:            | US-21 Replacement Bridge over Harbor River |              |             |             |     |
| Location:           | ---                                        | Sample Type: | tube        | Tested By:  | GA  |
| Boring ID:          | SB-1                                       | Test Date:   | 11/04/16    | Checked By: | mcm |
| Sample ID:          | UD-1                                       | Test Id:     | 397422      |             |     |
| Depth :             | 130.0-133.5 ft                             |              |             |             |     |
| Test Comment:       | ---                                        |              |             |             |     |
| Visual Description: | Moist, olive sandy silt                    |              |             |             |     |
| Sample Comment:     | ---                                        |              |             |             |     |

## Atterberg Limits - ASTM D4318



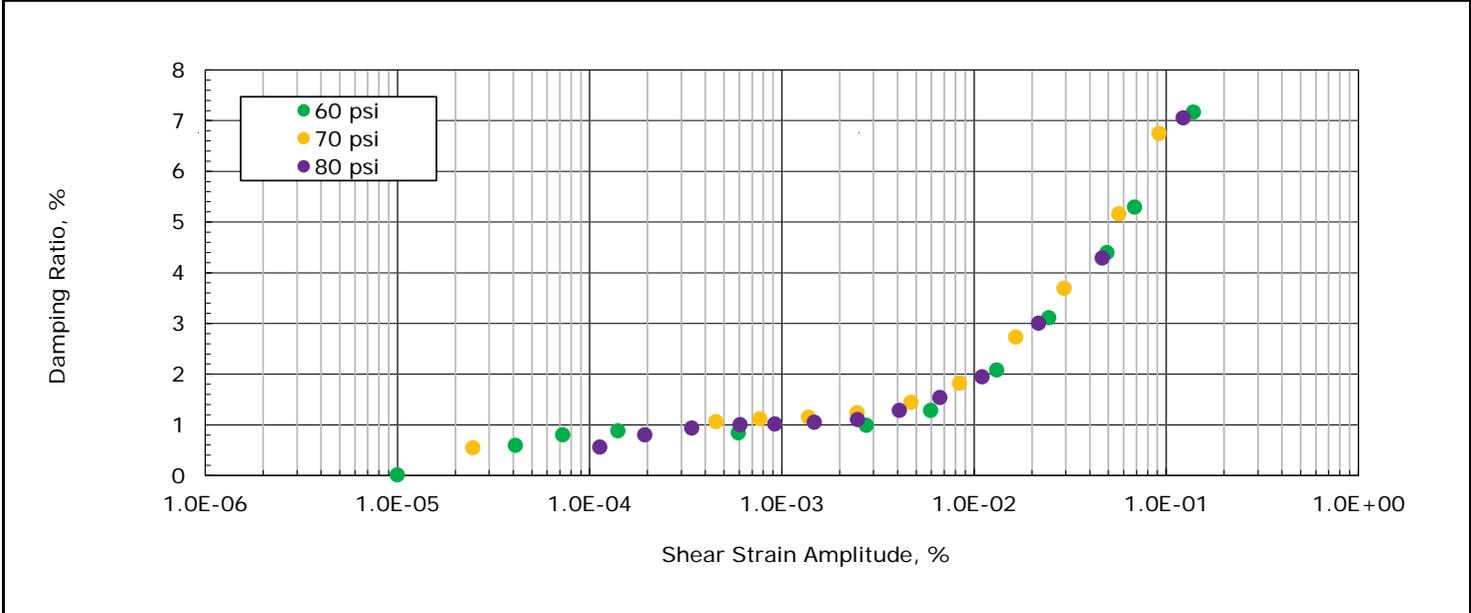
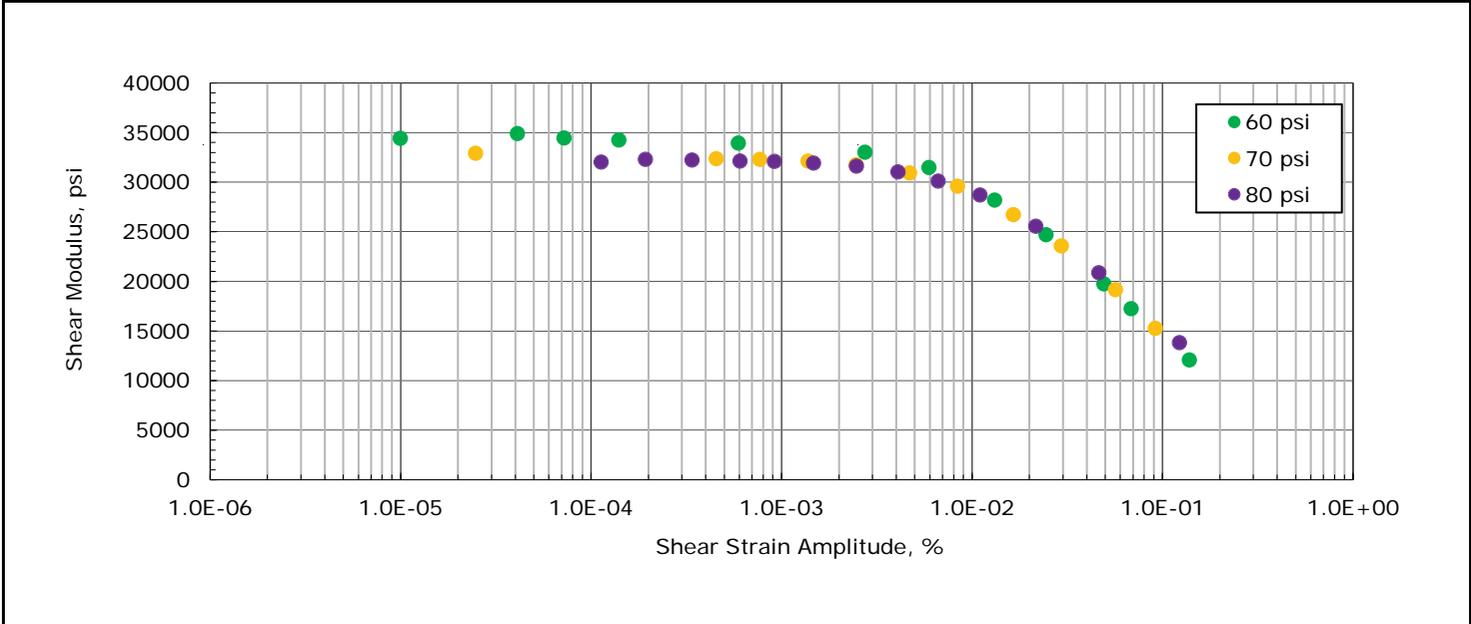
| Symbol | Sample ID | Boring | Depth         | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification |
|--------|-----------|--------|---------------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | UD-1      | SB-1   | 30.0-133.5 ft | 38                          | 42           | 30            | 12               | 0.6             | Sandy Silt (ML)     |

Sample Prepared using the WET method  
 2% Retained on #40 Sieve  
 Dry Strength: HIGH  
 Dilatancy: SLOW  
 Toughness: LOW



|                                      |                                                                                                             |           |           |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------|-----------|-----------|
| Client:                              | F&ME Consultants                                                                                            |           |           |
| Project Name:                        | US-21 Replacement Bridge over Harbor River                                                                  |           |           |
| Project Location:                    | ---                                                                                                         |           |           |
| GTX #:                               | 305005                                                                                                      |           |           |
| Test Date:                           | 10/18/16, 10/19/16, 10/25/16                                                                                |           |           |
| Tested By:                           | njh                                                                                                         |           |           |
| Checked By:                          | jdt                                                                                                         |           |           |
| Boring ID:                           | SB-1                                                                                                        |           |           |
| Sample ID:                           | UD-4                                                                                                        |           |           |
| Depth, ft:                           | 200.0-203.0                                                                                                 |           |           |
| <b>Test Confining Pressure, psi:</b> | <b>60</b>                                                                                                   | <b>70</b> | <b>80</b> |
| Visual Description:                  | Moist, olive gray silty clay                                                                                |           |           |
| Preparation:                         | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content. |           |           |

## Modulus and Damping of Soils by Resonant-Column Method by ASTM D4015



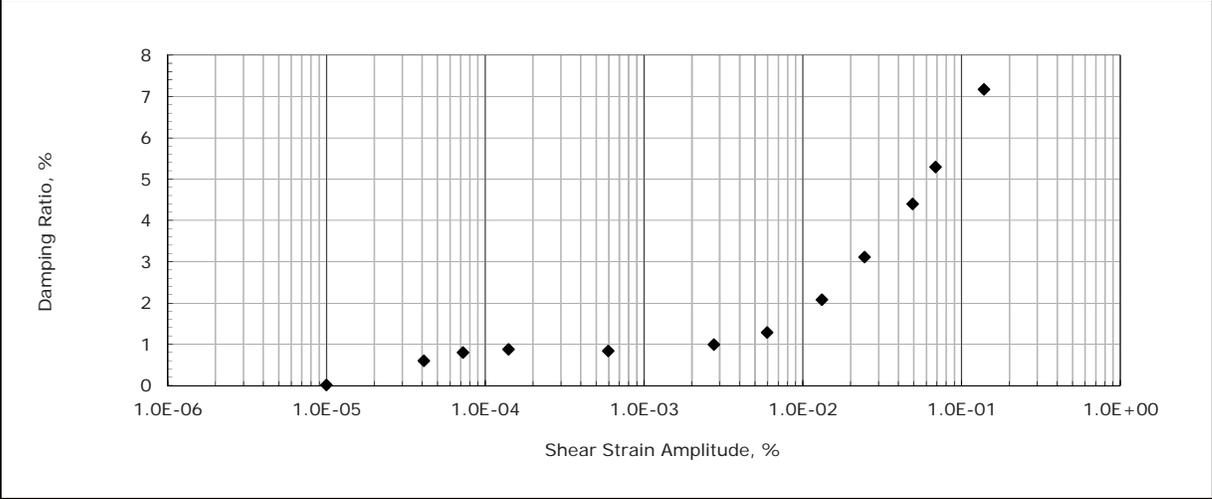
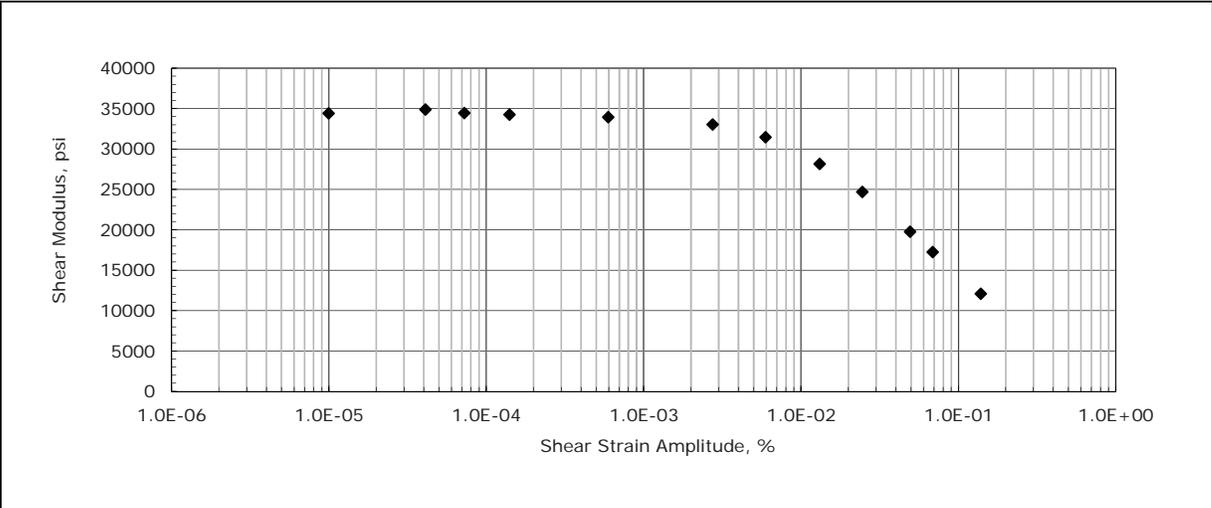
Notes: Data from three tests, each at a different confining pressure, plotted together on the same graph.





|                                      |                                                                                                             |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Client:                              | F&ME Consultants                                                                                            |
| Project Name:                        | US-21 Replacement Bridge over Harbor River                                                                  |
| Project Location:                    | ---                                                                                                         |
| GTX #:                               | 305005                                                                                                      |
| Test Date:                           | 10/18/16                                                                                                    |
| Tested By:                           | njh                                                                                                         |
| Checked By:                          | jdt                                                                                                         |
| Boring ID:                           | SB-1                                                                                                        |
| Sample ID:                           | UD4                                                                                                         |
| Depth, ft:                           | 200.0-203.0                                                                                                 |
| <b>Test Confining Pressure, psi:</b> | <b>60</b>                                                                                                   |
| Visual Description:                  | Moist, olive gray clay                                                                                      |
| Preparation:                         | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content. |

## Modulus and Damping of Soils by Resonant-Column Method by ASTM D4015



|                               |       |
|-------------------------------|-------|
| Initial Diameter, in:         | 2.83  |
| Initial Height, in:           | 5.80  |
| Initial Mass, grams:          | 1110  |
| Initial Moisture Content, %:  | 31.7  |
| Initial Dry Density, pcf:     | 88.0  |
| Initial Bulk Density, pcf:    | 115.9 |
| Initial Degree of Saturation: | 95.1  |
| Initial Void Ratio:           | 0.89  |

|                             |       |
|-----------------------------|-------|
| Final Diameter, in:         | 2.81  |
| Final Height, in:           | 5.73  |
| Final Mass, grams:          | 1095  |
| Final Moisture Content, %:  | 27.4  |
| Final Dry Density, pcf:     | 90.3  |
| Final Bulk Density, pcf:    | 115.0 |
| Final Degree of Saturation: | 86.7  |
| Final Void Ratio:           | 0.84  |

Notes: Moisture content obtained from sample trimmings  
Isotropic stress conditions



|                                         |                                                                                                                 |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Client:                                 | F&ME Consultants                                                                                                |
| Project Name:                           | US-21 Replacement Bridge over Harbor River                                                                      |
| Project Location:                       | ---                                                                                                             |
| GTX #:                                  | 305005                                                                                                          |
| Test Date:                              | 10/18/16                                                                                                        |
| Tested By:                              | njh                                                                                                             |
| Checked By:                             | jdt                                                                                                             |
| Boring ID:                              | SB-1                                                                                                            |
| Sample ID:                              | UD4                                                                                                             |
| Depth, ft:                              | 200.0-203.0                                                                                                     |
| <b>Test Confining Pressure, psi: 60</b> |                                                                                                                 |
| Visual Description:                     | Moist, olive gray clay                                                                                          |
| Test Conditions:                        | Confining Stress of 60 psi over a range of strains from 0.00000997 to 7.17% with a forced sinusoidal vibration. |
| Preparation:                            | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content.     |

**Modulus and Damping of Soils by Resonant-Column Method  
by ASTM D4015**

|                                                                                             |                                                               |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Apparatus Used: Geocomp Corp. quasi-fixed/free boundry condition automated RCTS Test System |                                                               |
| Active Mass, g: 2144.75                                                                     | Torque Calibration Factor, N-m/V: 12.9                        |
| Passive Mass, g: 1053.2                                                                     | Accelerometer Calibration Factor, rad/s <sup>2</sup> /V: 3293 |
| Active Inertia, kg-m <sup>2</sup> : 1.66E-03                                                |                                                               |
| Passive Inertia, kg-m <sup>2</sup> : 0.0012425                                              |                                                               |

| Elapsed Time | Excitation | Frequency | Axial Strain | Volumetric Strain | * Pore Pressure | Effective Confining Stress | Average Strain Amplitude | Shear Modulus, G | Damping Ratio, D |
|--------------|------------|-----------|--------------|-------------------|-----------------|----------------------------|--------------------------|------------------|------------------|
| min          | %          | Hz        | %            | %                 | psi             | psi                        | %                        | psi              | %                |
| 1.97         | 0.153      | 225       | 4.13E-02     | 0.041             | ---             | 60                         | 9.97E-06                 | 3.44E+04         | 0.01             |
| 2.38         | 0.963      | 226       | 4.13E-02     | 0.041             | ---             | 60                         | 4.10E-05                 | 3.49E+04         | 0.60             |
| 2.49         | 1.525      | 225       | 4.13E-02     | 0.041             | ---             | 60                         | 7.23E-05                 | 3.44E+04         | 0.80             |
| 2.59         | 2.418      | 225       | 4.13E-02     | 0.041             | ---             | 60                         | 1.40E-04                 | 3.43E+04         | 0.88             |
| 2.69         | 3.833      | 224       | 4.13E-02     | 0.041             | ---             | 60                         | 5.94E-04                 | 3.39E+04         | 0.84             |
| 2.80         | 6.078      | 221       | 4.13E-02     | 0.041             | ---             | 60                         | 2.75E-03                 | 3.30E+04         | 0.99             |
| 2.90         | 9.643      | 217       | 4.13E-02     | 0.041             | ---             | 60                         | 5.96E-03                 | 3.15E+04         | 1.28             |
| 3.11         | 15.359     | 206       | 4.13E-02     | 0.041             | ---             | 60                         | 1.32E-02                 | 2.82E+04         | 2.08             |
| 3.31         | 24.442     | 194       | 4.13E-02     | 0.041             | ---             | 60                         | 2.45E-02                 | 2.47E+04         | 3.11             |
| 3.62         | 39.145     | 175       | 4.13E-02     | 0.041             | ---             | 60                         | 4.92E-02                 | 1.97E+04         | 4.39             |
| 3.83         | 62.122     | 165       | 4.13E-02     | 0.041             | ---             | 60                         | 6.85E-02                 | 1.72E+04         | 5.29             |
| 4.25         | 99.226     | 139       | 4.13E-02     | 0.041             | ---             | 60                         | 1.38E-01                 | 1.21E+04         | 7.17             |

The Shear Wave Velocity can be determined by the following equation:

$$V_s = \sqrt{G \cdot g / \text{bulk density}}$$

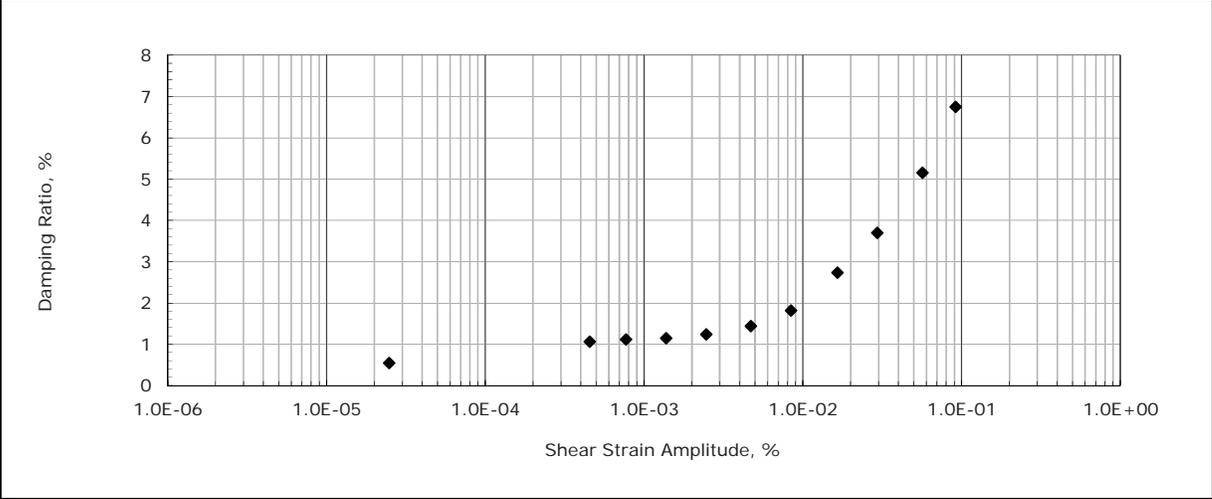
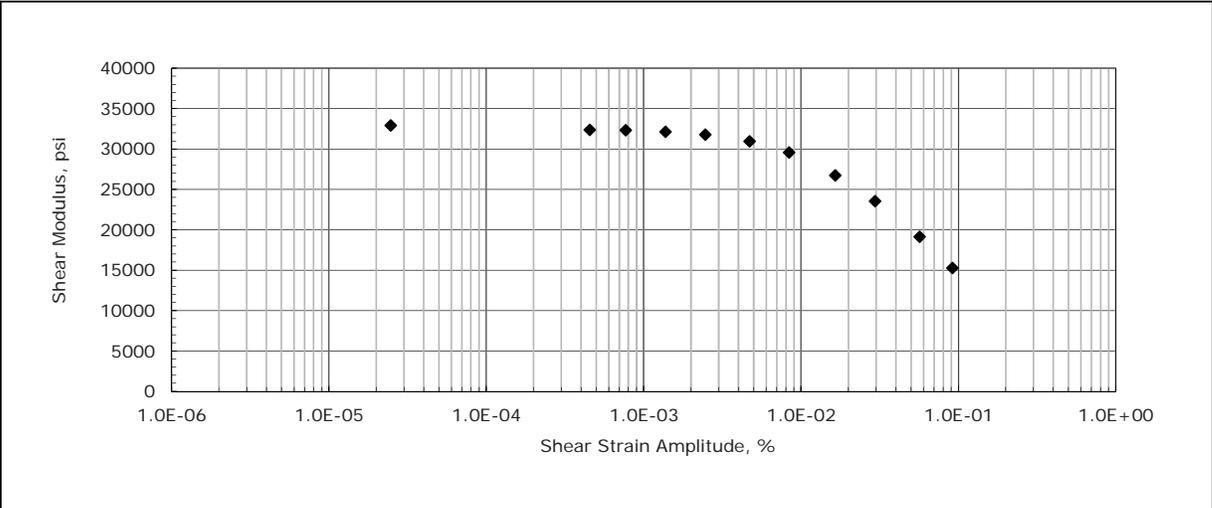
where:  $V_s$  = shear wave velocity  
 $G$  = shear modulus  
 $g$  = acceleration due to gravity, 9.81 m/sec<sup>2</sup>  
 final bulk density

\* Test is run with drainage valve open, but speed of test is such that excess pore pressure could develop, at higher shear strains within specimen.



|                                      |                                                                                                             |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Client:                              | F&ME Consultants                                                                                            |
| Project Name:                        | US-21 Replacement Bridge over Harbor River                                                                  |
| Project Location:                    | ---                                                                                                         |
| GTX #:                               | 305005                                                                                                      |
| Test Date:                           | 10/18/16                                                                                                    |
| Tested By:                           | njh                                                                                                         |
| Checked By:                          | jdt                                                                                                         |
| Boring ID:                           | SB-1                                                                                                        |
| Sample ID:                           | UD4                                                                                                         |
| Depth, ft:                           | 200.0-203.0                                                                                                 |
| <b>Test Confining Pressure, psi:</b> | <b>70</b>                                                                                                   |
| Visual Description:                  | Moist, olive gray silty clay                                                                                |
| Preparation:                         | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content. |

## Modulus and Damping of Soils by Resonant-Column Method by ASTM D4015



|                               |       |
|-------------------------------|-------|
| Initial Diameter, in:         | 2.84  |
| Initial Height, in:           | 5.89  |
| Initial Mass, grams:          | 1132  |
| Initial Moisture Content, %:  | 31.5  |
| Initial Dry Density, pcf:     | 87.9  |
| Initial Bulk Density, pcf:    | 115.6 |
| Initial Degree of Saturation: | 94.2  |
| Initial Void Ratio:           | 0.89  |

|                             |       |
|-----------------------------|-------|
| Final Diameter, in:         | 2.81  |
| Final Height, in:           | 5.78  |
| Final Mass, grams:          | 1122  |
| Final Moisture Content, %:  | 30.1  |
| Final Dry Density, pcf:     | 91.5  |
| Final Bulk Density, pcf:    | 119.1 |
| Final Degree of Saturation: | 98.3  |
| Final Void Ratio:           | 0.82  |

Notes: Moisture content obtained from sample trimmings  
Isotropic stress conditions



|                                         |                                                                                                                |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Client:                                 | F&ME Consultants                                                                                               |
| Project Name:                           | US-21 Replacement Bridge over Harbor River                                                                     |
| Project Location:                       | ---                                                                                                            |
| GTX #:                                  | 305005                                                                                                         |
| Test Date:                              | 10/18/16                                                                                                       |
| Tested By:                              | njh                                                                                                            |
| Checked By:                             | jdt                                                                                                            |
| Boring ID:                              | SB-1                                                                                                           |
| Sample ID:                              | UD4                                                                                                            |
| Depth, ft:                              | 200.0-203.0                                                                                                    |
| <b>Test Confining Pressure, psi: 70</b> |                                                                                                                |
| Visual Description:                     | Moist, olive gray silty clay                                                                                   |
| Test Conditions:                        | Confining Stress of 70 psi over a range of strains from 0.0000247 to 6.74% with a forced sinusoidal vibration. |
| Preparation:                            | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content.    |

**Modulus and Damping of Soils by Resonant-Column Method  
by ASTM D4015**

|                                                                                             |                                                               |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Apparatus Used: Geocomp Corp. quasi-fixed/free boundry condition automated RCTS Test System |                                                               |
| Active Mass, g: 2144.75                                                                     | Torque Calibration Factor, N-m/V: 12.9                        |
| Passive Mass, g: 1053.2                                                                     | Accelerometer Calibration Factor, rad/s <sup>2</sup> /V: 3293 |
| Active Inertia, kg-m <sup>2</sup> : 1.66E-03                                                |                                                               |
| Passive Inertia, kg-m <sup>2</sup> : 0.0012425                                              |                                                               |

| Elapsed Time | Excitation | Frequency | Axial Strain | Volumetric Strain | * Pore Pressure | Effective Confining Stress | Average Strain Amplitude | Shear Modulus, G | Damping Ratio, D |
|--------------|------------|-----------|--------------|-------------------|-----------------|----------------------------|--------------------------|------------------|------------------|
| min          | %          | Hz        | %            | %                 | psi             | psi                        | %                        | psi              | %                |
| 0.73         | 0.243      | 219       | 4.41E-02     | 0.044             | ---             | 70                         | 2.47E-05                 | 3.29E+04         | 0.55             |
| 1.14         | 1.530      | 218       | 4.41E-02     | 0.044             | ---             | 70                         | 4.54E-04                 | 3.24E+04         | 1.06             |
| 1.24         | 2.424      | 218       | 4.41E-02     | 0.044             | ---             | 70                         | 7.70E-04                 | 3.23E+04         | 1.12             |
| 1.35         | 3.842      | 218       | 4.41E-02     | 0.044             | ---             | 70                         | 1.38E-03                 | 3.21E+04         | 1.15             |
| 1.45         | 6.091      | 217       | 4.41E-02     | 0.044             | ---             | 70                         | 2.47E-03                 | 3.18E+04         | 1.24             |
| 1.56         | 9.657      | 214       | 4.41E-02     | 0.044             | ---             | 70                         | 4.70E-03                 | 3.09E+04         | 1.44             |
| 1.66         | 15.321     | 210       | 4.41E-02     | 0.044             | ---             | 70                         | 8.40E-03                 | 2.96E+04         | 1.82             |
| 1.87         | 24.378     | 201       | 4.41E-02     | 0.044             | ---             | 70                         | 1.65E-02                 | 2.67E+04         | 2.73             |
| 2.07         | 38.803     | 190       | 4.41E-02     | 0.044             | ---             | 70                         | 2.95E-02                 | 2.36E+04         | 3.69             |
| 2.38         | 61.938     | 172       | 4.41E-02     | 0.044             | ---             | 70                         | 5.67E-02                 | 1.91E+04         | 5.16             |
| 2.69         | 98.715     | 155       | 4.41E-02     | 0.044             | ---             | 70                         | 9.18E-02                 | 1.53E+04         | 6.74             |

The Shear Wave Velocity can be determined by the following equation:

$$V_s = \sqrt{G \cdot g / \text{bulk density}}$$

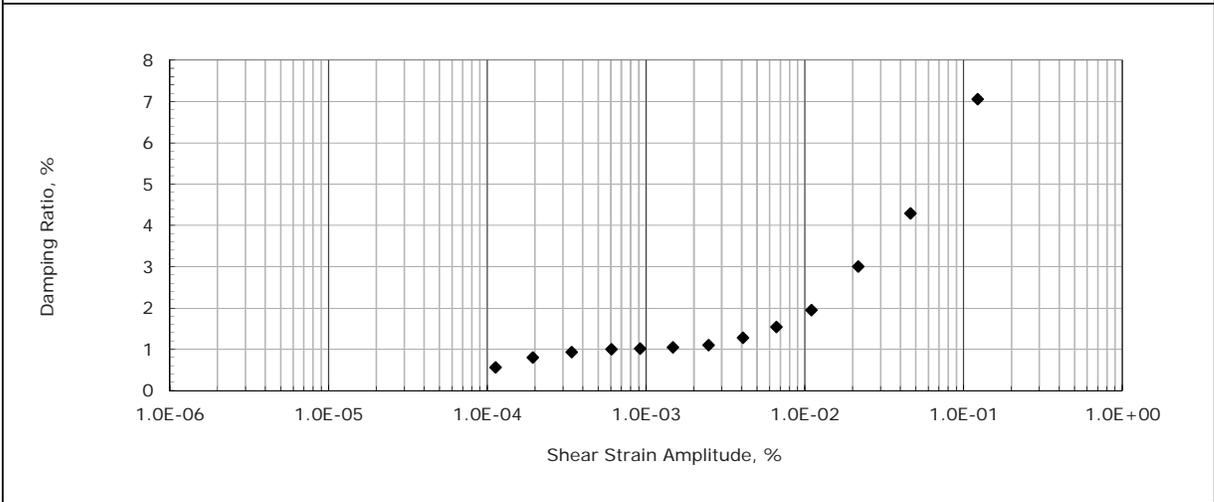
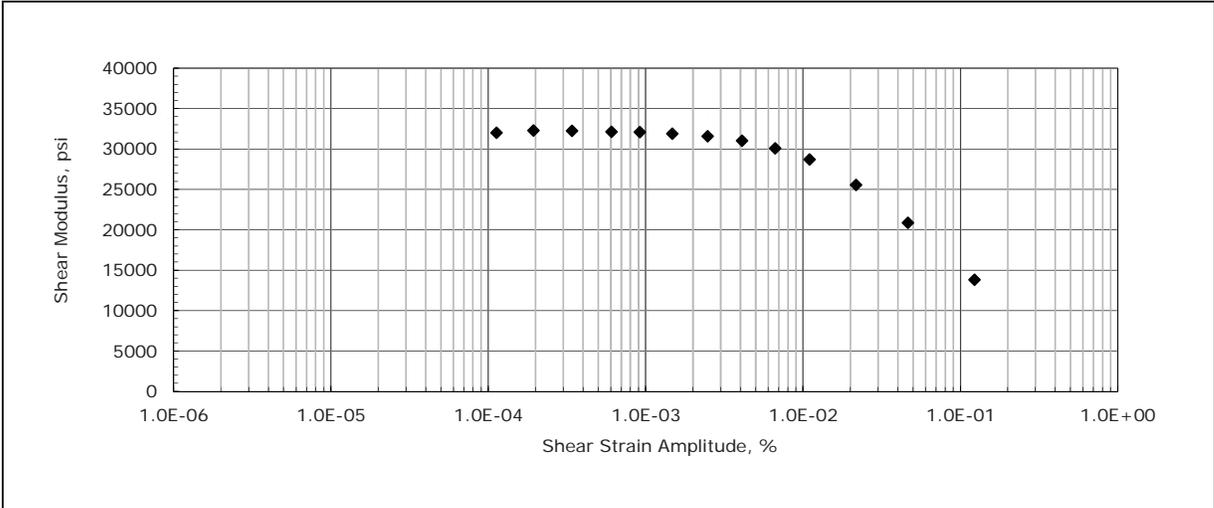
where:  $V_s$  = shear wave velocity  
 $G$  = shear modulus  
 $g$  = acceleration due to gravity, 9.81 m/sec<sup>2</sup>  
 final bulk density

\* Test is run with drainage valve open, but speed of test is such that excess pore pressure could develop, at higher shear strains within specimen.



|                                      |                                                                                                             |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Client:                              | F&ME Consultants                                                                                            |
| Project Name:                        | US-21 Replacement Bridge over Harbor River                                                                  |
| Project Location:                    | ---                                                                                                         |
| GTX #:                               | 305005                                                                                                      |
| Test Date:                           | 10/18/16                                                                                                    |
| Tested By:                           | njh                                                                                                         |
| Checked By:                          | jdt                                                                                                         |
| Boring ID:                           | SB-1                                                                                                        |
| Sample ID:                           | UD4                                                                                                         |
| Depth, ft:                           | 200.0-203.0                                                                                                 |
| <b>Test Confining Pressure, psi:</b> | <b>80</b>                                                                                                   |
| Visual Description:                  | Moist, olive gray silty clay                                                                                |
| Preparation:                         | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content. |

## Modulus and Damping of Soils by Resonant-Column Method by ASTM D4015



|                               |       |
|-------------------------------|-------|
| Initial Diameter, in:         | 2.83  |
| Initial Height, in:           | 5.99  |
| Initial Mass, grams:          | 1130  |
| Initial Moisture Content, %:  | 31.7  |
| Initial Dry Density, pcf:     | 86.8  |
| Initial Bulk Density, pcf:    | 114.3 |
| Initial Degree of Saturation: | 92.1  |
| Initial Void Ratio:           | 0.92  |

|                             |       |
|-----------------------------|-------|
| Final Diameter, in:         | 2.79  |
| Final Height, in:           | 5.85  |
| Final Mass, grams:          | 1113  |
| Final Moisture Content, %:  | 30.6  |
| Final Dry Density, pcf:     | 91.3  |
| Final Bulk Density, pcf:    | 119.3 |
| Final Degree of Saturation: | 99.5  |
| Final Void Ratio:           | 0.82  |

Notes: Moisture content obtained from sample trimmings  
Isotropic stress conditions



|                                         |                                                                                                               |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Client:                                 | F&ME Consultants                                                                                              |
| Project Name:                           | US-21 Replacement Bridge over Harbor River                                                                    |
| Project Location:                       | ---                                                                                                           |
| GTX #:                                  | 305005                                                                                                        |
| Test Date:                              | 10/18/16                                                                                                      |
| Tested By:                              | njh                                                                                                           |
| Checked By:                             | jdt                                                                                                           |
| Boring ID:                              | SB-1                                                                                                          |
| Sample ID:                              | UD4                                                                                                           |
| Depth, ft:                              | 200.0-203.0                                                                                                   |
| <b>Test Confining Pressure, psi: 80</b> |                                                                                                               |
| Visual Description:                     | Moist, olive gray silty clay                                                                                  |
| Test Conditions:                        | Confining Stress of 80 psi over a range of strains from 0.000113 to 7.05% with a forced sinusoidal vibration. |
| Preparation:                            | Extruded from tube, cut, trimmed and placed into apparatus at the as-received density and moisture content.   |

**Modulus and Damping of Soils by Resonant-Column Method  
by ASTM D4015**

|                                                                                             |                                                               |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Apparatus Used: Geocomp Corp. quasi-fixed/free boundry condition automated RCTS Test System |                                                               |
| Active Mass, g: 2144.75                                                                     | Torque Calibration Factor, N-m/V: 12.9                        |
| Passive Mass, g: 1053.2                                                                     | Accelerometer Calibration Factor, rad/s <sup>2</sup> /V: 3293 |
| Active Inertia, kg-m <sup>2</sup> : 1.66E-03                                                |                                                               |
| Passive Inertia, kg-m <sup>2</sup> : 0.0012425                                              |                                                               |

| Elapsed Time | Excitation | Frequency | Axial Strain | Volumetric Strain | * Pore Pressure | Effective Confining Stress | Average Strain Amplitude | Shear Modulus, G | Damping Ratio, D |
|--------------|------------|-----------|--------------|-------------------|-----------------|----------------------------|--------------------------|------------------|------------------|
| min          | %          | Hz        | %            | %                 | psi             | psi                        | %                        | psi              | %                |
| 0.73         | 0.243      | 214       | 5.58E-02     | 0.056             | ---             | 80                         | 1.13E-04                 | 3.20E+04         | 0.56             |
| 0.93         | 0.611      | 215       | 5.58E-02     | 0.056             | ---             | 80                         | 1.93E-04                 | 3.23E+04         | 0.80             |
| 1.04         | 0.966      | 215       | 5.58E-02     | 0.056             | ---             | 80                         | 3.40E-04                 | 3.22E+04         | 0.93             |
| 1.14         | 1.532      | 215       | 5.58E-02     | 0.056             | ---             | 80                         | 6.06E-04                 | 3.21E+04         | 1.00             |
| 1.24         | 2.428      | 215       | 5.58E-02     | 0.056             | ---             | 80                         | 9.19E-04                 | 3.21E+04         | 1.02             |
| 1.35         | 3.847      | 214       | 5.58E-02     | 0.056             | ---             | 80                         | 1.48E-03                 | 3.19E+04         | 1.04             |
| 1.45         | 6.100      | 213       | 5.58E-02     | 0.056             | ---             | 80                         | 2.48E-03                 | 3.16E+04         | 1.10             |
| 1.55         | 9.672      | 212       | 5.58E-02     | 0.056             | ---             | 80                         | 4.09E-03                 | 3.10E+04         | 1.28             |
| 1.66         | 15.338     | 209       | 5.58E-02     | 0.056             | ---             | 80                         | 6.64E-03                 | 3.01E+04         | 1.54             |
| 1.76         | 24.337     | 205       | 5.58E-02     | 0.056             | ---             | 80                         | 1.10E-02                 | 2.87E+04         | 1.95             |
| 1.97         | 38.749     | 194       | 5.58E-02     | 0.056             | ---             | 80                         | 2.17E-02                 | 2.55E+04         | 3.00             |
| 2.28         | 61.840     | 177       | 5.58E-02     | 0.056             | ---             | 80                         | 4.64E-02                 | 2.09E+04         | 4.29             |
| 2.69         | 98.957     | 146       | 5.58E-02     | 0.056             | ---             | 80                         | 1.23E-01                 | 1.38E+04         | 7.05             |

The Shear Wave Velocity can be determined by the following equation:

$$V_s = \sqrt{G \cdot g / \text{bulk density}}$$

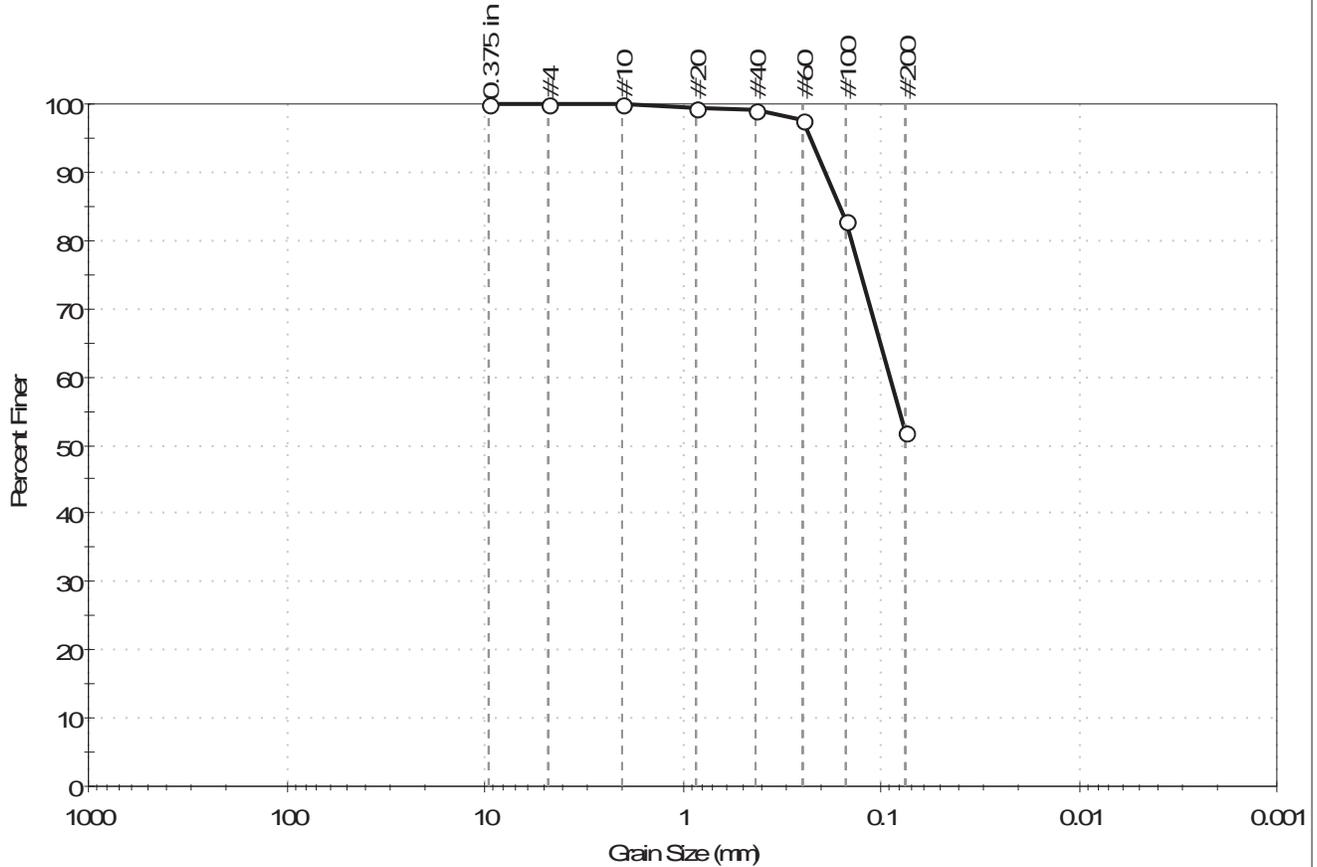
where:  $V_s$  = shear wave velocity  
 $G$  = shear modulus  
 $g$  = acceleration due to gravity, 9.81 m/sec<sup>2</sup>  
 final bulk density

\* Test is run with drainage valve open, but speed of test is such that excess pore pressure could develop, at higher shear strains within specimen.



|                     |                                            |              |             |             |        |
|---------------------|--------------------------------------------|--------------|-------------|-------------|--------|
| Client:             | F&ME Consultants                           |              | Project No: | GTX-305005  |        |
| Project:            | US-21 Replacement Bridge over Harbor River |              |             |             |        |
| Location:           | ---                                        |              | Tested By:  | GA          |        |
| Boring ID:          | SB-1                                       | Sample Type: | tube        | Checked By: | mcm    |
| Sample ID:          | UD-4                                       | Test Date:   | 11/04/16    | Test Id:    | 397425 |
| Depth :             | 200.0-203.0 ft                             |              |             |             |        |
| Test Comment:       | ---                                        |              |             |             |        |
| Visual Description: | Moist, olive sandy silt                    |              |             |             |        |
| Sample Comment:     | ---                                        |              |             |             |        |

## Particle Size Analysis - ASTM D422



|         |         |       |                   |
|---------|---------|-------|-------------------|
| %Cobble | %Gravel | %Sand | %Silt & Clay Size |
| —       | 0.1     | 47.8  | 52.1              |

| 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           | 100           |               |          |
| #40        | 0.42           | 99            |               |          |
| #60        | 0.25           | 98            |               |          |
| #100       | 0.15           | 83            |               |          |
| #200       | 0.075          | 52            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.1611 mm | D <sub>30</sub> = N/A |
| D <sub>60</sub> = 0.0896 mm | 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  |

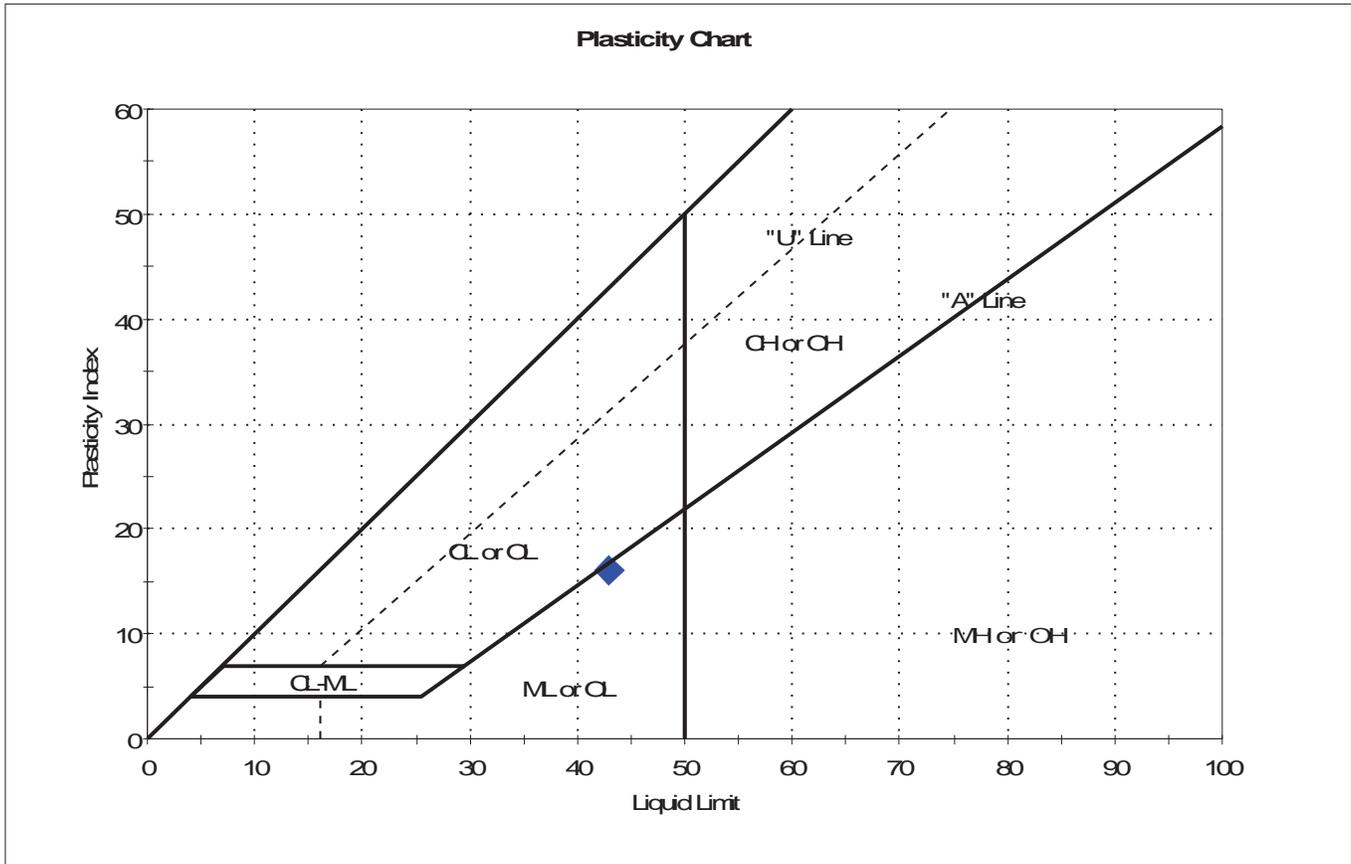
| <u>Classification</u> |                          |
|-----------------------|--------------------------|
| <u>ASTM</u>           | Sandy Silt (ML)          |
| <u>AASHTO</u>         | Clayey Soils (A-7-6 (6)) |

| <u>Sample/Test Description</u>   |
|----------------------------------|
| Sand/Gravel Particle Shape : --- |
| Sand/Gravel Hardness : ---       |



|                     |                                            |              |             |             |     |
|---------------------|--------------------------------------------|--------------|-------------|-------------|-----|
| Client:             | F&ME Consultants                           |              | Project No: | GTX-305005  |     |
| Project:            | US-21 Replacement Bridge over Harbor River |              |             |             |     |
| Location:           | ---                                        | Sample Type: | tube        | Tested By:  | GA  |
| Boring ID:          | SB-1                                       | Test Date:   | 11/04/16    | Checked By: | mcm |
| Sample ID:          | UD-4                                       | Test Id:     | 397423      |             |     |
| Depth :             | 200.0-203.0 ft                             |              |             |             |     |
| Test Comment:       | ---                                        |              |             |             |     |
| Visual Description: | Moist, olive sandy silt                    |              |             |             |     |
| Sample Comment:     | ---                                        |              |             |             |     |

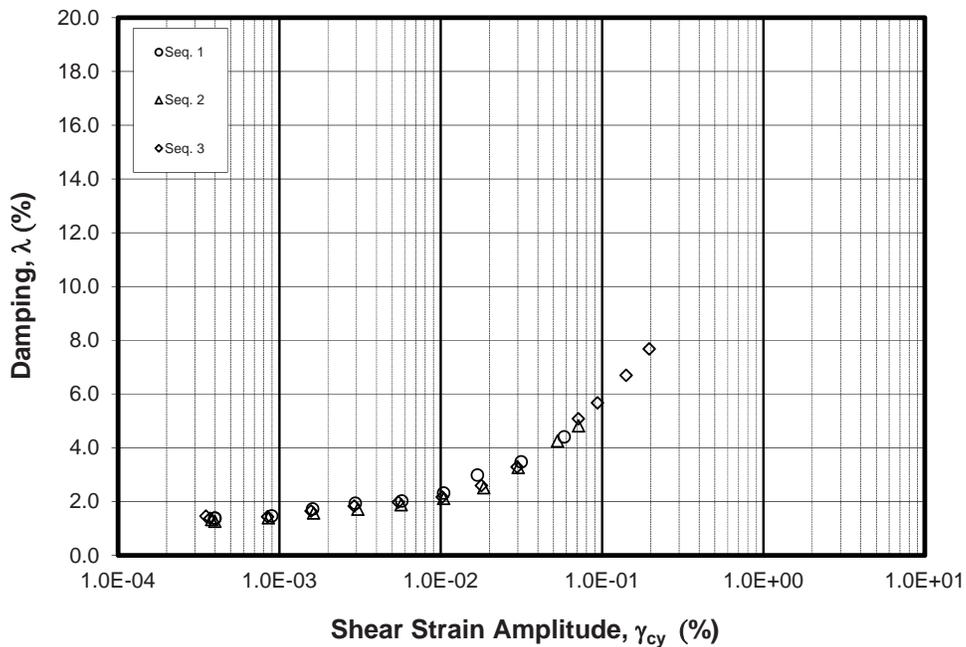
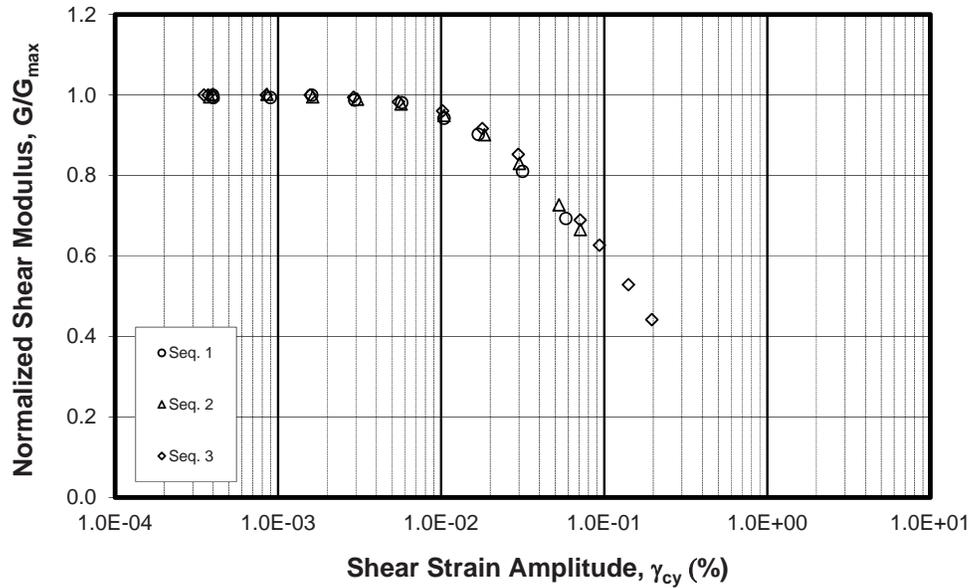
## Atterberg Limits - ASTM D4318



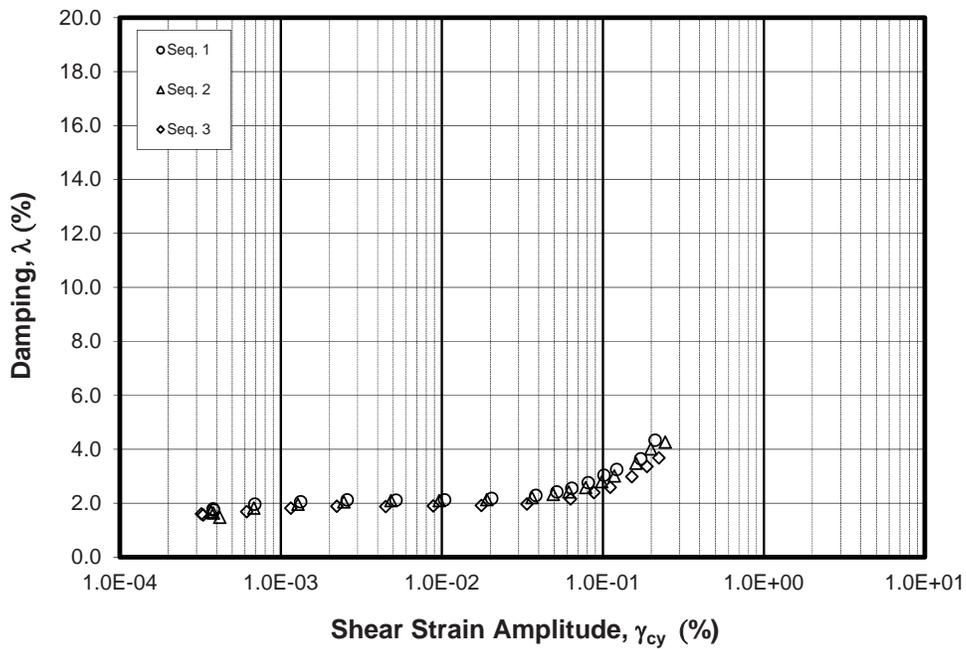
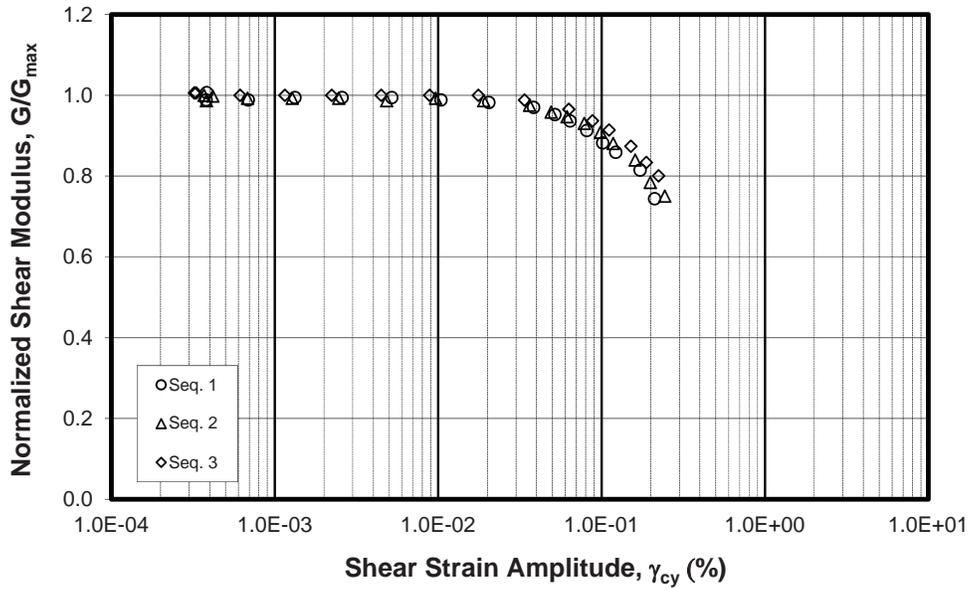
| Symbol | Sample ID | Boring | Depth          | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification |
|--------|-----------|--------|----------------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | UD-4      | SB-1   | 200.0-203.0 ft | 32                          | 43           | 27            | 16               | 0.3             | Sandy Silt (ML)     |

Sample Prepared using the WET method  
 1% Retained on #40 Sieve  
 Dry Strength: HIGH  
 Dilatancy: SLOW  
 Toughness: LOW

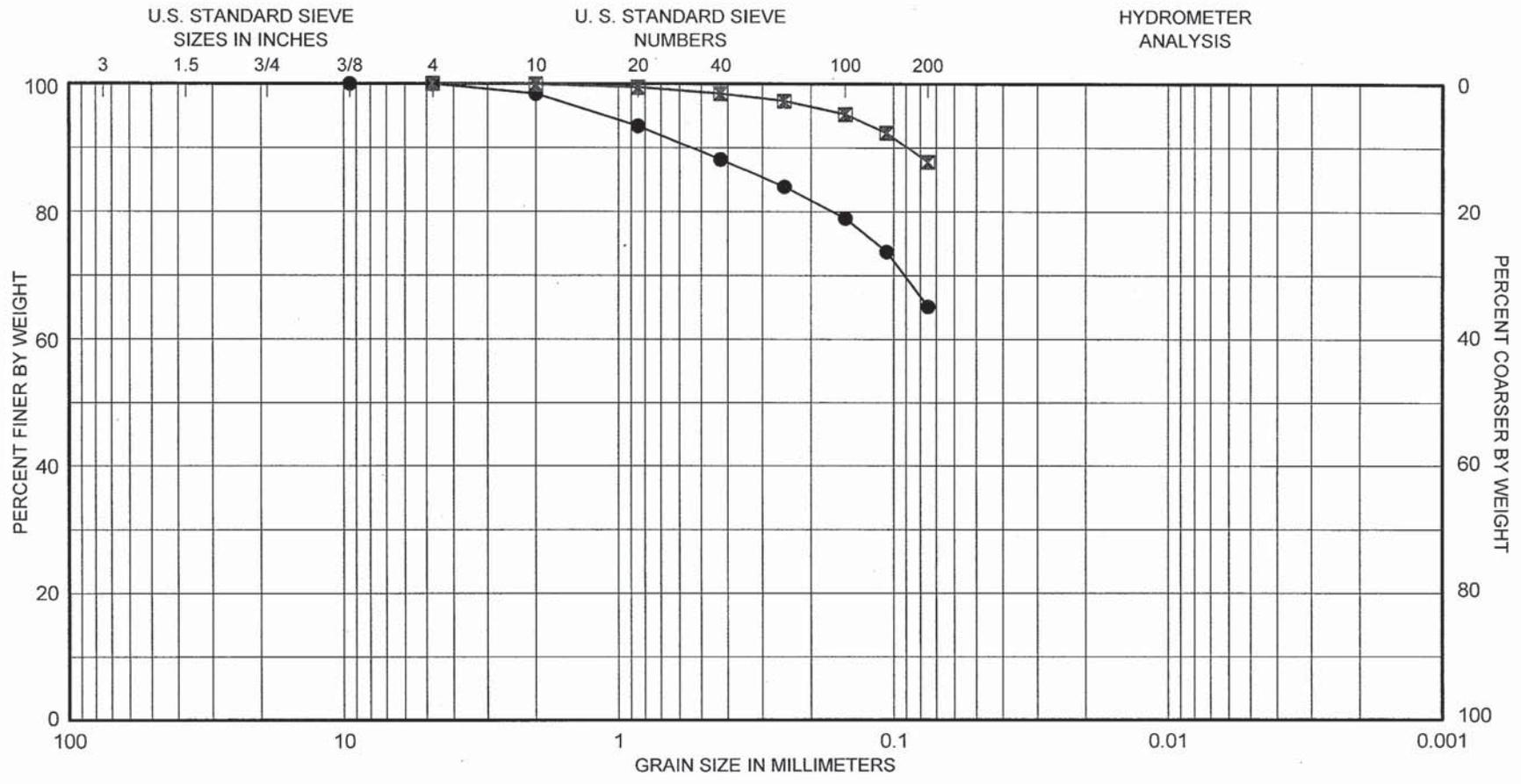




**RESONANT COLUMN TEST**  
 Three Stages of Isotropic Consolidation - OCR = 1  
 Sample: UD-6a Depth: 257.85 ft  
 Boring SB-1



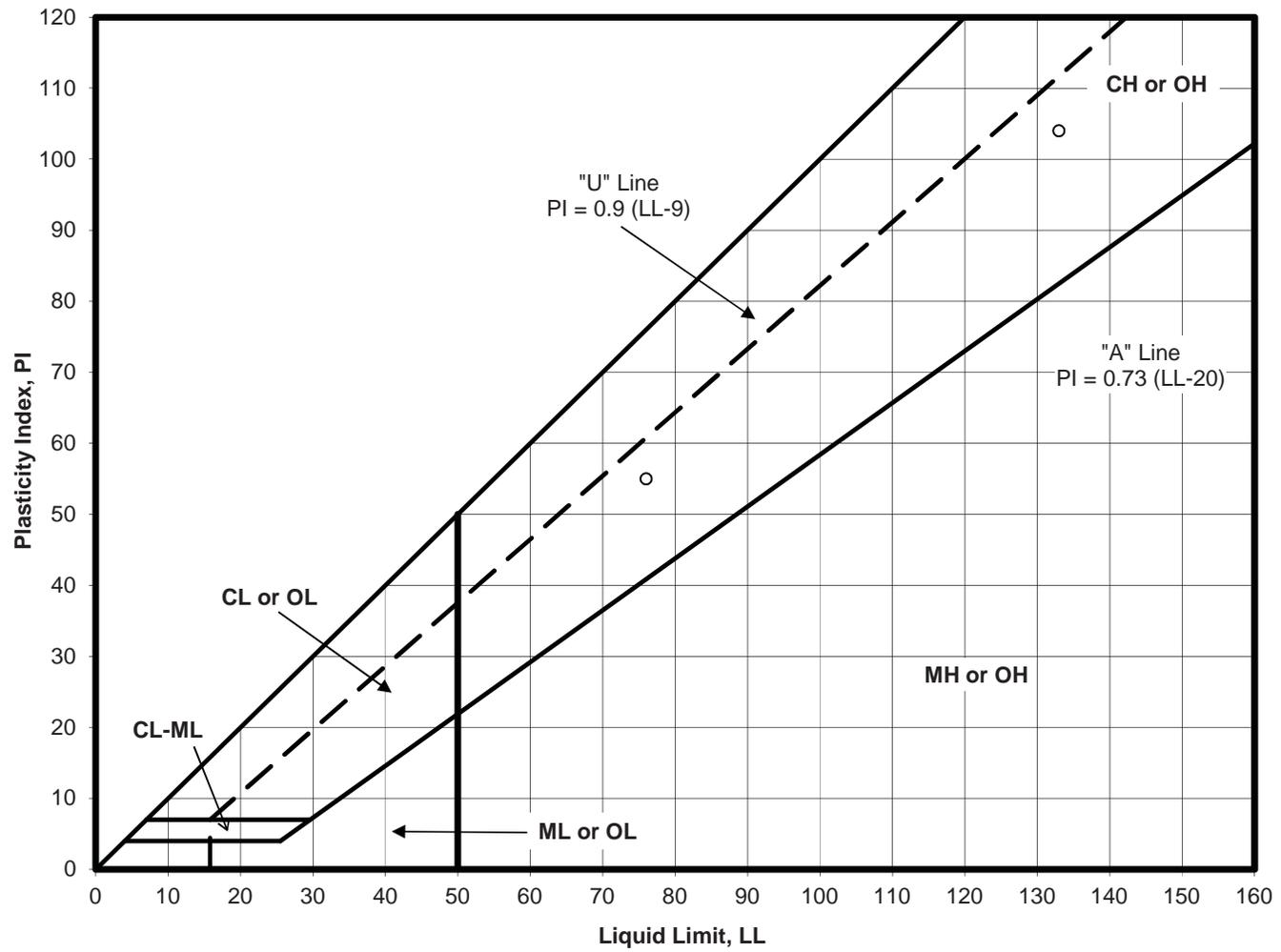
**RESONANT COLUMN TEST**  
 Three Stages of Isotropic Consolidation - OCR = 1  
 Sample: UD-9a Depth: 380.55 ft  
 Boring SB-1



| GRAVEL |      | SAND   |        |      | SILT or CLAY |
|--------|------|--------|--------|------|--------------|
| Coarse | Fine | Coarse | Medium | Fine |              |

| SYMBOL | BORING     | DEPTH, FT | $C_c$ | $C_u$ | $D_{50}$ | $D_{90}$ | CLASSIFICATION                                                             |
|--------|------------|-----------|-------|-------|----------|----------|----------------------------------------------------------------------------|
| ●      | SB-1_UD-6a | 257.85    |       |       |          | 0.54     | Sandy Clay, greenish gray                                                  |
| ⊠      | SB-1_UD-9a | 380.55    |       |       |          | 0.09     | Clay, olive gray and greenish gray, with san pockets and carbonate nodules |
| *      |            |           |       |       |          |          |                                                                            |
| ⊗      |            |           |       |       |          |          |                                                                            |

GRAIN SIZE CURVE



**PLASTICITY CHART**  
**Project No. 04.11160019**

| Sample     | LL  | PL | PI  |
|------------|-----|----|-----|
| SB-1_UD-6a | 76  | 21 | 55  |
| SB-1_UD-9a | 133 | 29 | 104 |



|            |                                            |              |            |
|------------|--------------------------------------------|--------------|------------|
| Client:    | F&ME Consultants                           |              |            |
| Project:   | US-21 Replacement Bridge over Harbor River |              |            |
| Location:  | ---                                        | Project No:  | GTX-305005 |
| Boring ID: | ---                                        | Sample Type: | ---        |
| Sample ID: | ---                                        | Test Date:   | 08/30/16   |
| Depth :    | ---                                        | Test Id:     | 387124     |
|            |                                            | Tested By:   | jbr        |
|            |                                            | Checked By:  | mcm        |

## Moisture Content of Soil and Rock - ASTM D2216

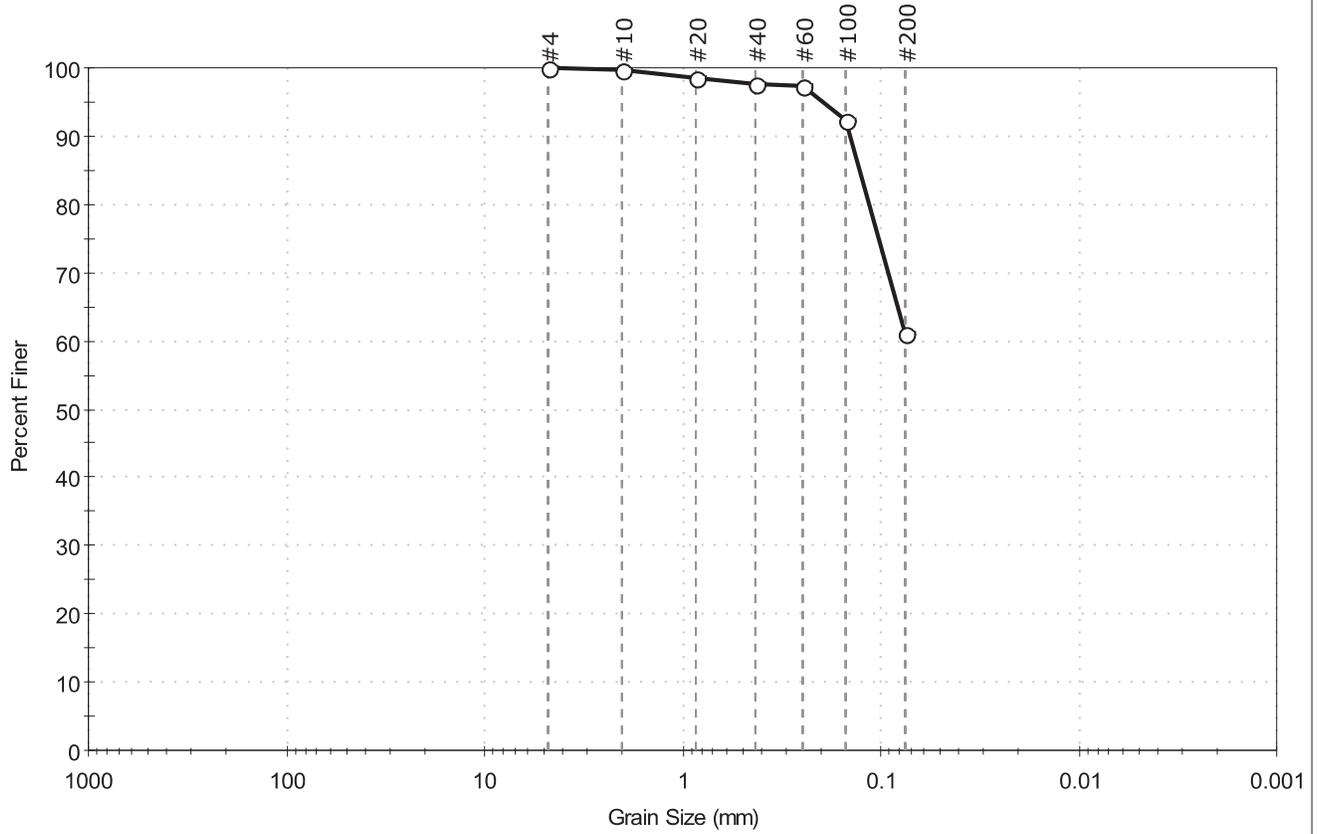
| Boring ID | Sample ID | Depth        | Description             | Moisture Content, % |
|-----------|-----------|--------------|-------------------------|---------------------|
| AP-1      | UD-1      | 16.0-18.0 ft | Moist, olive sandy clay | 63.0                |

Notes: Temperature of Drying : 110° Celsius



|                          |                                                     |                        |
|--------------------------|-----------------------------------------------------|------------------------|
| Client: F&ME Consultants | Project: US-21 Replacement Bridge over Harbor River | Project No: GTX-305005 |
| Location: ---            | Boring ID: AP-1                                     | Sample Type: tube      |
| Sample ID: UD-1          | Test Date: 08/26/16                                 | Tested By: jbr         |
| Depth: 16.0-18.0 ft      | Test Id: 387101                                     | Checked By: mcm        |
| Test Comment: ---        | Visual Description: Moist, olive sandy clay         | Sample Comment: ---    |

## Particle Size Analysis - ASTM D422



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 0.0      | 39.0   | 61.0               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 100           |               |          |
| #20        | 0.85           | 99            |               |          |
| #40        | 0.42           | 98            |               |          |
| #60        | 0.25           | 97            |               |          |
| #100       | 0.15           | 92            |               |          |
| #200       | 0.075          | 61            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.1278 mm | 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  |

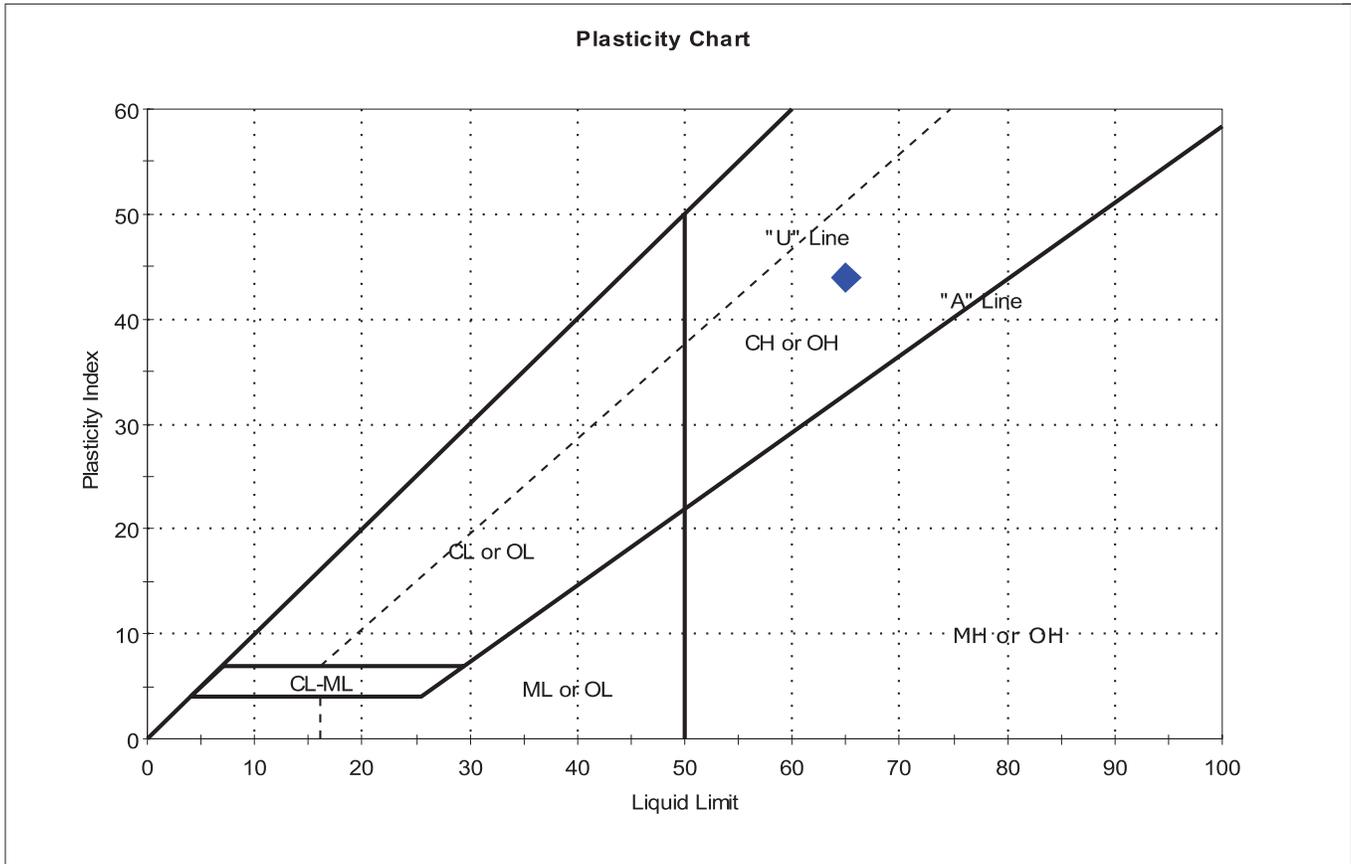
| <u>Classification</u> |                           |
|-----------------------|---------------------------|
| <u>ASTM</u>           | Sandy Fat clay (CH)       |
| <u>AASHTO</u>         | Clayey Soils (A-7-6 (24)) |

| <u>Sample/Test Description</u> |       |
|--------------------------------|-------|
| Sand/Gravel Particle Shape     | : --- |
| Sand/Gravel Hardness           | : --- |



|                          |                                                     |                        |
|--------------------------|-----------------------------------------------------|------------------------|
| Client: F&ME Consultants | Project: US-21 Replacement Bridge over Harbor River | Project No: GTX-305005 |
| Location: ---            | Boring ID: AP-1                                     | Sample Type: tube      |
| Tested By: GA            | Sample ID: UD-1                                     | Test Date: 08/31/16    |
| Checked By: mcm          | Depth: 16.0-18.0 ft                                 | Test Id: 387109        |
| Test Comment: ---        | Visual Description: Moist, olive sandy clay         | Sample Comment: ---    |

## Atterberg Limits - ASTM D4318

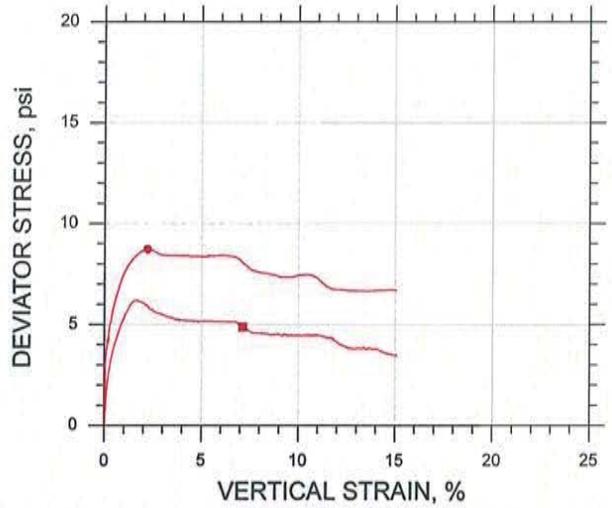
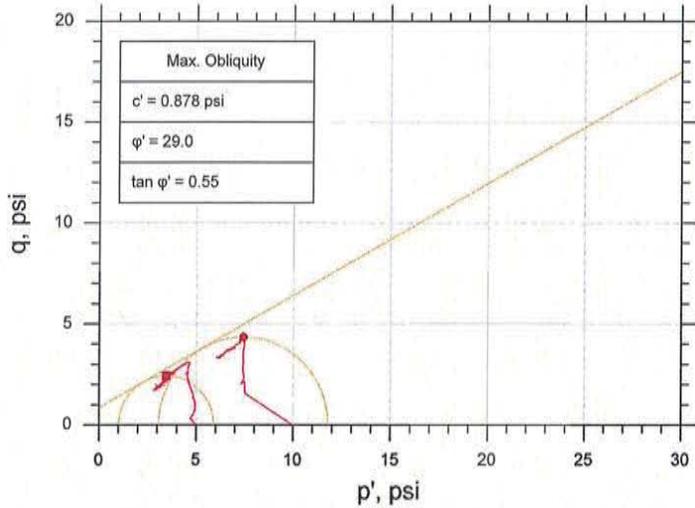


| Symbol | Sample ID | Boring | Depth        | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification |
|--------|-----------|--------|--------------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | UD-1      | AP-1   | 16.0-18.0 ft | 63                          | 65           | 21            | 44               | 1               | Sandy Fat clay (CH) |

Sample Prepared using the WET method  
 2% Retained on #40 Sieve  
 Dry Strength: VERY HIGH  
 Dilatancy: NONE  
 Toughness: MEDIUM

|                                         |                                 |
|-----------------------------------------|---------------------------------|
| Client: F&ME Consultants                |                                 |
| Project Name: US 21 Replacement Bridge  |                                 |
| Project Location: ---                   |                                 |
| Project Number: GTX-305005              |                                 |
| Tested By: md                           | Checked By: mcm                 |
| Boring ID: AP-1                         |                                 |
| Preparation: intact                     |                                 |
| Description: Moist, gray clay with sand |                                 |
| Classification: Fat clay                |                                 |
| Group Symbol: CH                        |                                 |
| Liquid Limit: ---                       | Plastic Limit: ---              |
| Plasticity Index: ---                   | Estimated Specific Gravity: 2.7 |

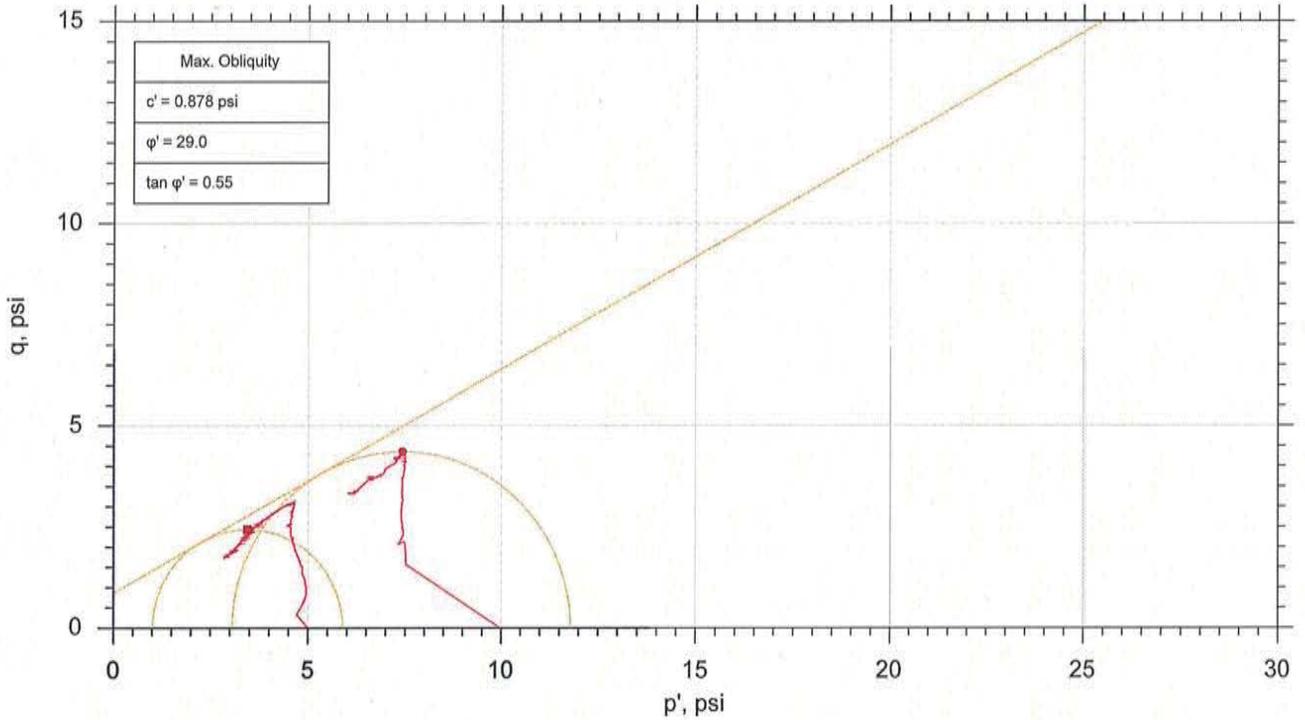
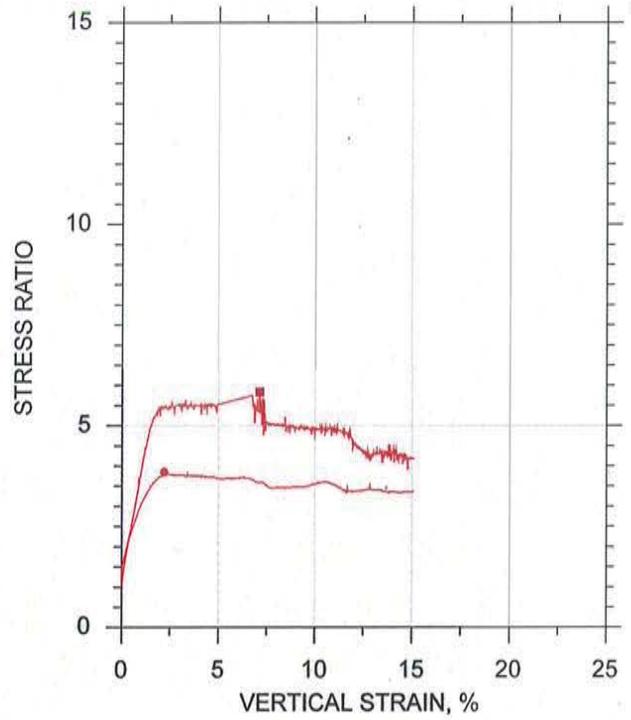
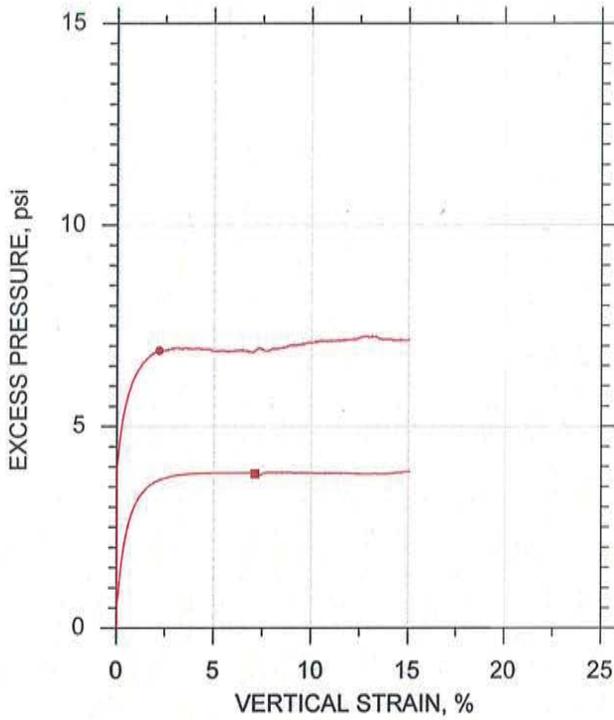
**CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767**



|                                                                                                                                                                                                  |                                                  |              |       |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|--------------|-------|--|
| Symbol                                                                                                                                                                                           | ■                                                | ●            |       |  |
| Sample ID                                                                                                                                                                                        | ST-1                                             | ST-1         |       |  |
| Depth, ft                                                                                                                                                                                        | 16.0-18.0 ft                                     | 16.0-18.0 ft |       |  |
| Test Number                                                                                                                                                                                      | CU-5-1                                           | CU-5-2       |       |  |
| Initial                                                                                                                                                                                          | Height, in                                       | 4.680        | 4.500 |  |
|                                                                                                                                                                                                  | Diameter, in                                     | 2.020        | 2.030 |  |
|                                                                                                                                                                                                  | Moisture Content (from Cuttings), %              | 50.2         | 60.1  |  |
|                                                                                                                                                                                                  | Dry Density, pcf                                 | 66.5         | 63.3  |  |
|                                                                                                                                                                                                  | Saturation (Wet Method), %                       | 88.4         | 97.5  |  |
|                                                                                                                                                                                                  | Void Ratio                                       | 1.53         | 1.66  |  |
| Before Shear                                                                                                                                                                                     | Moisture Content, %                              | 51.2         | 59.6  |  |
|                                                                                                                                                                                                  | Dry Density, pcf                                 | 70.7         | 64.6  |  |
|                                                                                                                                                                                                  | Cross-sectional Area (Method A), in <sup>2</sup> | 3.034        | 3.180 |  |
|                                                                                                                                                                                                  | Saturation, %                                    | 100.0        | 100.0 |  |
|                                                                                                                                                                                                  | Void Ratio                                       | 1.38         | 1.61  |  |
| Back Pressure, psi                                                                                                                                                                               | 51.00                                            | 160.8        |       |  |
| Vertical Effective Consolidation Stress, psi                                                                                                                                                     | 4.947                                            | 9.959        |       |  |
| Horizontal Effective Consolidation Stress, psi                                                                                                                                                   | 4.994                                            | 9.982        |       |  |
| Vertical Strain after Consolidation, %                                                                                                                                                           | 0.5866                                           | 0.3451       |       |  |
| Volumetric Strain after Consolidation, %                                                                                                                                                         | 5.758                                            | 2.070        |       |  |
| Time to 50% Consolidation, min                                                                                                                                                                   | 262.4                                            | 18.06        |       |  |
| Shear Strength, psi                                                                                                                                                                              | 2.440                                            | 4.369        |       |  |
| Strain at Failure, %                                                                                                                                                                             | 7.12                                             | 2.18         |       |  |
| Strain Rate, %/min                                                                                                                                                                               | 0.01600                                          | 0.01600      |       |  |
| Deviator Stress at Failure, psi                                                                                                                                                                  | 4.880                                            | 8.738        |       |  |
| Effective Minor Principal Stress at Failure, psi                                                                                                                                                 | 1.007                                            | 3.054        |       |  |
| Effective Major Principal Stress at Failure, psi                                                                                                                                                 | 5.887                                            | 11.79        |       |  |
| B-Value                                                                                                                                                                                          | 0.96                                             | 0.95         |       |  |
| Notes:                                                                                                                                                                                           |                                                  |              |       |  |
| - Before Shear Saturation set to 100% for phase calculation.                                                                                                                                     |                                                  |              |       |  |
| - Moisture Content determined by ASTM D2216.                                                                                                                                                     |                                                  |              |       |  |
| - Deviator Stress includes membrane correction.                                                                                                                                                  |                                                  |              |       |  |
| - Values for c and phi 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

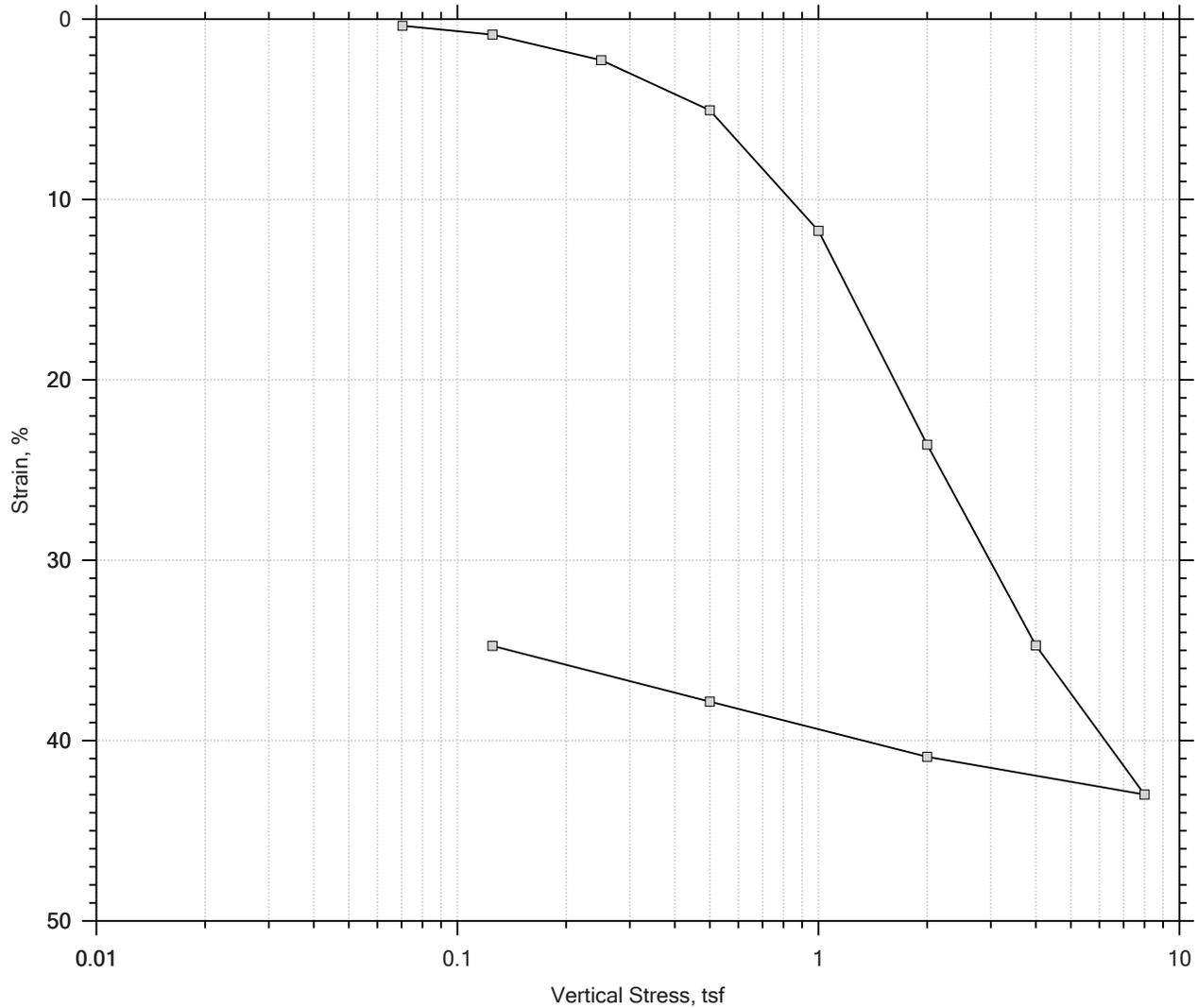


| Sample No. | Test No. | Depth  | Tested By    | Test Date | Checked By | Check Date | Test File |                    |
|------------|----------|--------|--------------|-----------|------------|------------|-----------|--------------------|
| ■          | ST-1     | CU-5-1 | 16.0-18.0 ft | md        | 8/24/16    | mcm        | 9/7/16    | 305005-CU-5-1m.dat |
| ●          | ST-1     | CU-5-2 | 16.0-18.0 ft | md        | 8/24/16    | mcm        | 9/7/16    | 305005-CU-5-2m.dat |
|            |          |        |              |           |            |            |           |                    |

|  |                                         |  |                     |  |                         |  |
|--|-----------------------------------------|--|---------------------|--|-------------------------|--|
|  | Project: US 21 Replacement Bridge       |  | Location: ---       |  | Project No.: GTX-305005 |  |
|  | Boring No.: AP-1                        |  | Sample Type: intact |  |                         |  |
|  | Description: Moist, gray clay with sand |  |                     |  |                         |  |
|  | Remarks: System B                       |  |                     |  |                         |  |

# One-Dimensional Consolidation by ASTM D2435 - Method B

## Summary Report

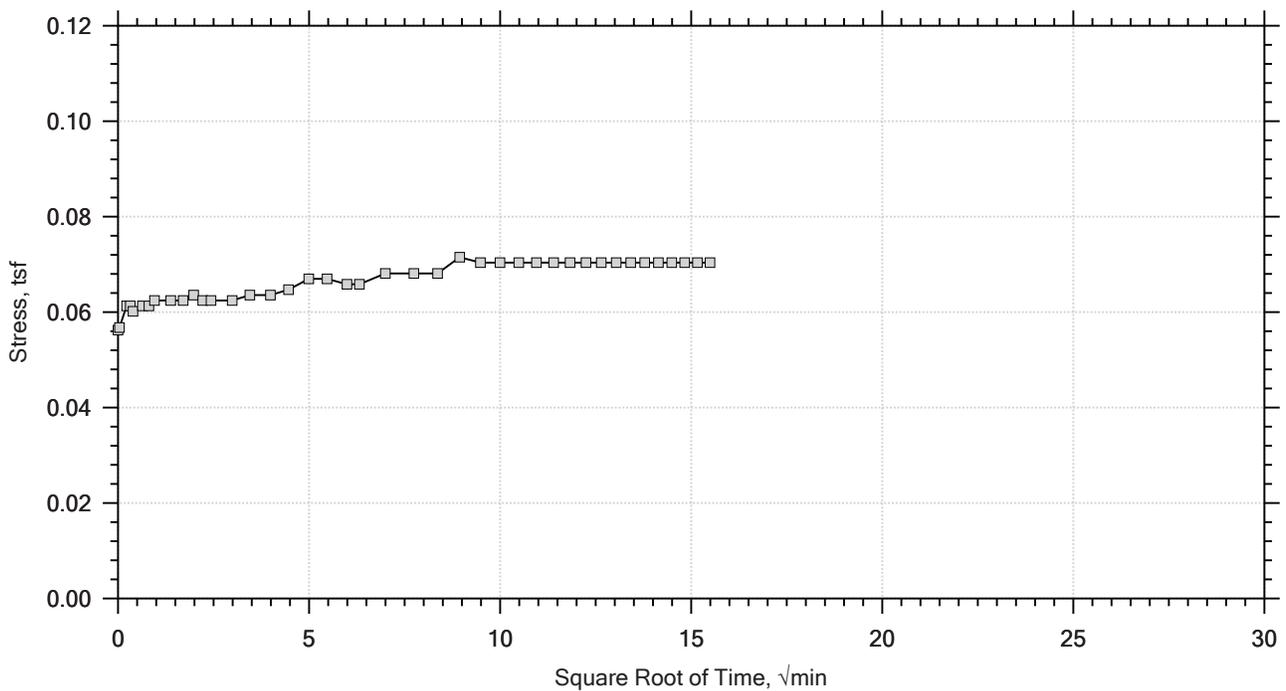
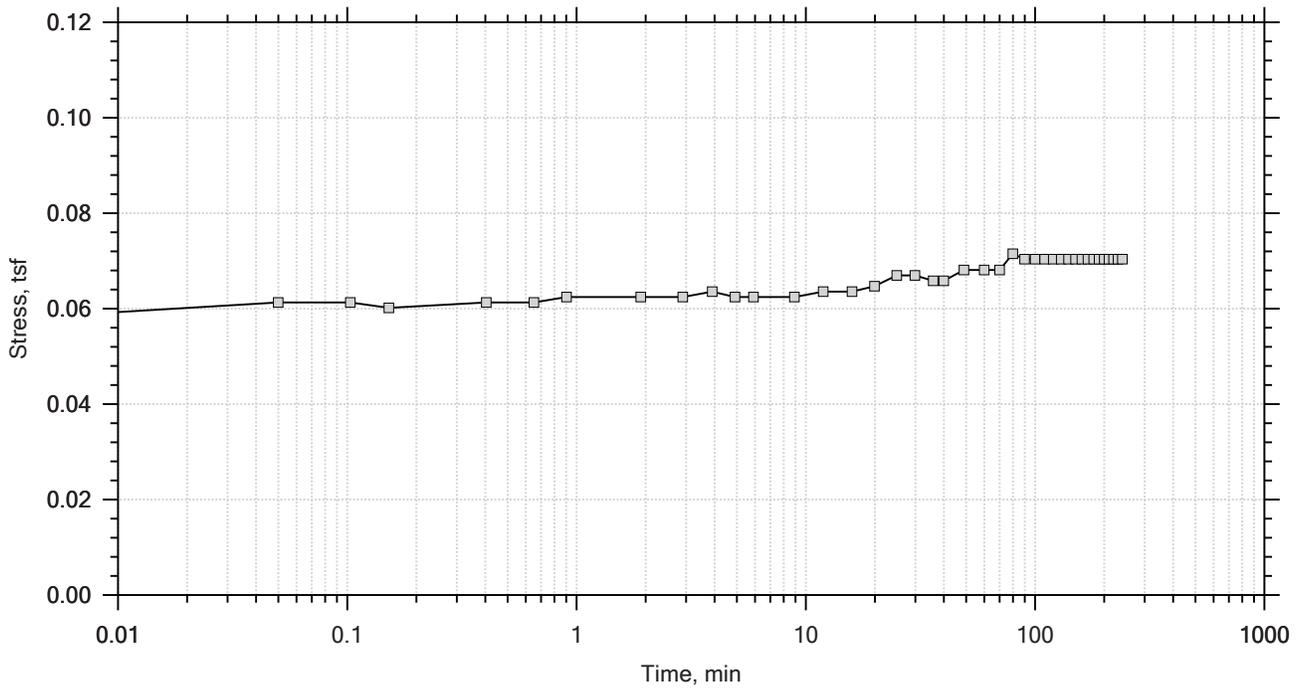


|                                        |        |              |          | Before Test          | After Test |        |
|----------------------------------------|--------|--------------|----------|----------------------|------------|--------|
| Current Vertical Effective Stress: --- |        |              |          | Water Content, %     | 85.59      | 49.46  |
| Preconsolidation Stress: ---           |        |              |          | Dry Unit Weight, pcf | 50.811     | 72.587 |
| Compression Ratio: ---                 |        |              |          | Saturation, %        | 99.16      | 100.00 |
| Diameter: 2.5 in                       |        | Height: 1 in |          | Void Ratio           | 2.36       | 1.35   |
| LL: 65                                 | PL: 21 | PI: 44       | GS: 2.74 |                      |            |        |

|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
| Displacement at End of Increment                                                    |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

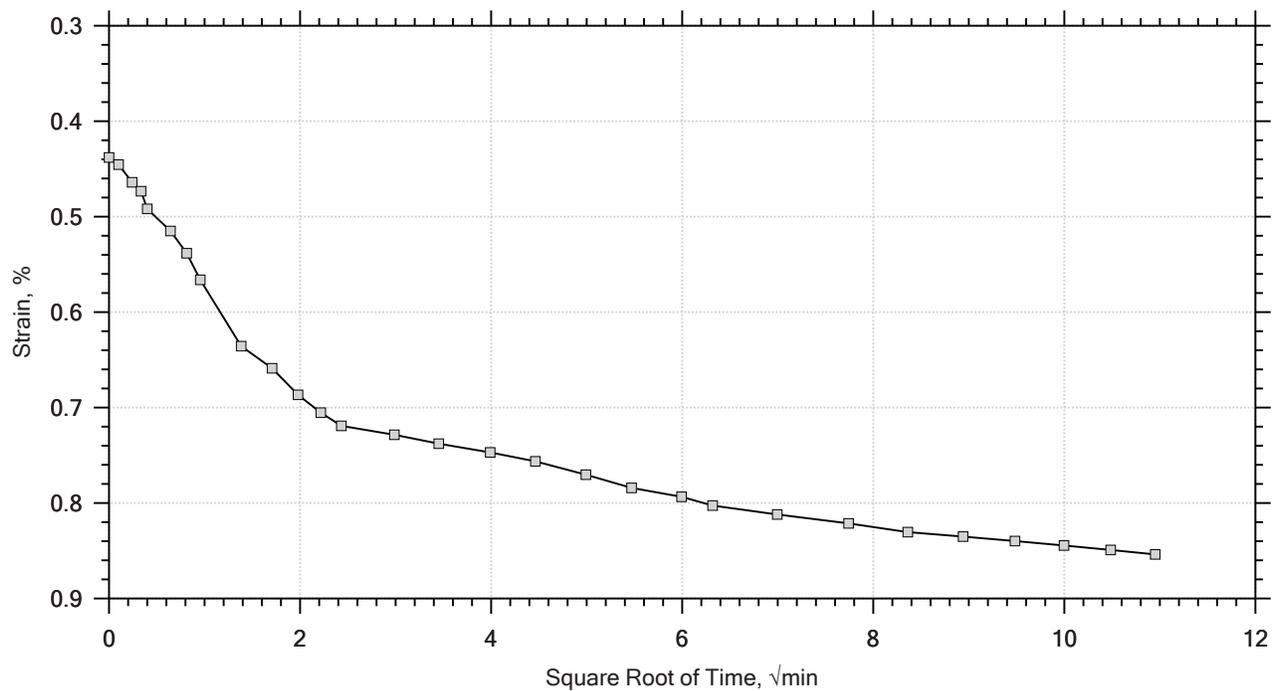
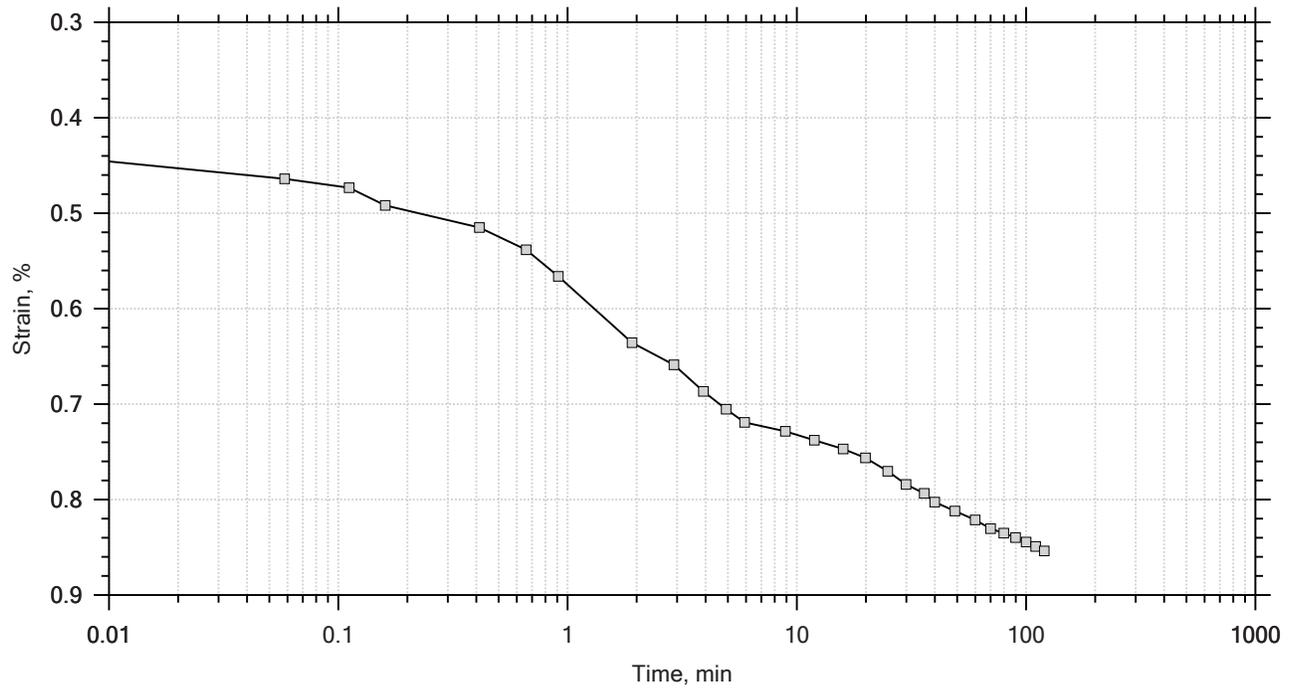
Time Curve 1 of 11  
 Constant Volume Step  
 Stress: 0.0704 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

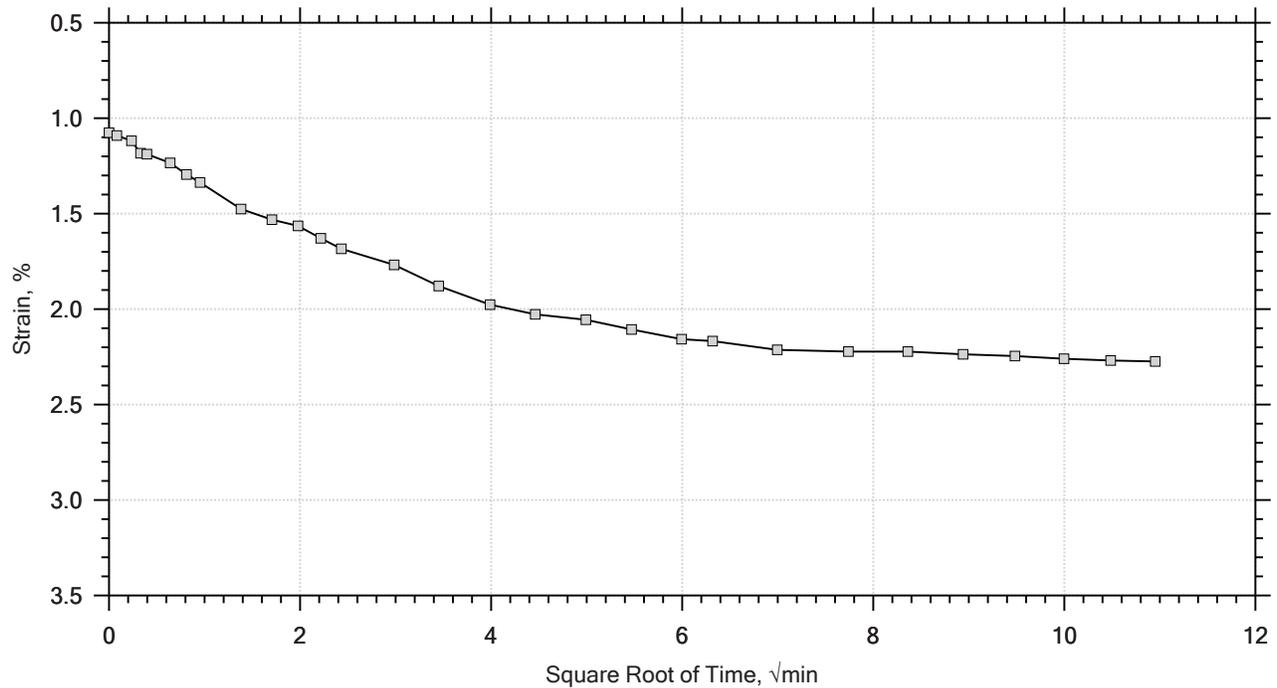
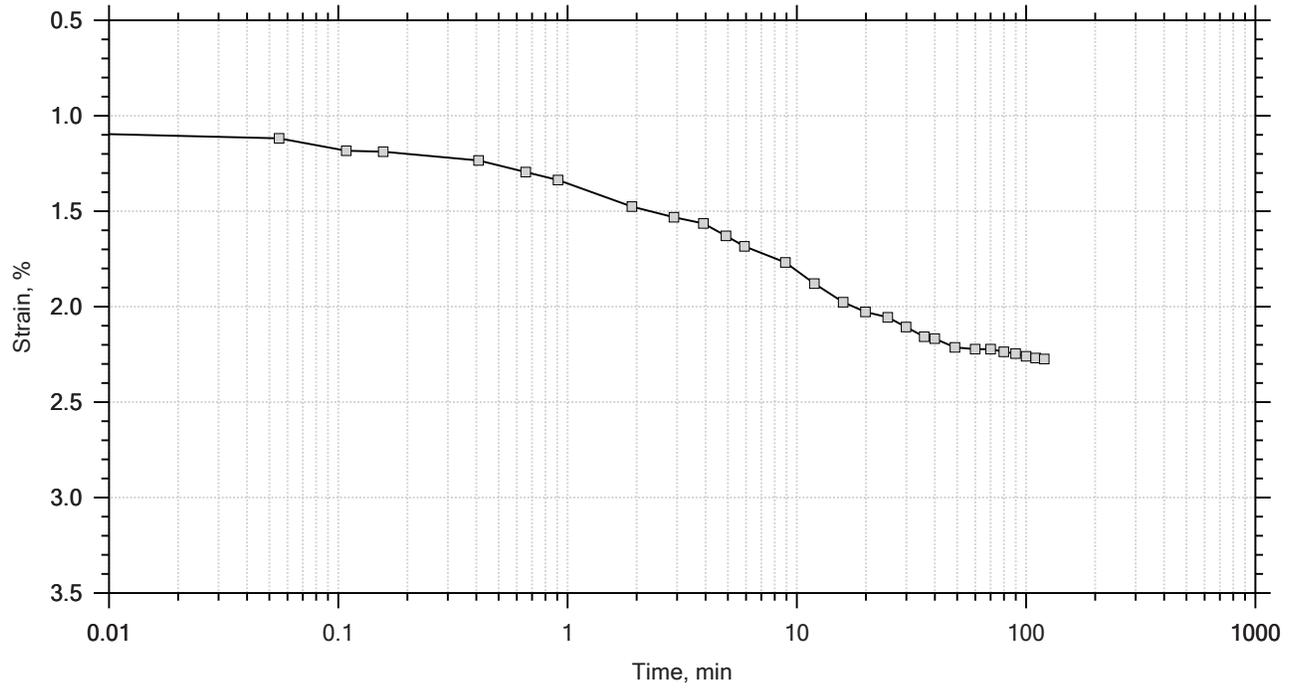
Time Curve 2 of 11  
 Constant Load Step  
 Stress: 0.125 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

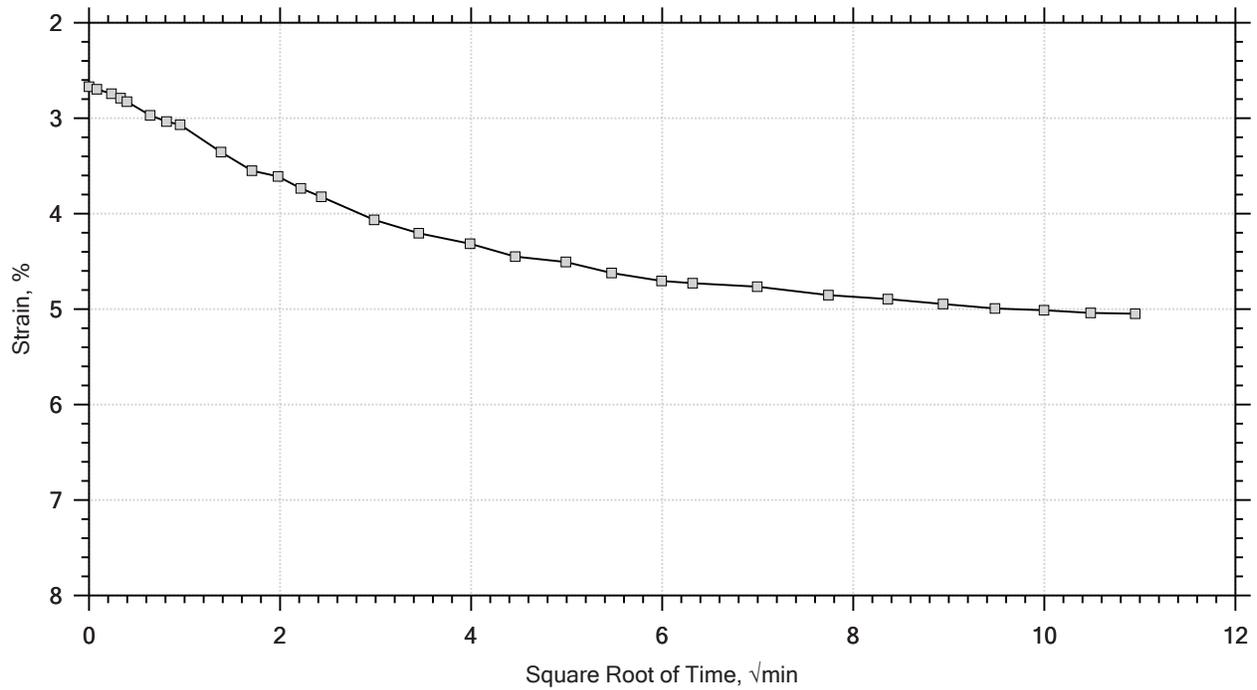
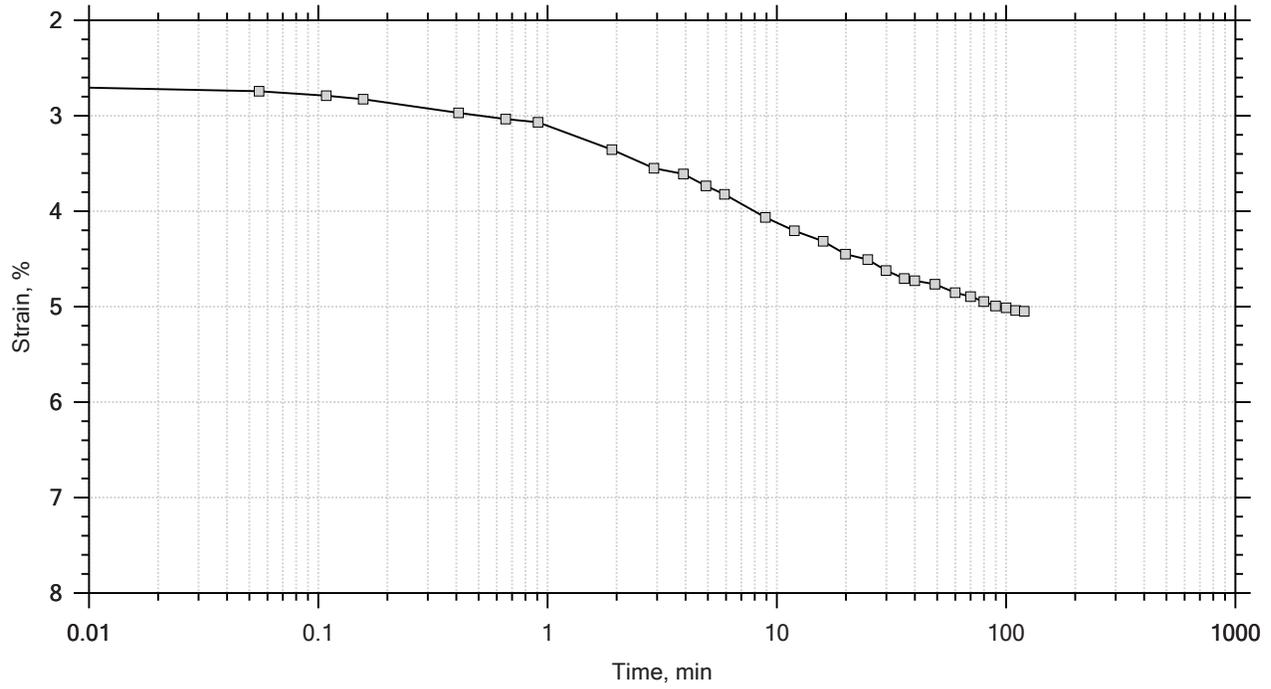
Time Curve 3 of 11  
 Constant Load Step  
 Stress: 0.25 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

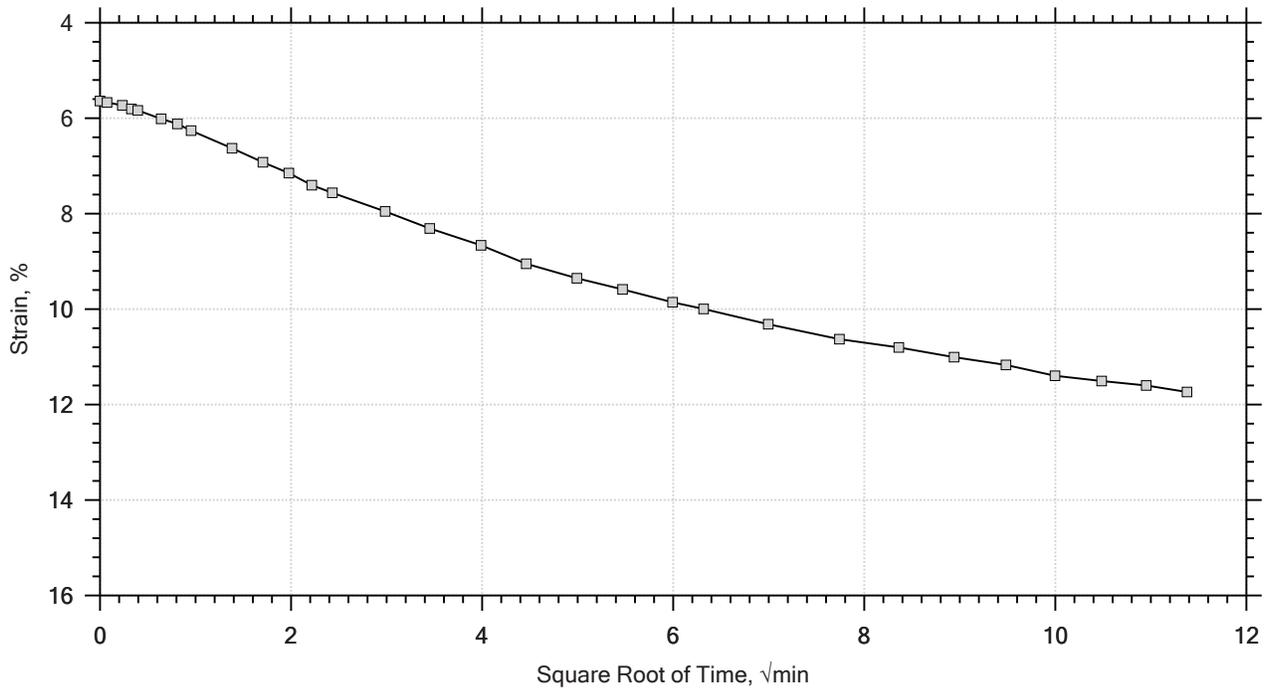
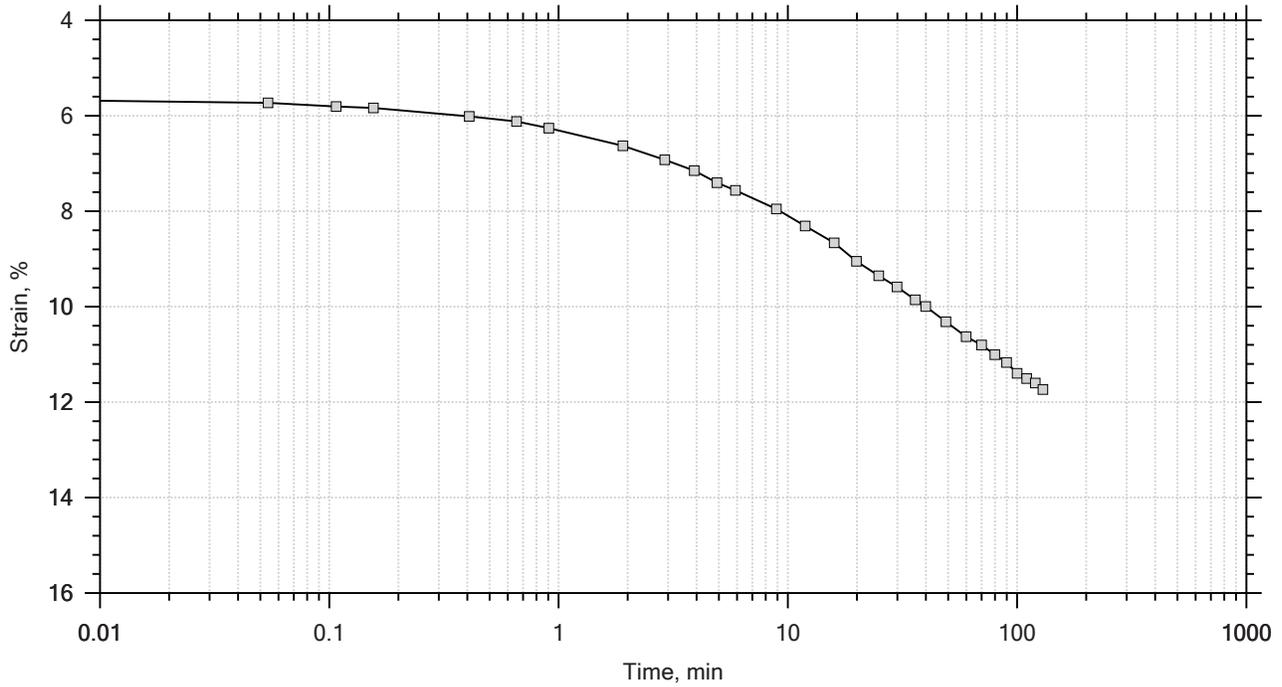
Time Curve 4 of 11  
 Constant Load Step  
 Stress: 0.5 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

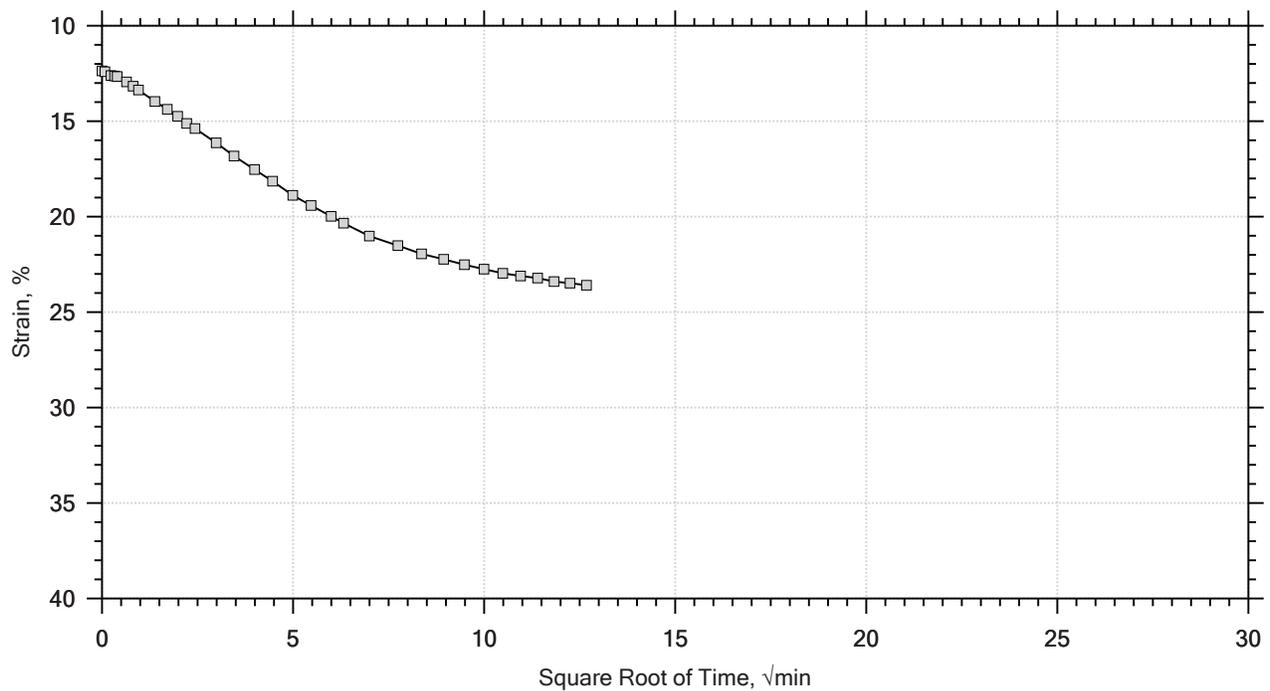
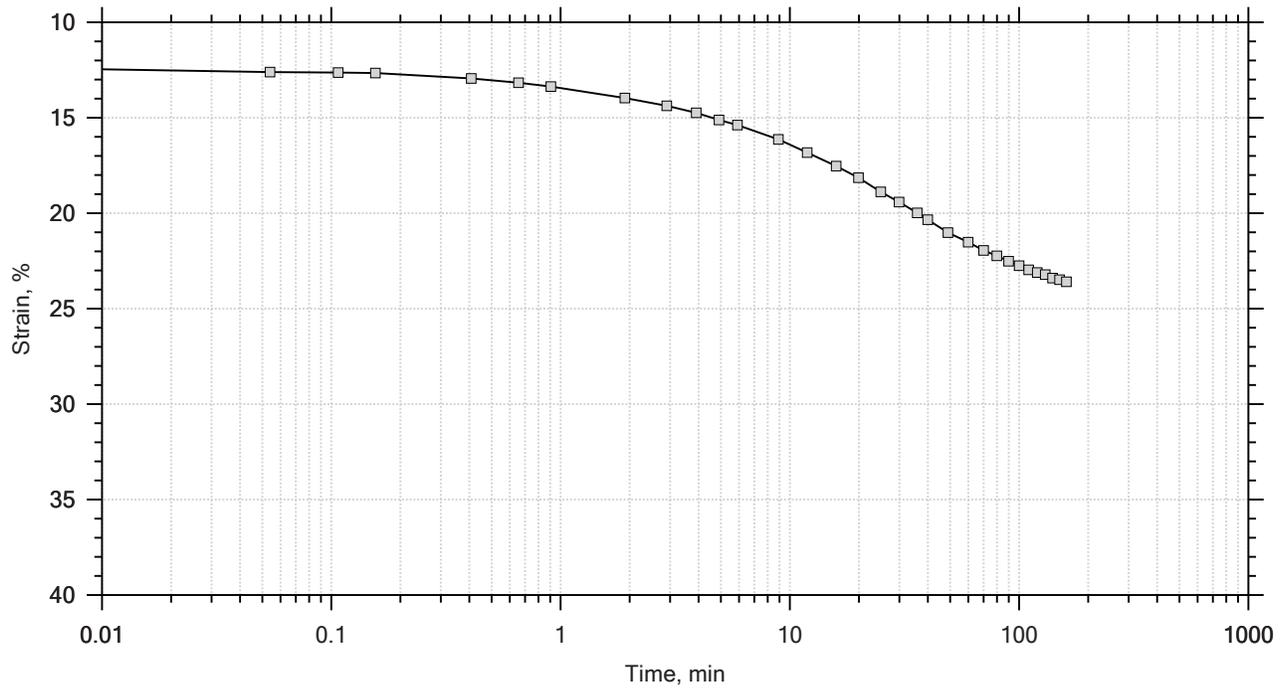
Time Curve 5 of 11  
 Constant Load Step  
 Stress: 1 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 11  
 Constant Load Step  
 Stress: 2 tsf

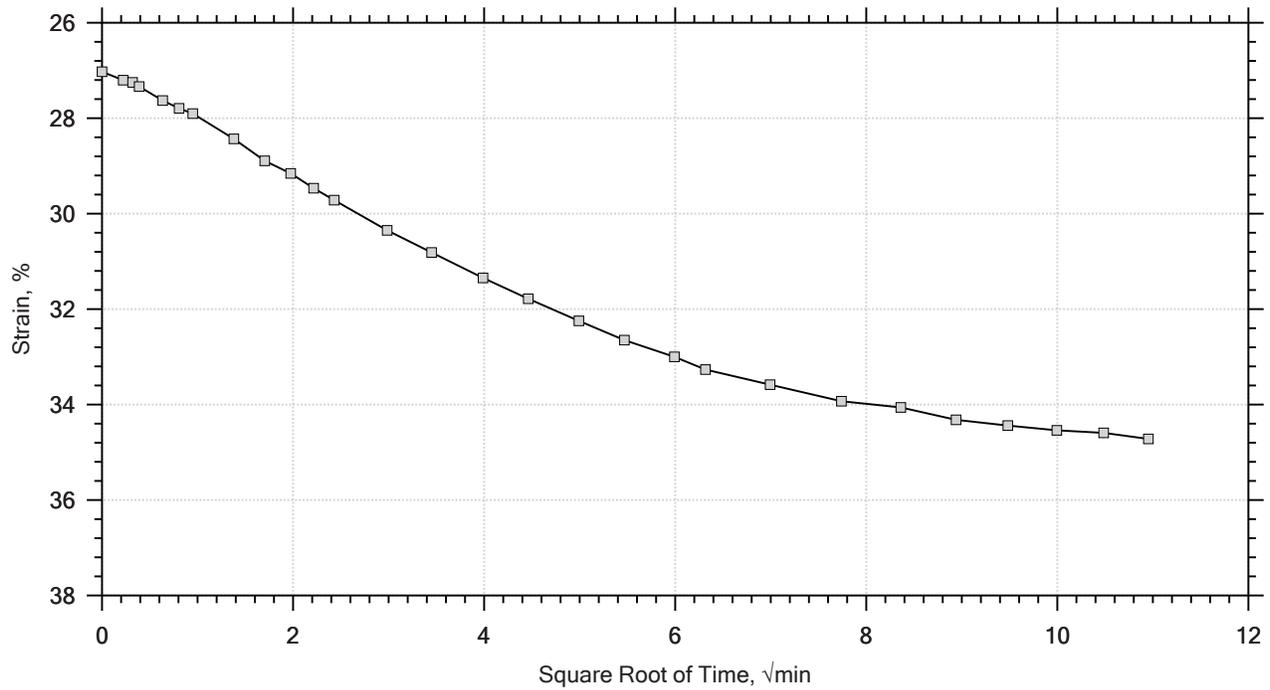
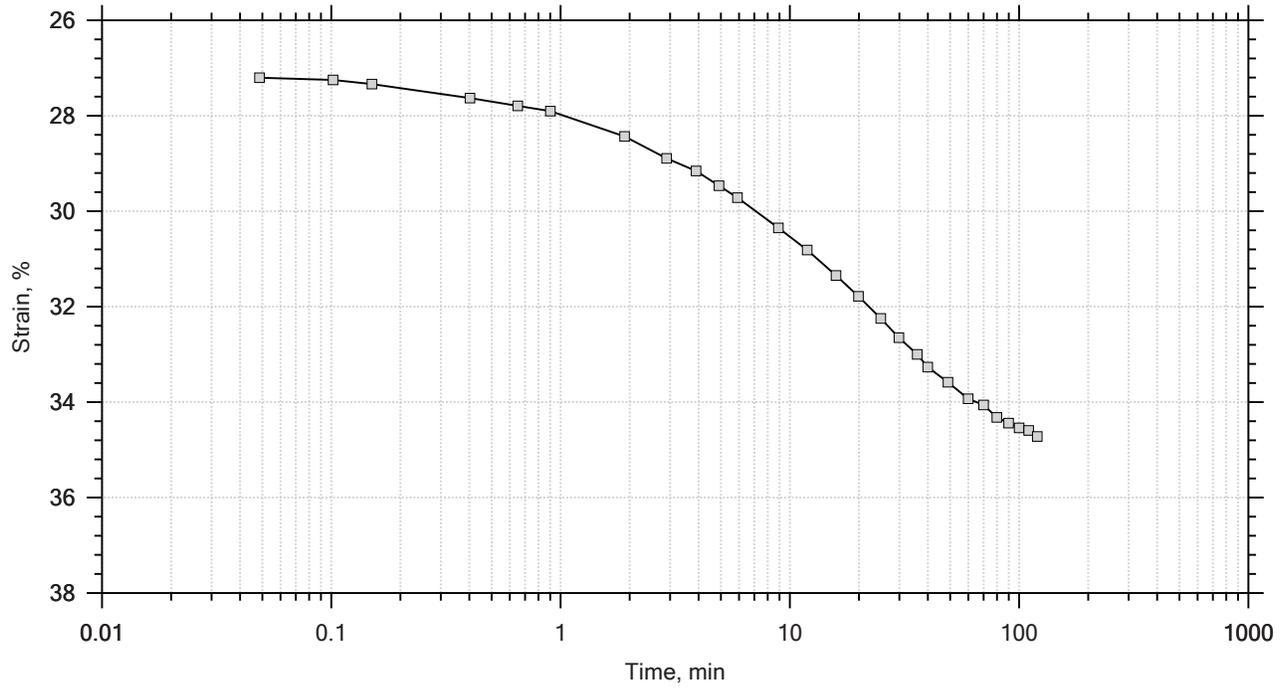


|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |



# One-Dimensional Consolidation by ASTM D2435 - Method B

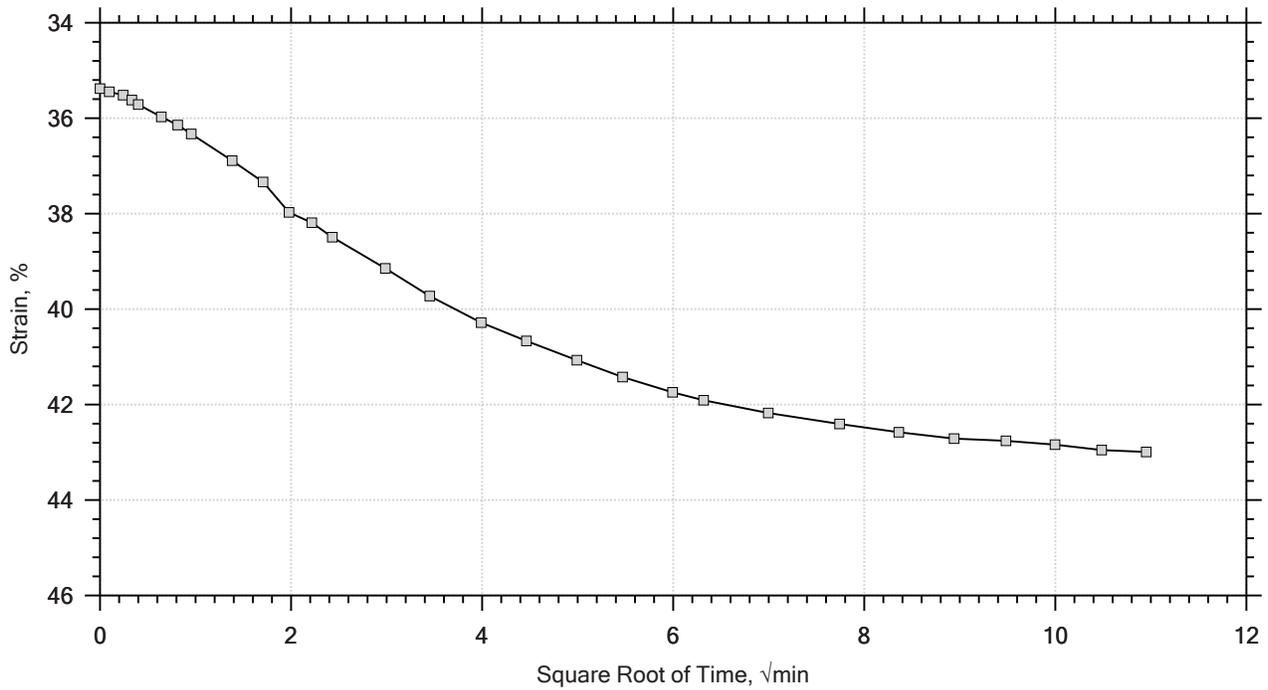
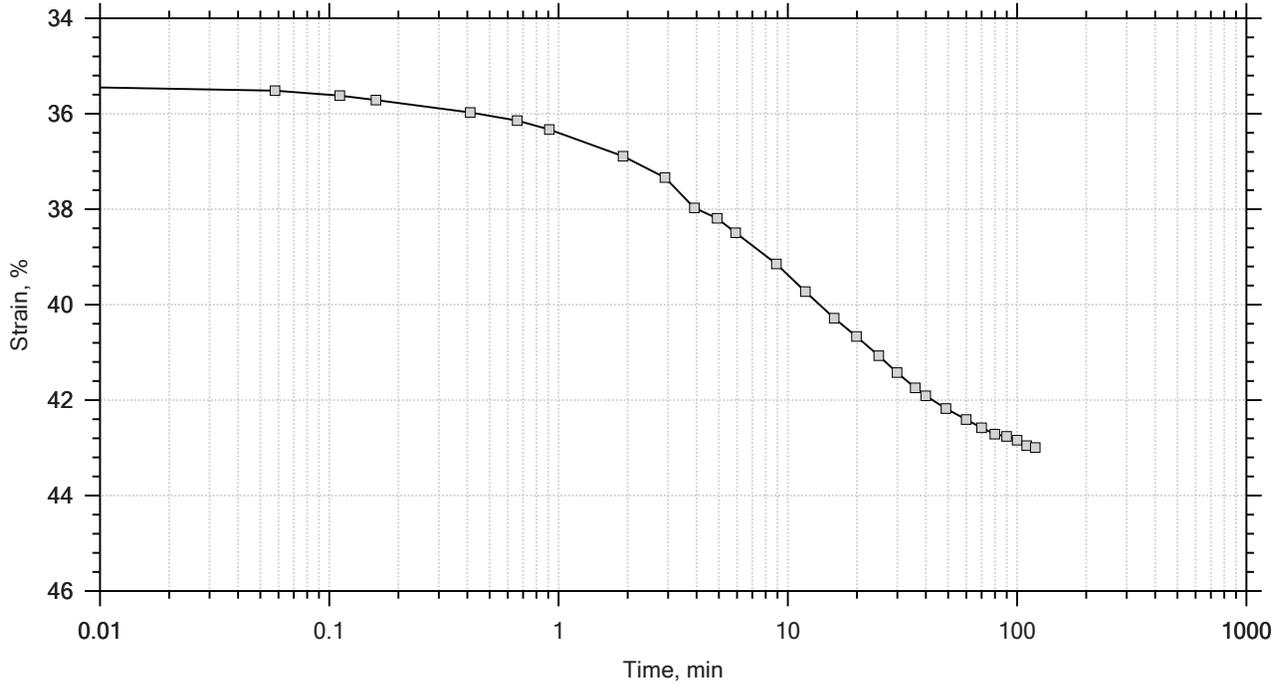
Time Curve 7 of 11  
 Constant Load Step  
 Stress: 4 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

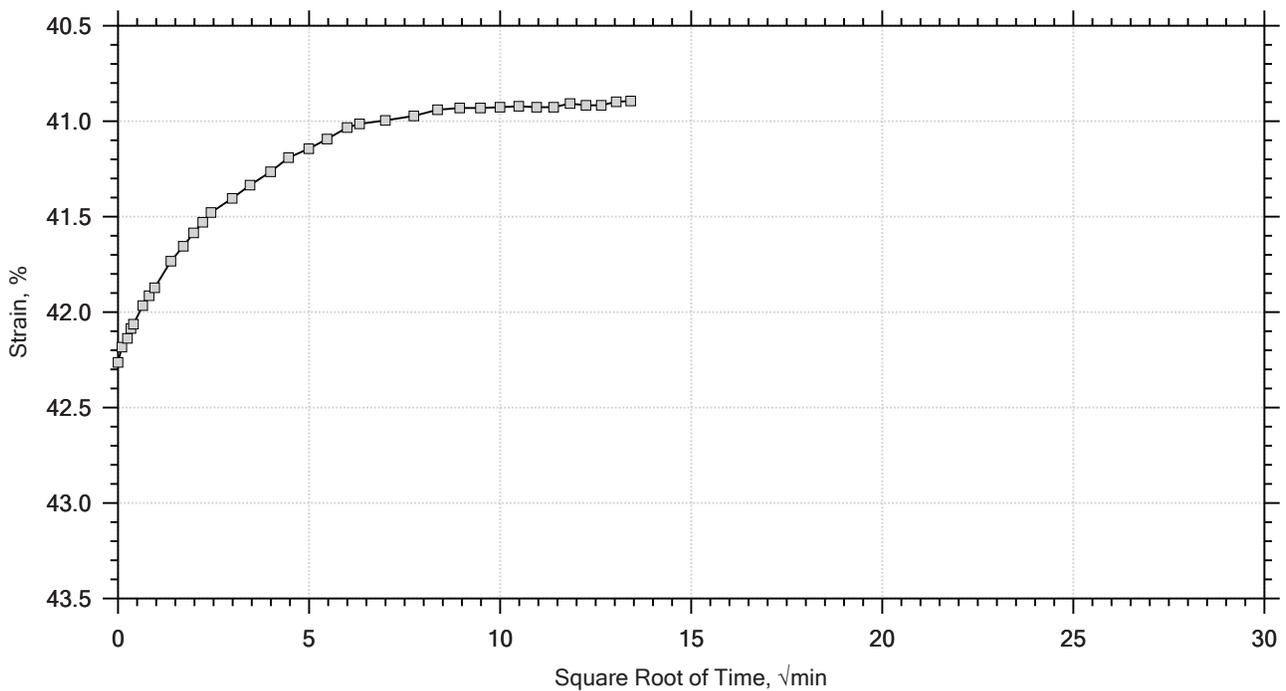
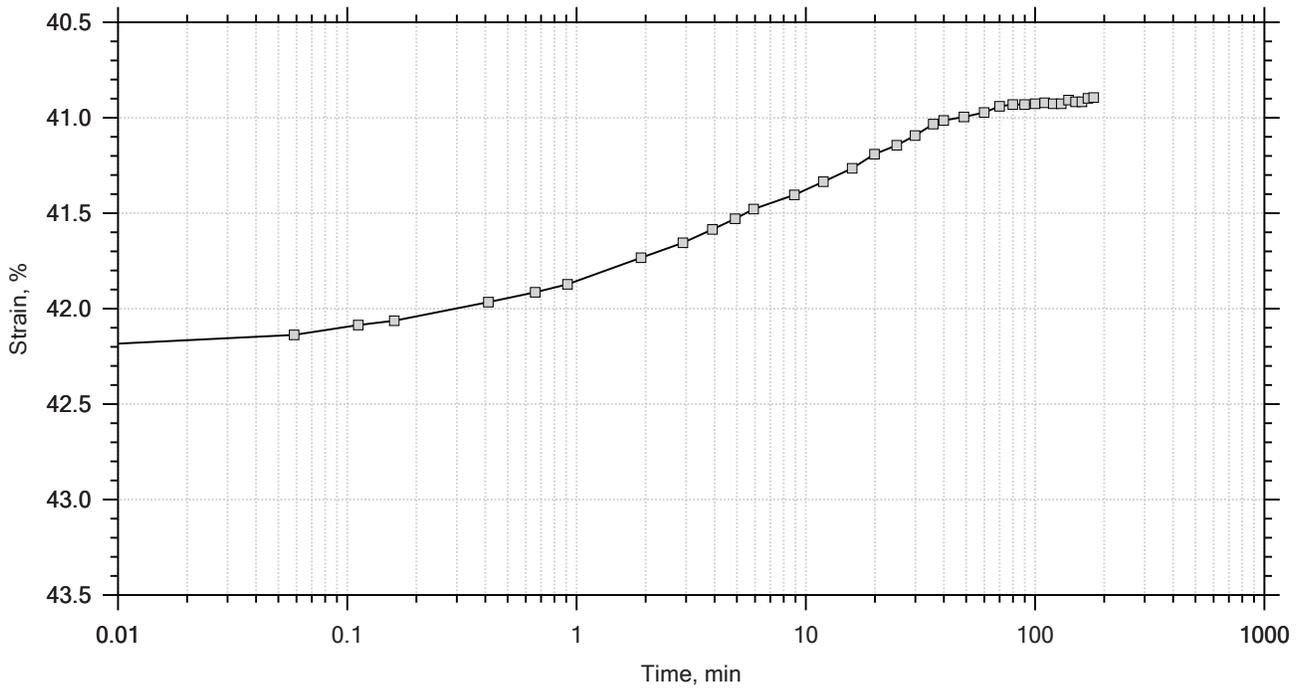
Time Curve 8 of 11  
 Constant Load Step  
 Stress: 8 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 11  
 Constant Load Step  
 Stress: 2 tsf



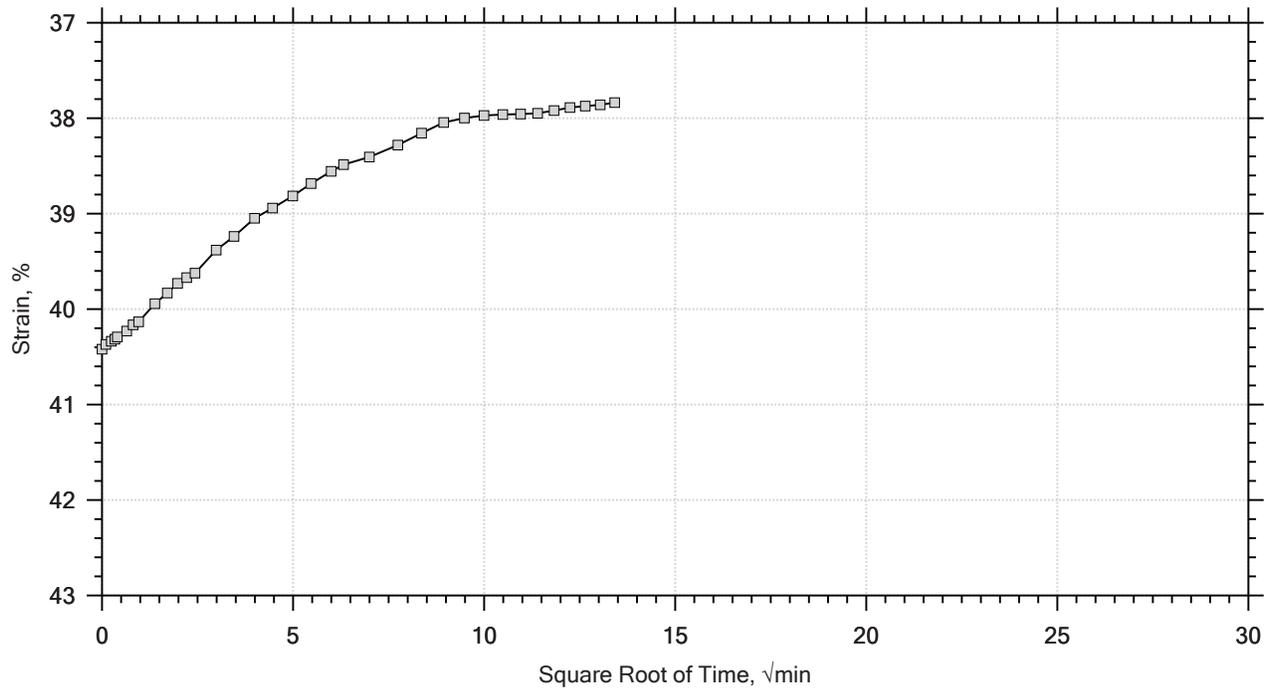
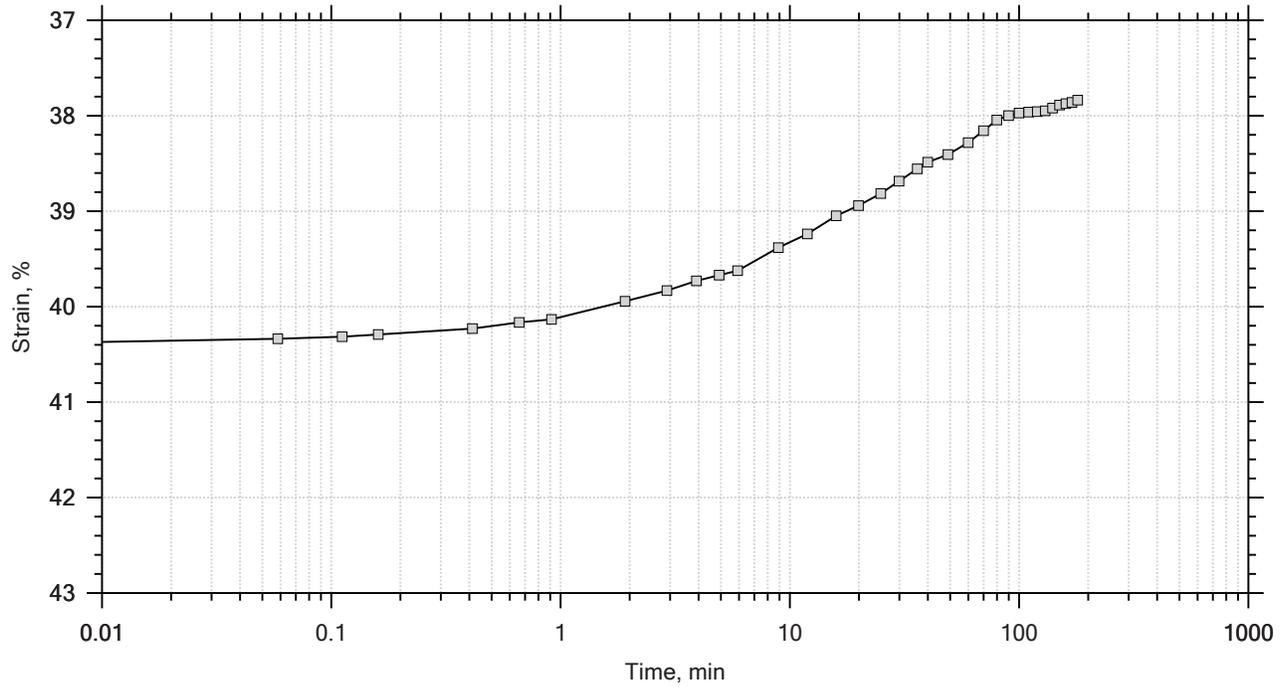
|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 11

Constant Load Step

Stress: 0.5 tsf



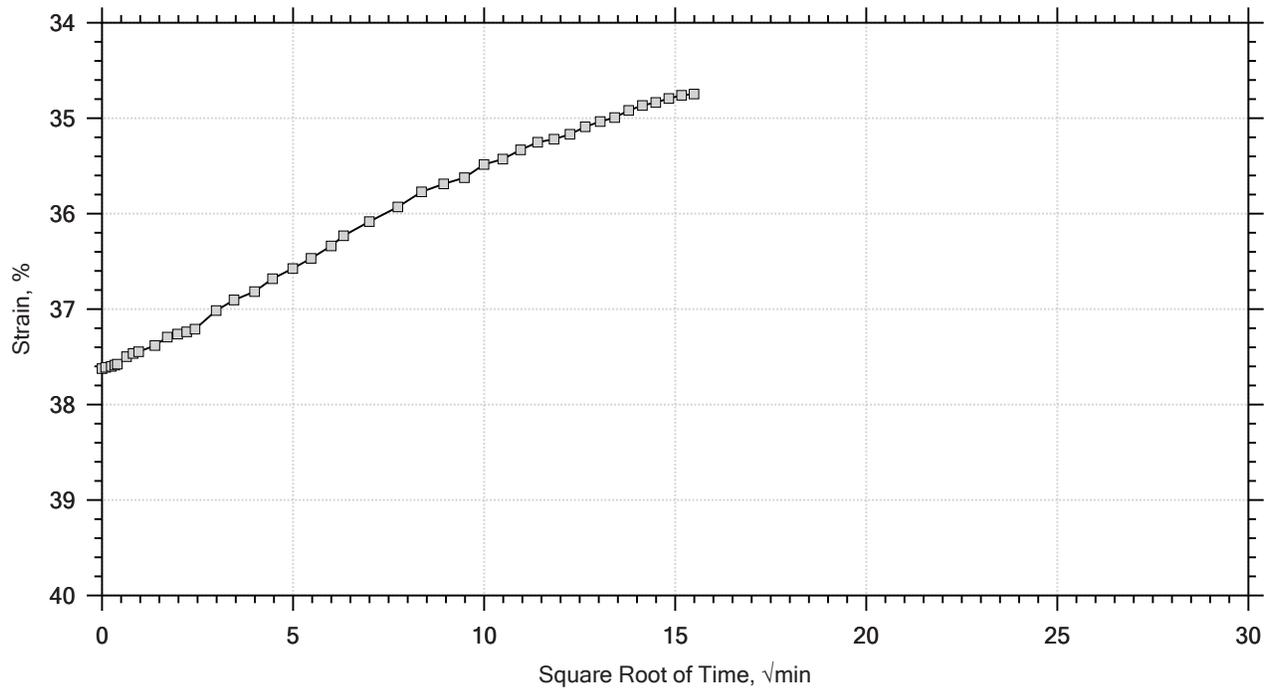
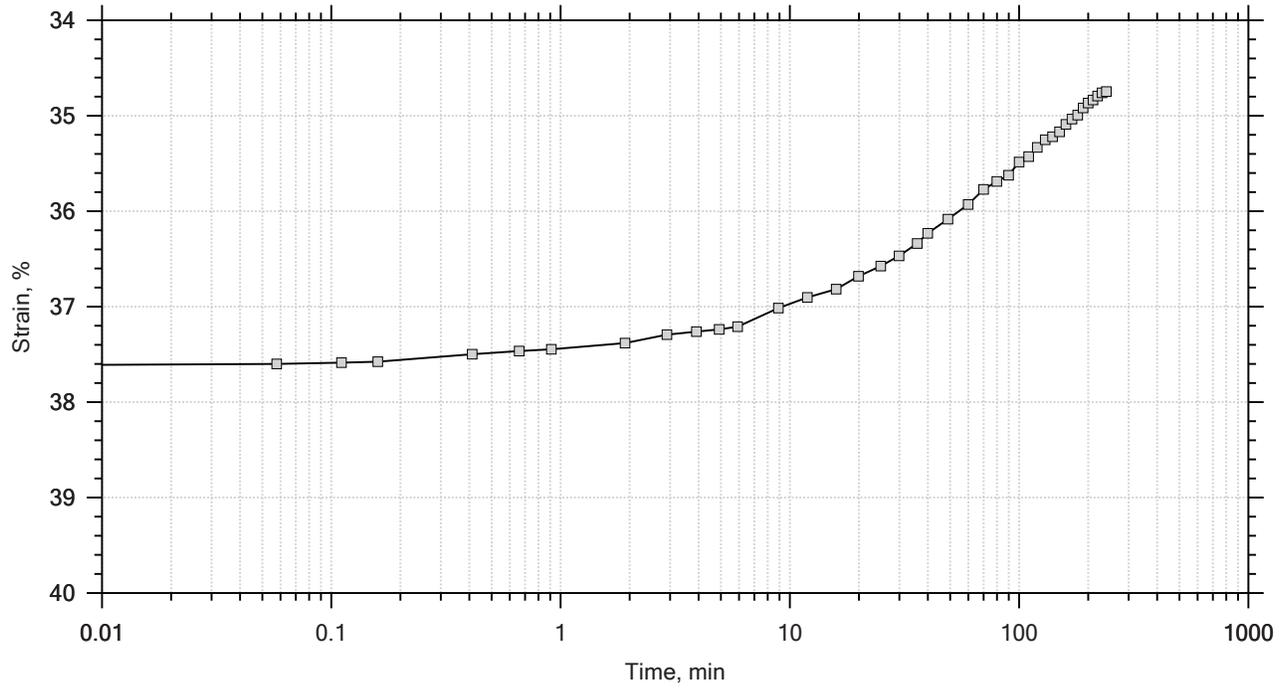
|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 11

Constant Load Step

Stress: 0.125 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

|                            |                                  |                      |
|----------------------------|----------------------------------|----------------------|
| Specimen Diameter: 2.50 in | Estimated Specific Gravity: 2.74 | Liquid Limit: 65     |
| Initial Height: 1.00 in    | Initial Void Ratio: 2.36         | Plastic Limit: 21    |
| Final Height: 0.70 in      | Final Void Ratio: 1.35           | Plasticity Index: 44 |

|                               | Before Test<br>Trimmings | Before Test<br>Specimen | After Test<br>Specimen | After Test<br>Trimmings |
|-------------------------------|--------------------------|-------------------------|------------------------|-------------------------|
| Container ID                  | 15994                    | RING                    |                        | B-295                   |
| Mass Container, gm            | 8.45                     | 110.11                  | 110.11                 | 8.28                    |
| Mass Container + Wet Soil, gm | 133.6                    | 231.62                  | 207.96                 | 105.89                  |
| Mass Container + Dry Soil, gm | 78.91                    | 175.58                  | 175.58                 | 73.59                   |
| Mass Dry Soil, gm             | 70.46                    | 65.471                  | 65.471                 | 65.31                   |
| Water Content, %              | 77.62                    | 85.59                   | 49.46                  | 49.46                   |
| Void Ratio                    | ---                      | 2.36                    | 1.35                   | ---                     |
| Degree of Saturation, %       | ---                      | 99.16                   | 100.00                 | ---                     |
| Dry Unit Weight, pcf          | ---                      | 50.811                  | 72.587                 | ---                     |

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: SU-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/24/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-5                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System V, Swell Pressure = 0.0704 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |









|            |                                            |              |            |
|------------|--------------------------------------------|--------------|------------|
| Client:    | F&ME Consultants                           | Project No:  | GTX-305005 |
| Project:   | US-21 Replacement Bridge over Harbor River |              |            |
| Location:  | ---                                        |              |            |
| Boring ID: | ---                                        | Sample Type: | ---        |
| Sample ID: | ---                                        | Test Date:   | 08/30/16   |
| Depth :    | ---                                        | Test Id:     | 387124     |
|            |                                            | Tested By:   | jbr        |
|            |                                            | Checked By:  | mcm        |

## Moisture Content of Soil and Rock - ASTM D2216

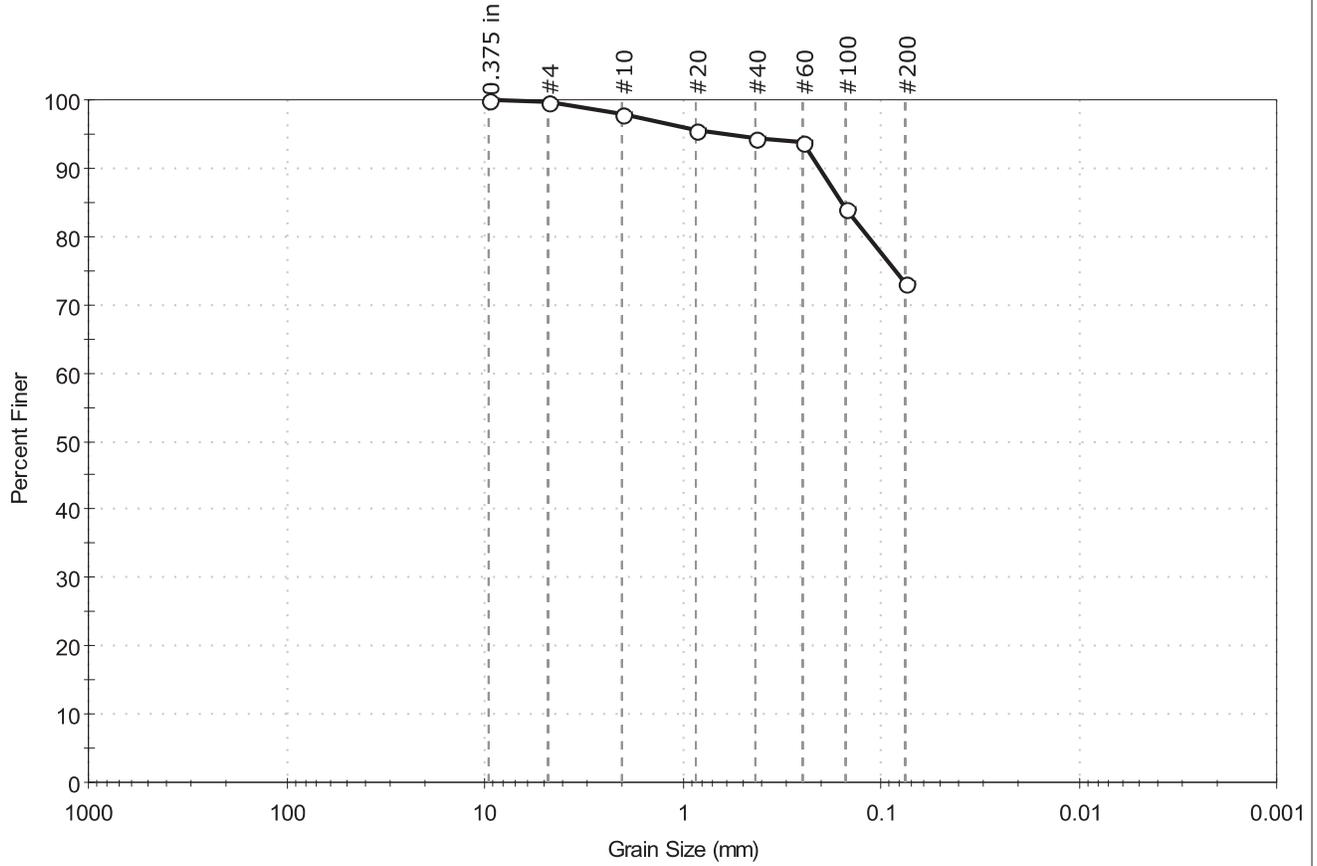
| Boring ID | Sample ID | Depth        | Description                 | Moisture Content, % |
|-----------|-----------|--------------|-----------------------------|---------------------|
| AP-1      | UD-2      | 18.0-20.0 ft | Moist, olive clay with sand | 86.3                |

Notes: Temperature of Drying : 110° Celsius



|                          |                                                     |                        |
|--------------------------|-----------------------------------------------------|------------------------|
| Client: F&ME Consultants | Project: US-21 Replacement Bridge over Harbor River | Project No: GTX-305005 |
| Location: ---            | Boring ID: AP-1                                     | Sample Type: tube      |
| Sample ID: UD-2          | Test Date: 08/24/16                                 | Tested By: jbr         |
| Depth: 18.0-20.0 ft      | Test Id: 387102                                     | Checked By: mcm        |
| Test Comment: ---        | Visual Description: Moist, olive clay with sand     | Sample Comment: ---    |

## Particle Size Analysis - ASTM D422



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 0.2      | 26.5   | 73.3               |

| 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           | 96            |               |          |
| #40        | 0.42           | 94            |               |          |
| #60        | 0.25           | 94            |               |          |
| #100       | 0.15           | 84            |               |          |
| #200       | 0.075          | 73            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.1582 mm | 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  |

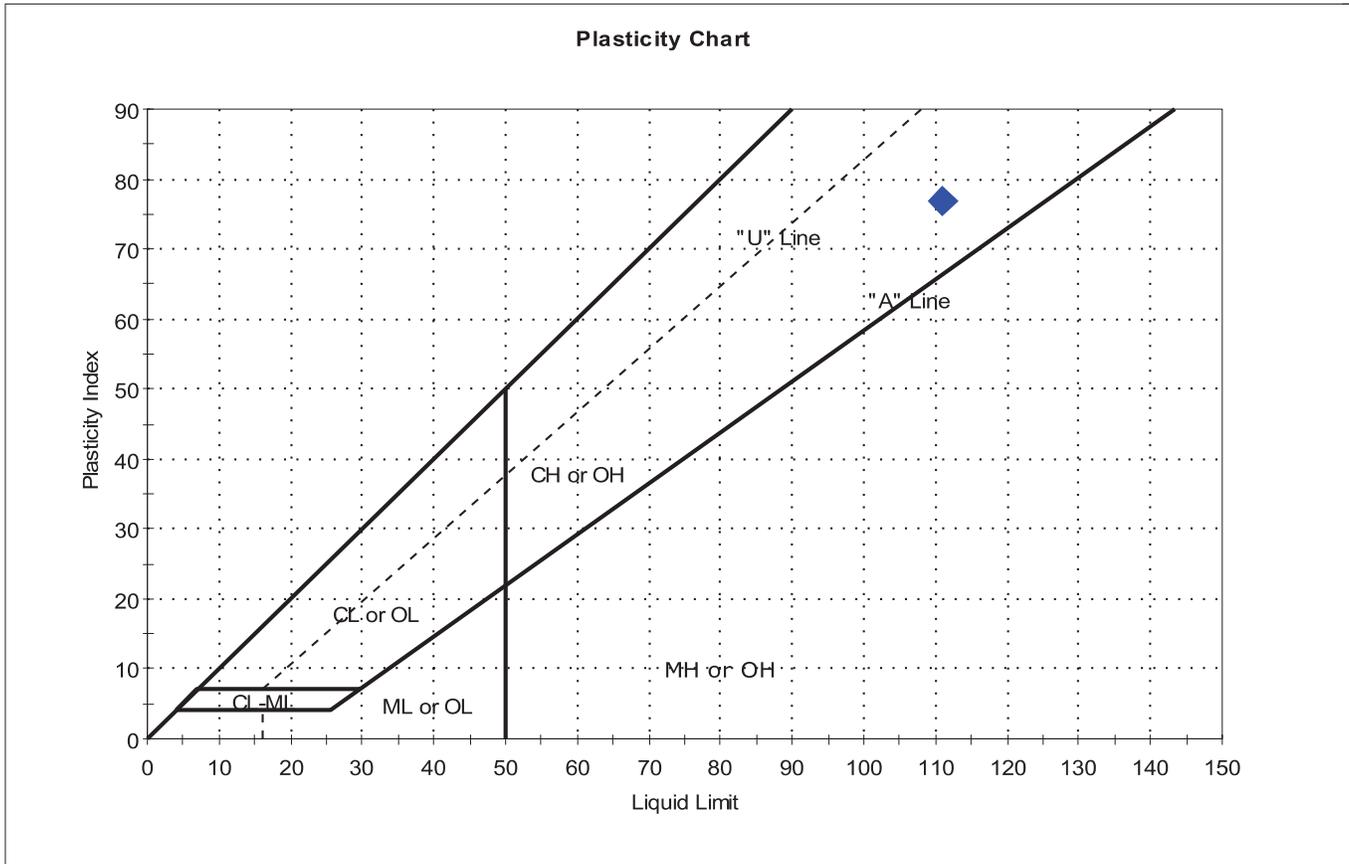
| <u>Classification</u> |                           |
|-----------------------|---------------------------|
| <u>ASTM</u>           | Fat clay with sand (CH)   |
| <u>AASHTO</u>         | Clayey Soils (A-7-5 (60)) |

| <u>Sample/Test Description</u>   |
|----------------------------------|
| Sand/Gravel Particle Shape : --- |
| Sand/Gravel Hardness : ---       |



|                     |                                            |              |            |
|---------------------|--------------------------------------------|--------------|------------|
| Client:             | F&ME Consultants                           | Project No:  | GTX-305005 |
| Project:            | US-21 Replacement Bridge over Harbor River | Tested By:   | cam        |
| Location:           | ---                                        | Checked By:  | mcm        |
| Boring ID:          | AP-1                                       | Sample Type: | tube       |
| Sample ID:          | UD-2                                       | Test Date:   | 08/26/16   |
| Depth:              | 18.0-20.0 ft                               | Test Id:     | 387110     |
| Test Comment:       | ---                                        |              |            |
| Visual Description: | Moist, olive clay with sand                |              |            |
| Sample Comment:     | ---                                        |              |            |

## Atterberg Limits - ASTM D4318



| Symbol | Sample ID | Boring | Depth        | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification     |
|--------|-----------|--------|--------------|-----------------------------|--------------|---------------|------------------|-----------------|-------------------------|
| ◆      | UD-2      | AP-1   | 18.0-20.0 ft | 86                          | 111          | 34            | 77               | 0.7             | Fat clay with sand (CH) |

Sample Prepared using the WET method  
 6% Retained on #40 Sieve  
 Dry Strength: VERY HIGH  
 Dilatancy: SLOW  
 Toughness: LOW



Client: F&M Consultants

Project Name: US-21 Replacement Bridge

Project Location: ---

Project Number: GTX-305005

Tested By: md

Checked By: mcm

Boring ID: AP-1

Preparation: Intact

Description: Moist, olive clay with sand

Classification: Fat clay with sand

Group Symbol: CH

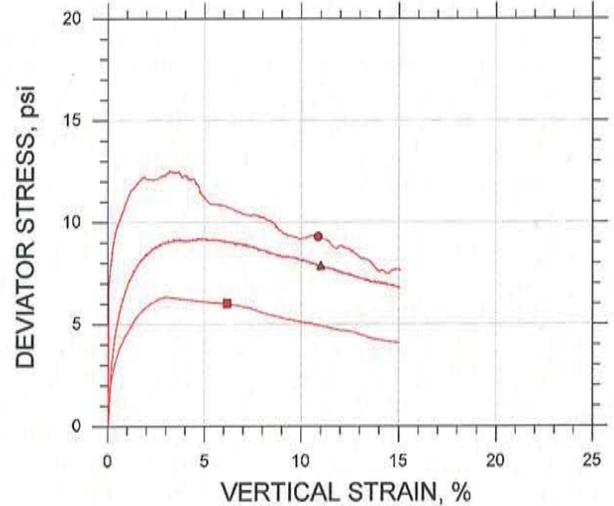
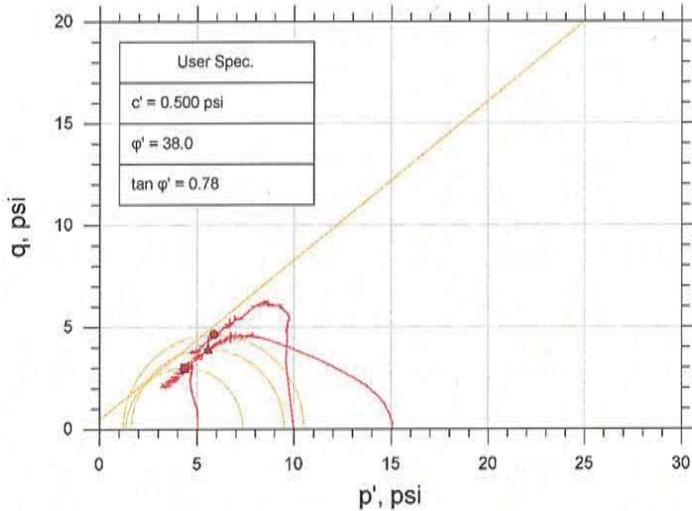
Liquid Limit: 111

Plastic Limit: 34

Plasticity Index: 77

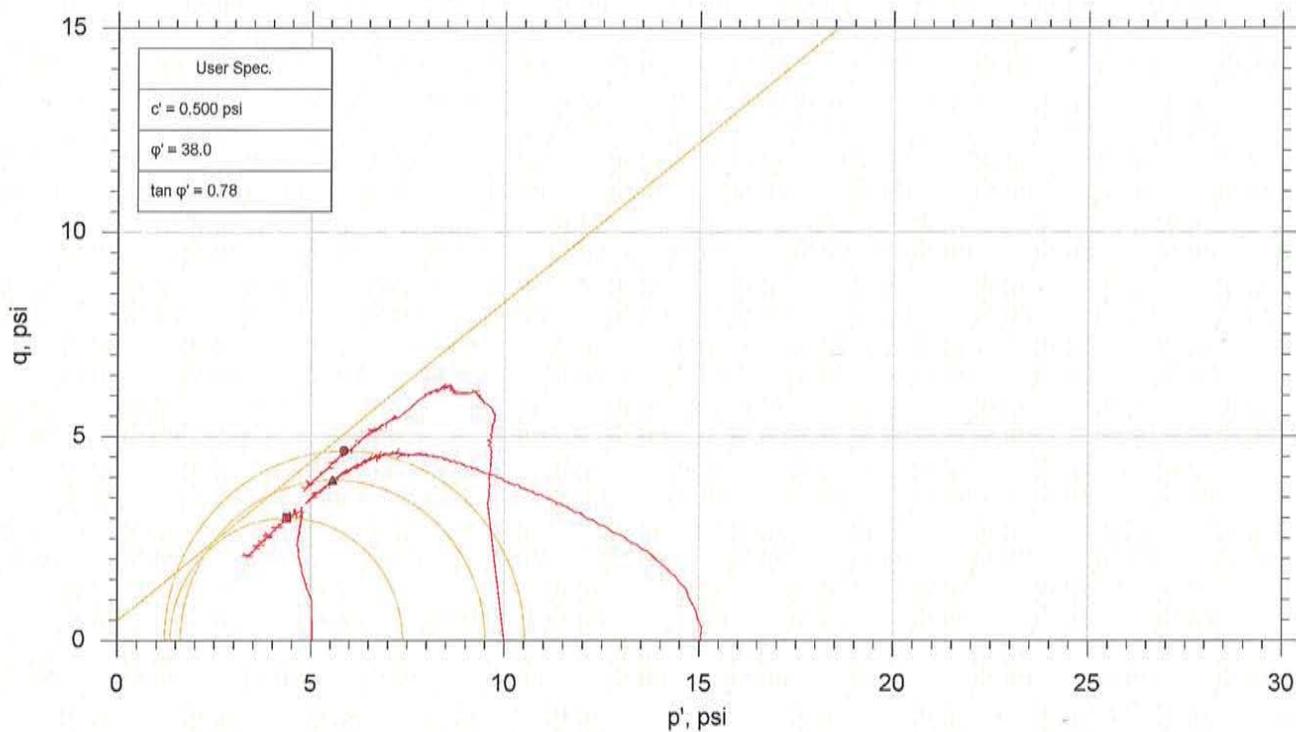
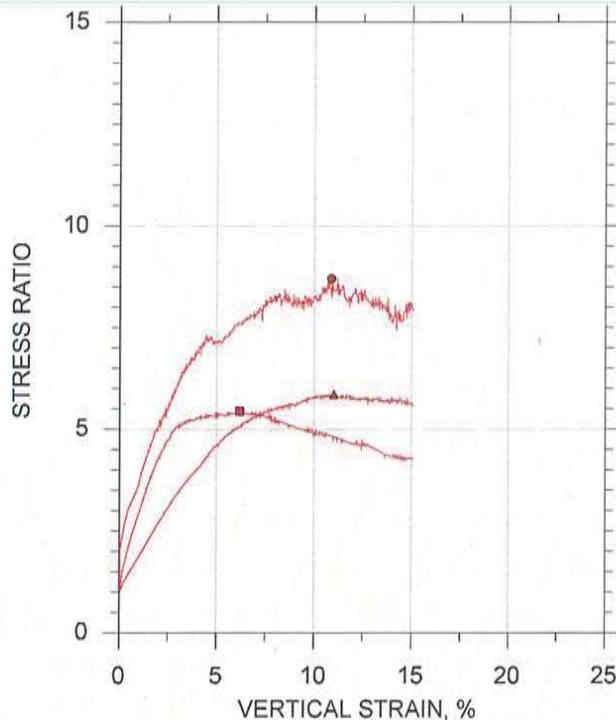
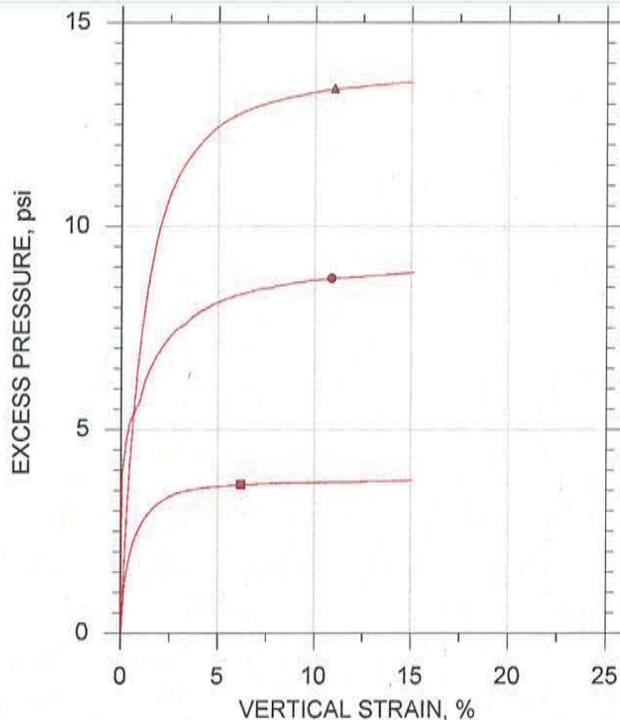
Estimated Specific Gravity: 2.7

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



| Symbol                                           | ■                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ●            | ▲            |       |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-------|
| Sample ID                                        | ST-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ST-2         | ST-2         |       |
| Depth, ft                                        | 18.0-20.0 ft                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 18.0-20.0 ft | 18.0-20.0 ft |       |
| Test Number                                      | CU-3-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CU-3-2       | CU-3-3       |       |
| Initial                                          | Height, in                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 4.550        | 4.540        | 4.490 |
|                                                  | Diameter, in                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2.030        | 2.030        | 2.030 |
|                                                  | Moisture Content (from Cuttings), %                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 71.3         | 84.8         | 84.8  |
|                                                  | Dry Density, pcf                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 55.7         | 46.4         | 49.5  |
|                                                  | Saturation (Wet Method), %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 95.0         | 87.0         | 95.0  |
|                                                  | Void Ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2.02         | 2.63         | 2.41  |
| Before Shear                                     | Moisture Content, %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 71.0         | 69.6         | 66.8  |
|                                                  | Dry Density, pcf                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 57.8         | 58.6         | 60.1  |
|                                                  | Cross-sectional Area (Method A), in <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3.123        | 2.614        | 2.723 |
|                                                  | Saturation, %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 100.0        | 100.0        | 100.0 |
|                                                  | Void Ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1.92         | 1.88         | 1.80  |
|                                                  | Back Pressure, psi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 127.0        | 29.02        | 28.99 |
| Vertical Effective Consolidation Stress, psi     | 5.008                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9.831        | 14.86        |       |
| Horizontal Effective Consolidation Stress, psi   | 5.009                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9.968        | 15.01        |       |
| Vertical Strain after Consolidation, %           | 0.03924                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1.773        | 2.088        |       |
| Volumetric Strain after Consolidation, %         | 3.576                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 20.60        | 17.44        |       |
| Time to 50% Consolidation, min                   | 148.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 458.0        | 342.3        |       |
| Shear Strength, psi                              | 3.011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4.650        | 3.939        |       |
| Strain at Failure, %                             | 6.18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 10.9         | 11.0         |       |
| Strain Rate, %/min                               | 0.01600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.01600      | 0.01600      |       |
| Deviator Stress at Failure, psi                  | 6.022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9.300        | 7.877        |       |
| Effective Minor Principal Stress at Failure, psi | 1.355                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1.207        | 1.622        |       |
| Effective Major Principal Stress at Failure, psi | 7.376                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10.51        | 9.499        |       |
| B-Value                                          | 0.95                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.99         | 0.95         |       |
| Notes:                                           | <ul style="list-style-type: none"> <li>- Before Shear Saturation set to 100% for phase calculation.</li> <li>- Moisture Content determined by ASTM D2216.</li> <li>- Atterberg Limits determined by ASTM D4318.</li> <li>- Deviator Stress includes membrane correction.</li> <li>- Values for c and <math>\phi</math> 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.</li> </ul> |              |              |       |
| Remarks:                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |              |       |

System T. Note CU-2-2 test specimen not used in determining cohesion or friction values.

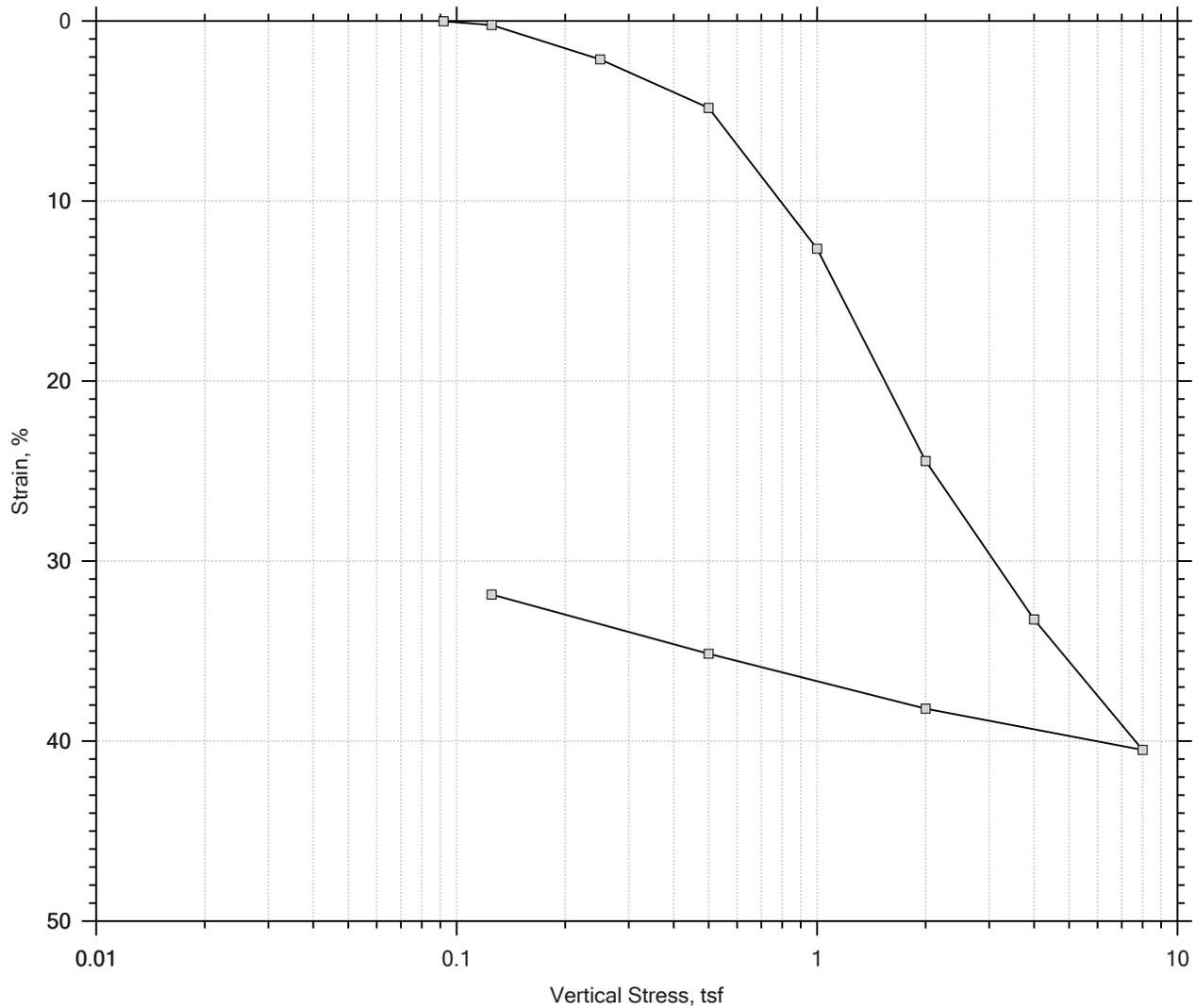


| Sample No. | Test No. | Depth  | Tested By    | Test Date | Checked By | Check Date | Test File |                    |
|------------|----------|--------|--------------|-----------|------------|------------|-----------|--------------------|
| ■          | ST-2     | CU-3-1 | 18.0-20.0 ft | md        | 8/22/16    | mcm        | 8/29/16   | 305005-CU-3-1m.dat |
| ●          | ST-2     | CU-3-2 | 18.0-20.0 ft | md        | 8/22/16    | mcm        | 8/29/16   | 305005-CU-3-2m.dat |
| ▲          | ST-2     | CU-3-3 | 18.0-20.0 ft | md        | 8/22/16    | mcm        | 8/29/16   | 305005-CU-3-3m.dat |

|  |                                                                                                   |                     |                         |
|--|---------------------------------------------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                                                                 | Location: --        | Project No.: GTX-305005 |
|  | Boring No.: AP-1                                                                                  | Sample Type: Intact |                         |
|  | Description: Moist, olive clay with sand                                                          |                     |                         |
|  | Remarks: System T. Note CU-2-2 test specimen not used in determining cohesion or friction values. |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

## Summary Report

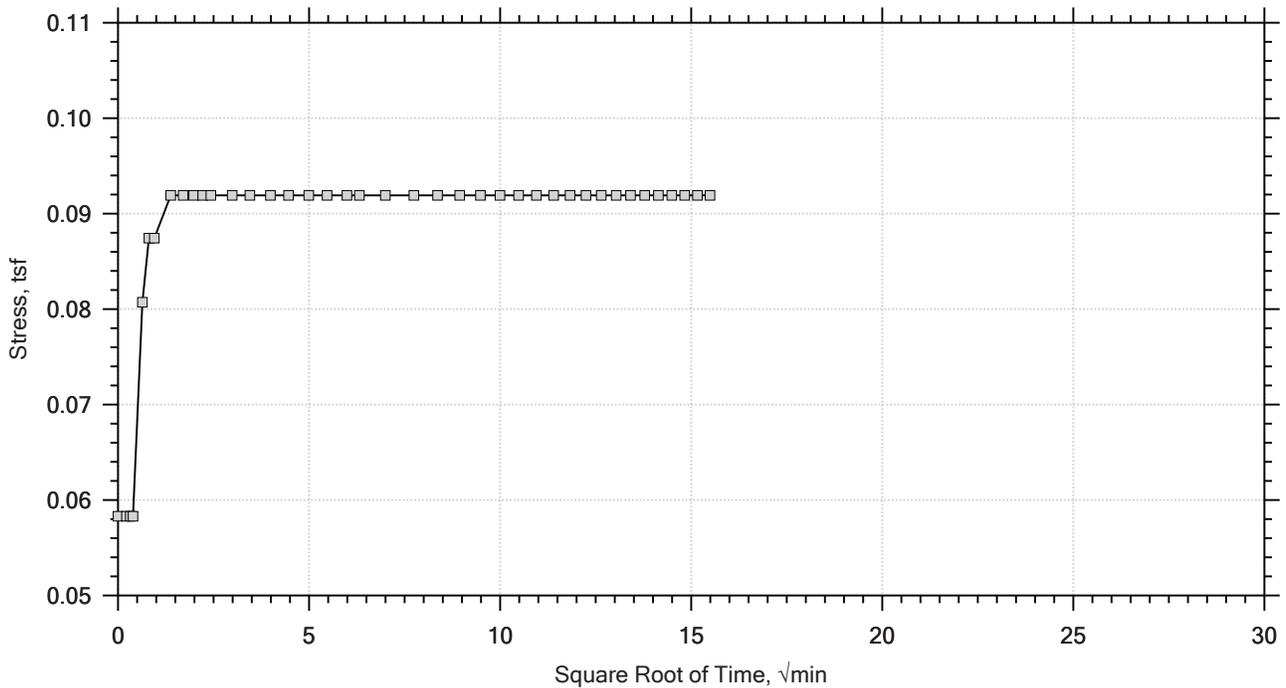
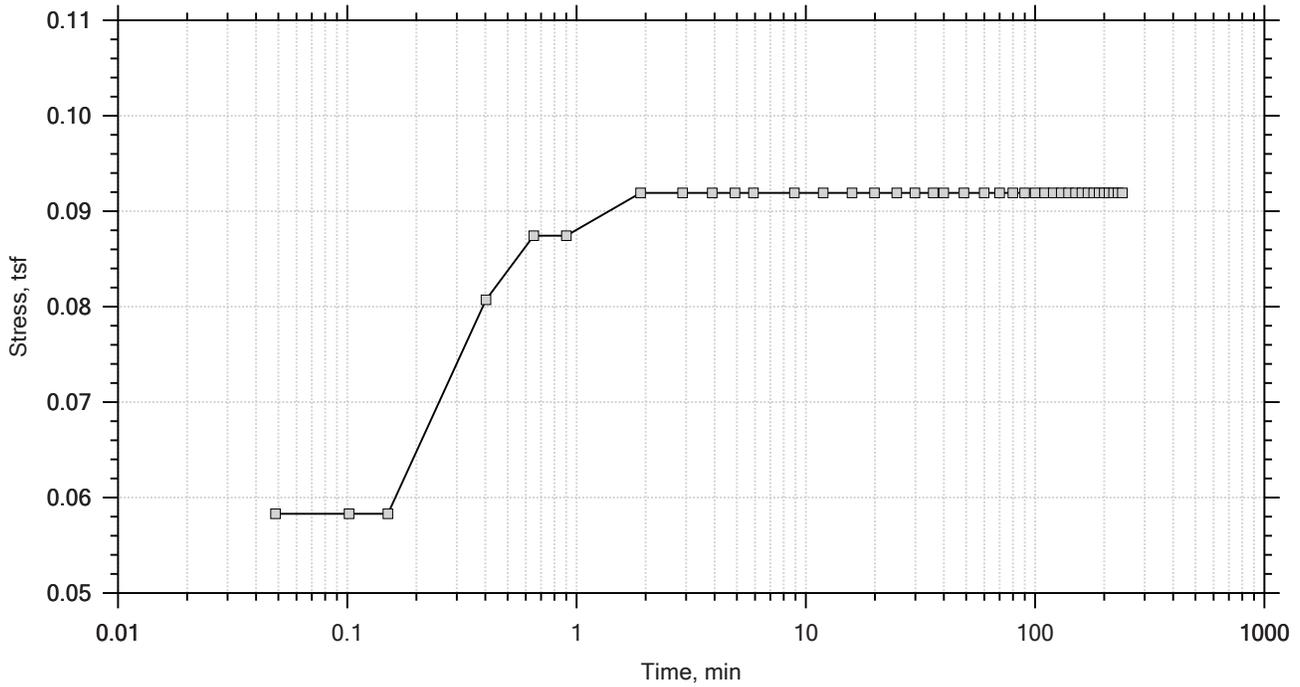


|                                        |        |              |          | Before Test          | After Test |        |
|----------------------------------------|--------|--------------|----------|----------------------|------------|--------|
| Current Vertical Effective Stress: --- |        |              |          | Water Content, %     | 89.14      | 52.62  |
| Preconsolidation Stress: ---           |        |              |          | Dry Unit Weight, pcf | 48.913     | 69.876 |
| Compression Ratio: ---                 |        |              |          | Saturation, %        | 98.06      | 100.00 |
| Diameter: 2.5 in                       |        | Height: 1 in |          | Void Ratio           | 2.48       | 1.43   |
| LL: 111                                | PL: 34 | PI: 77       | GS: 2.72 |                      |            |        |

|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     | Displacement at End of Increment               |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

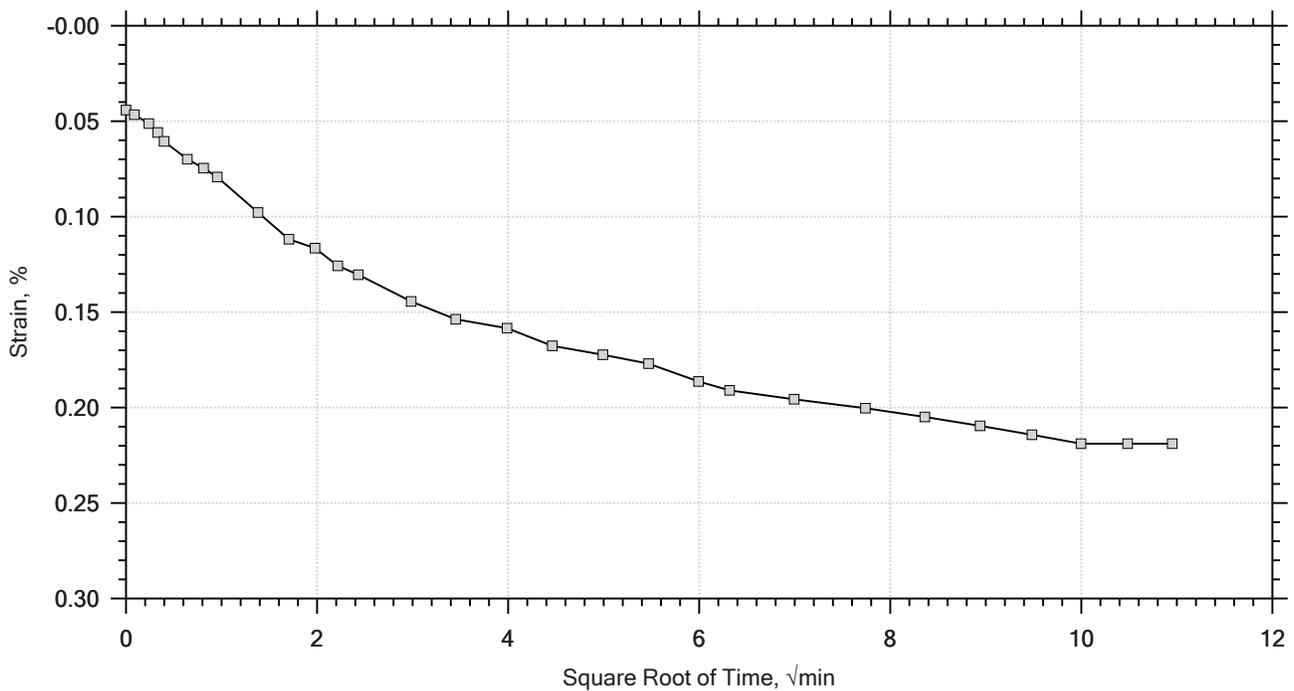
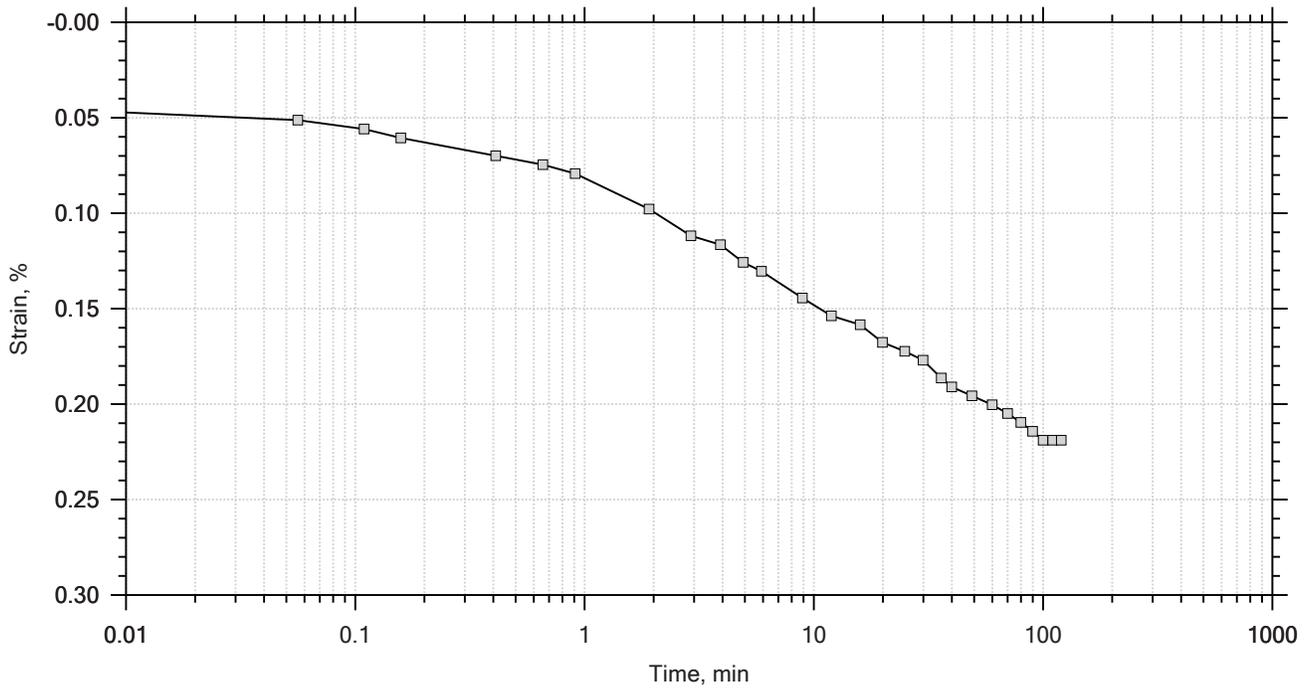
Time Curve 1 of 11  
 Constant Volume Step  
 Stress: 0.0919 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 11  
 Constant Load Step  
 Stress: 0.125 tsf

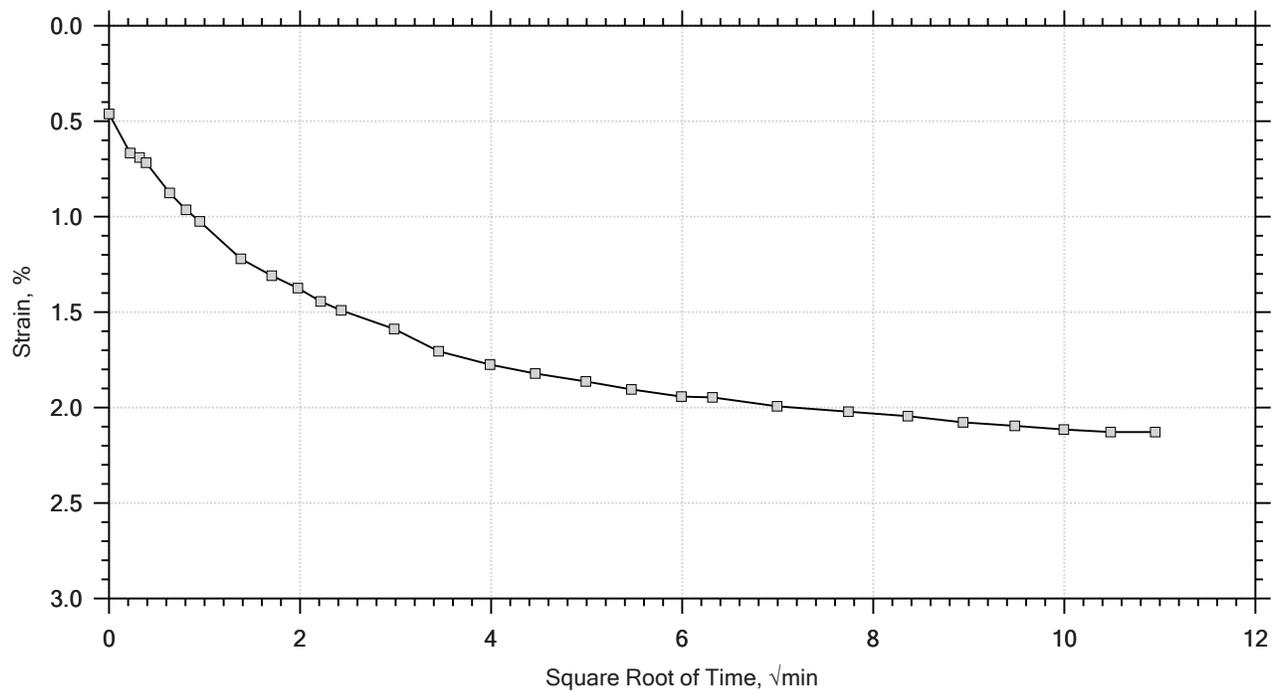
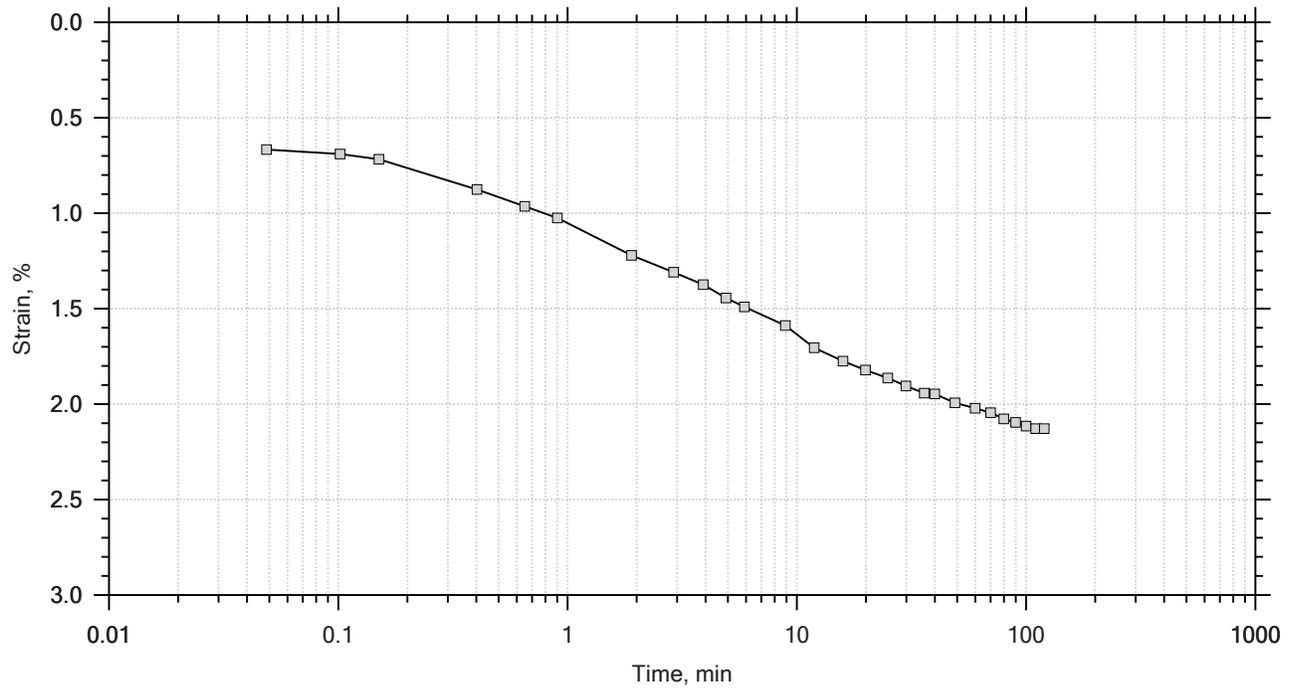


|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |



# One-Dimensional Consolidation by ASTM D2435 - Method B

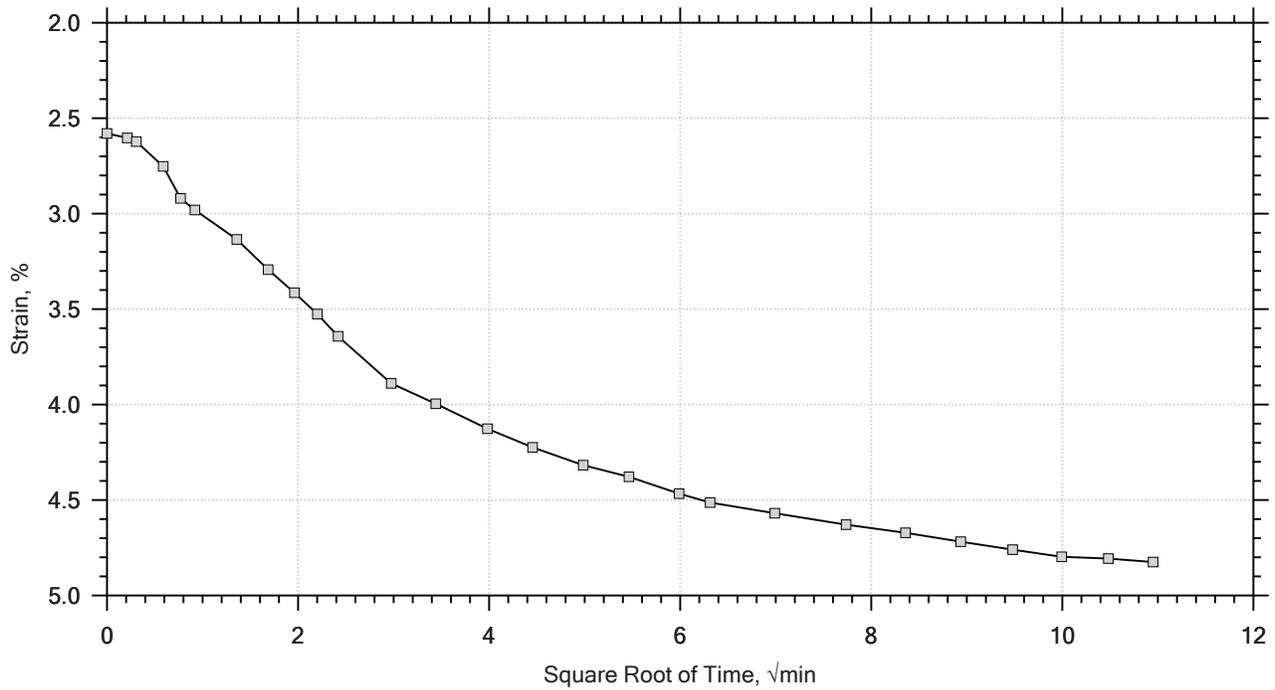
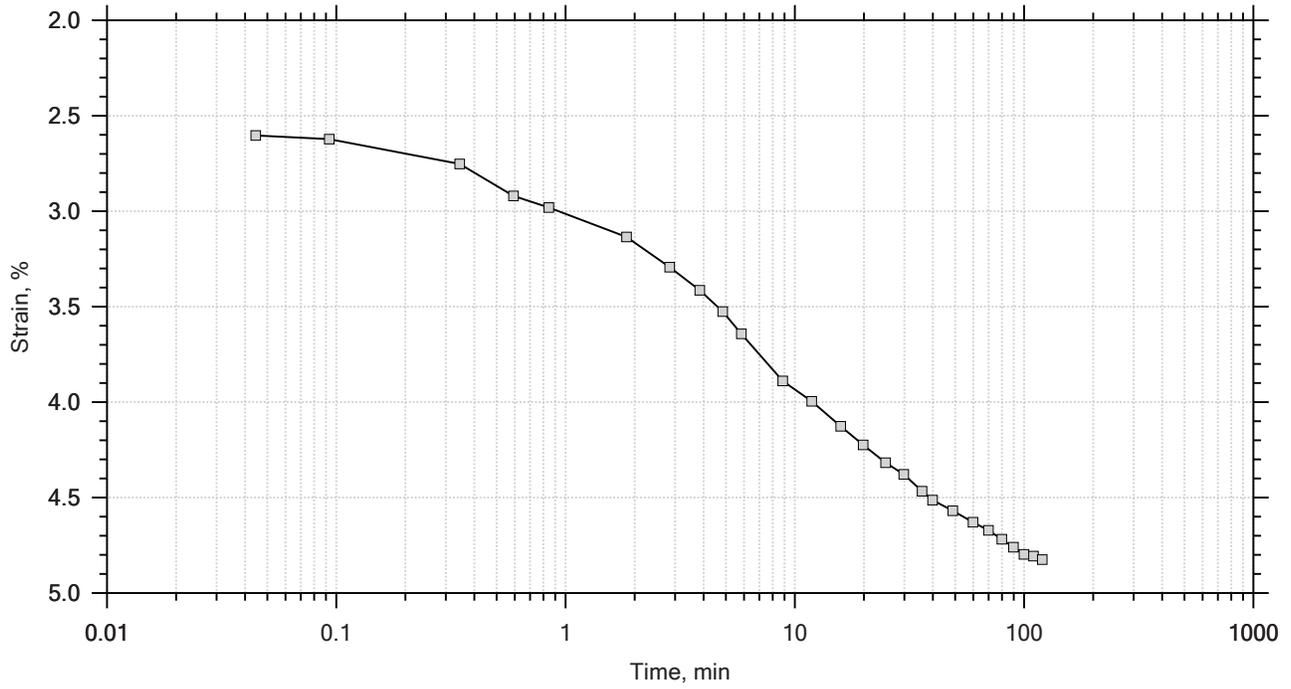
Time Curve 3 of 11  
 Constant Load Step  
 Stress: 0.25 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

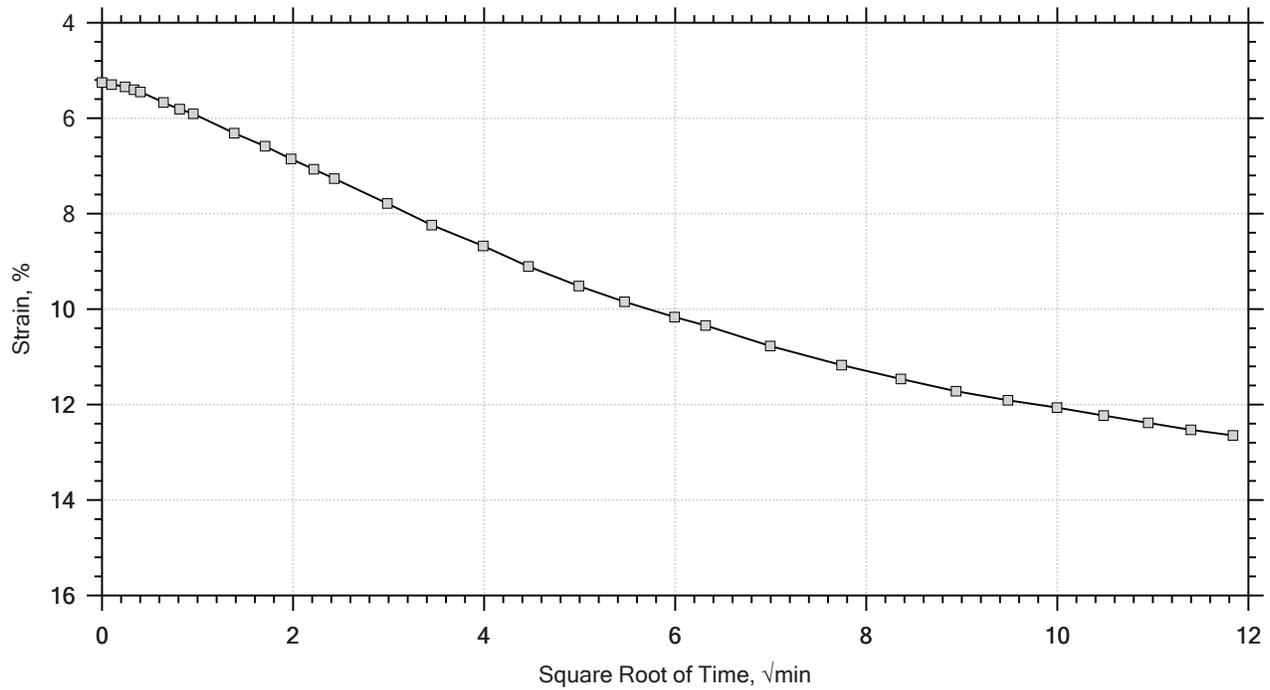
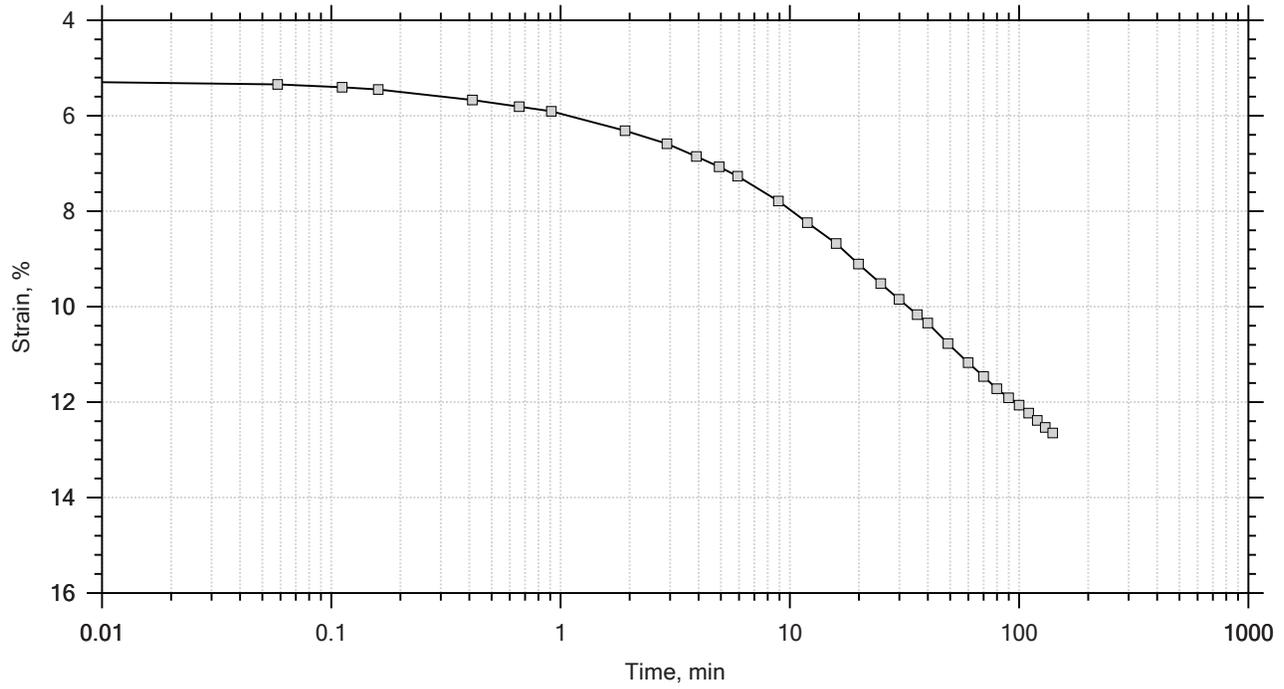
Time Curve 4 of 11  
 Constant Load Step  
 Stress: 0.5 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

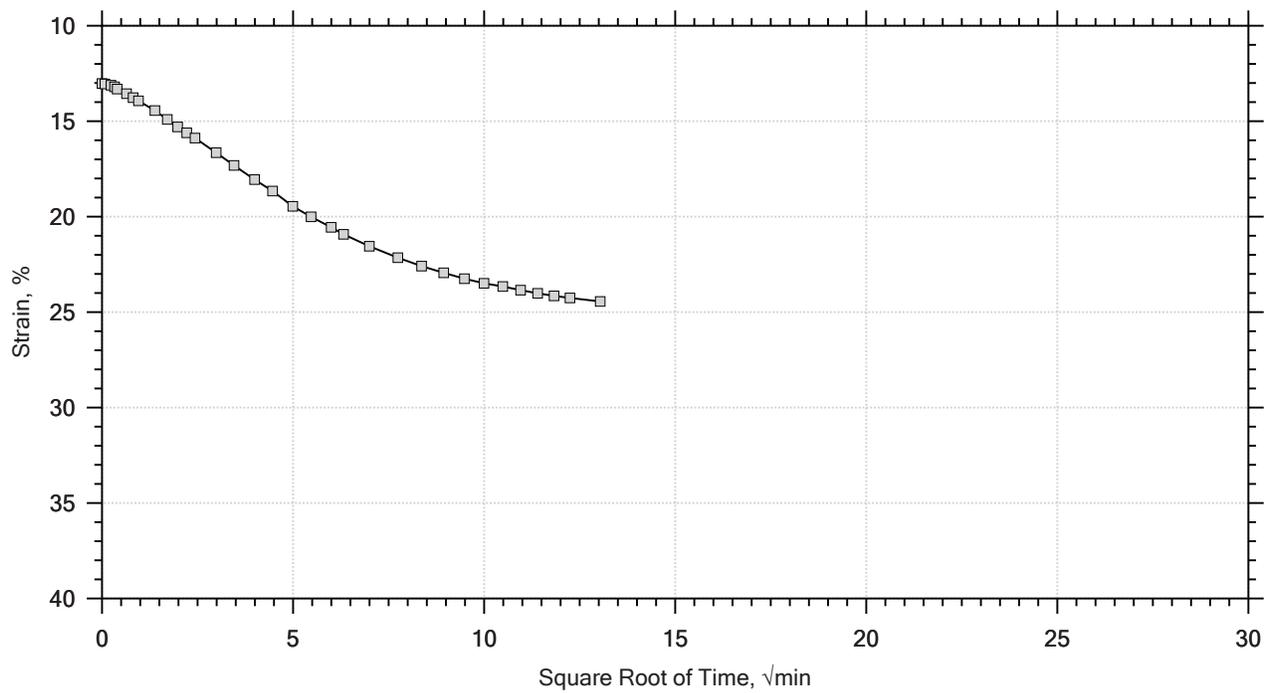
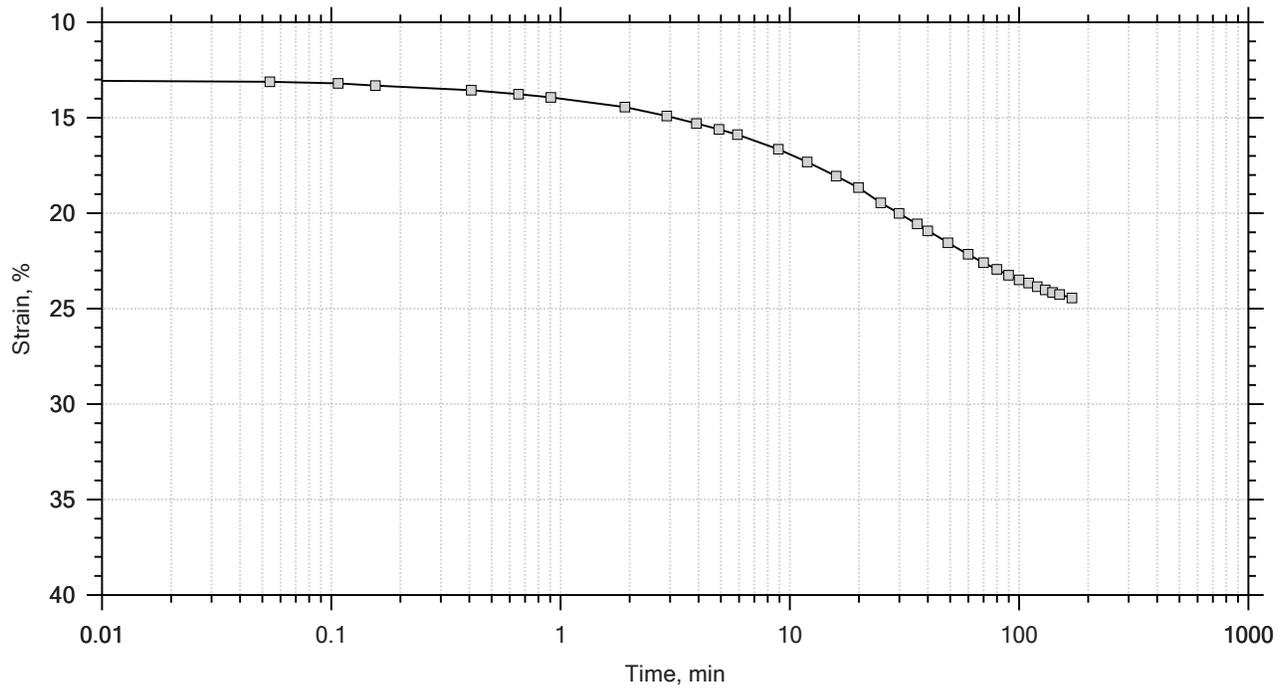
Time Curve 5 of 11  
 Constant Load Step  
 Stress: 1 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

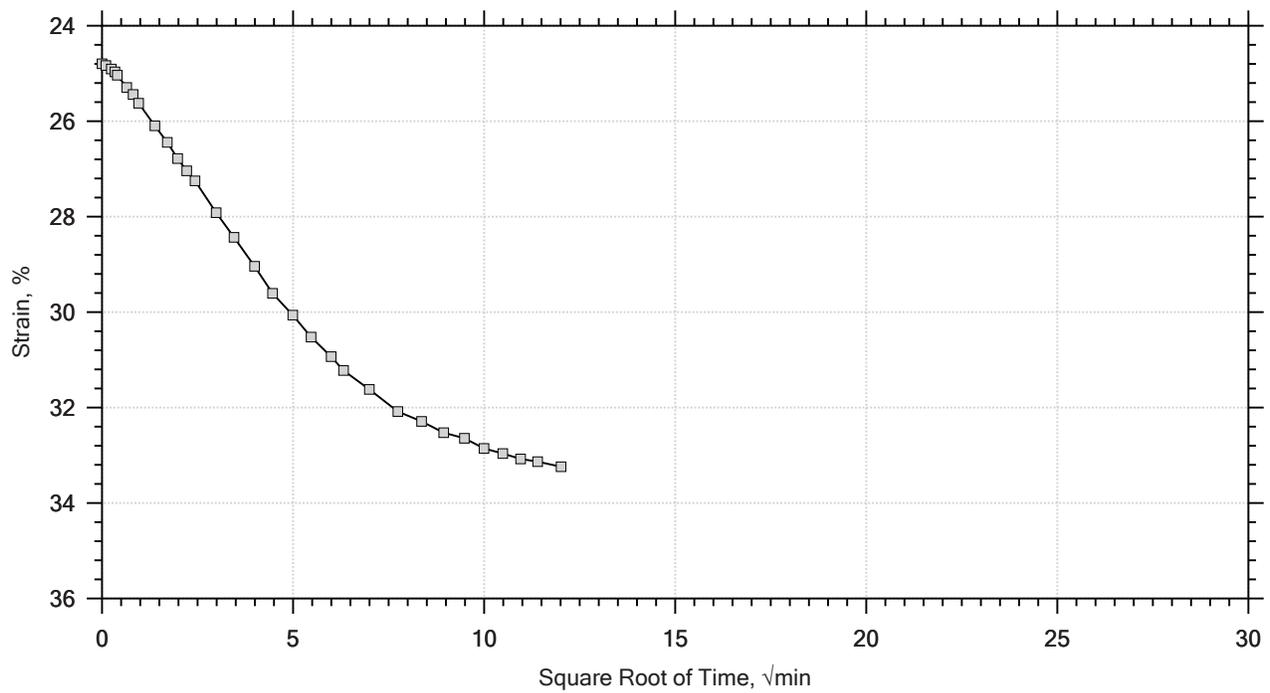
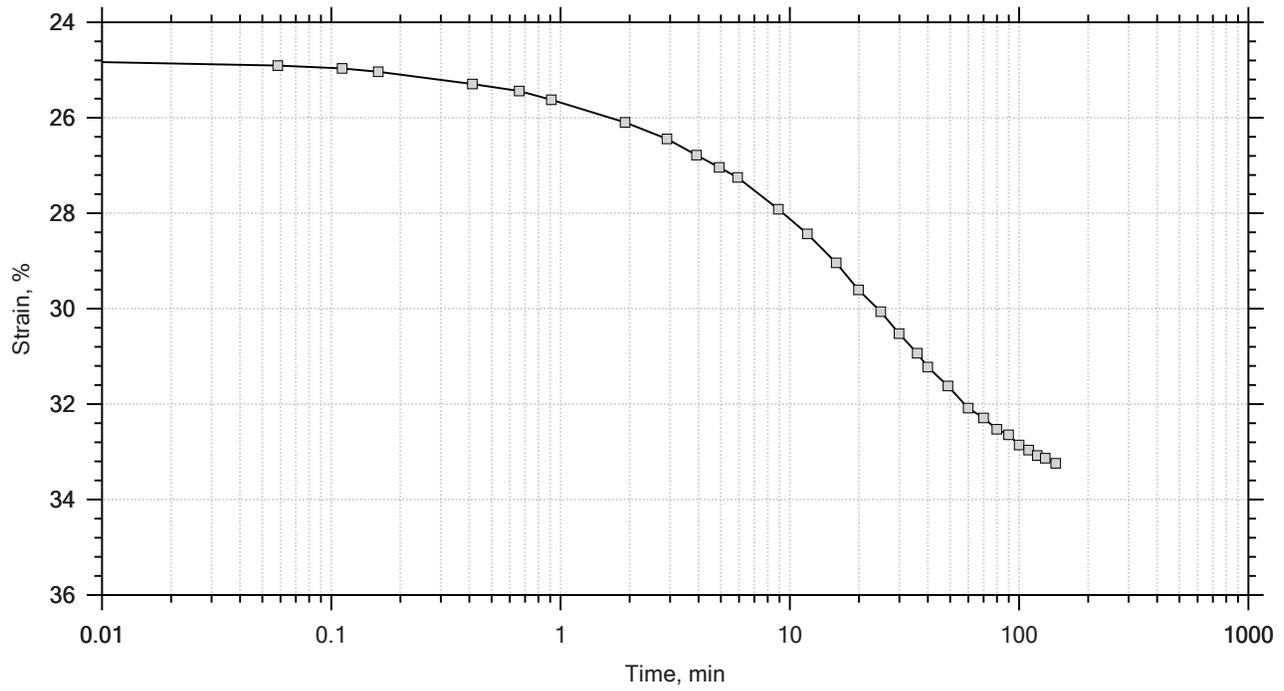
Time Curve 6 of 11  
 Constant Load Step  
 Stress: 2 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

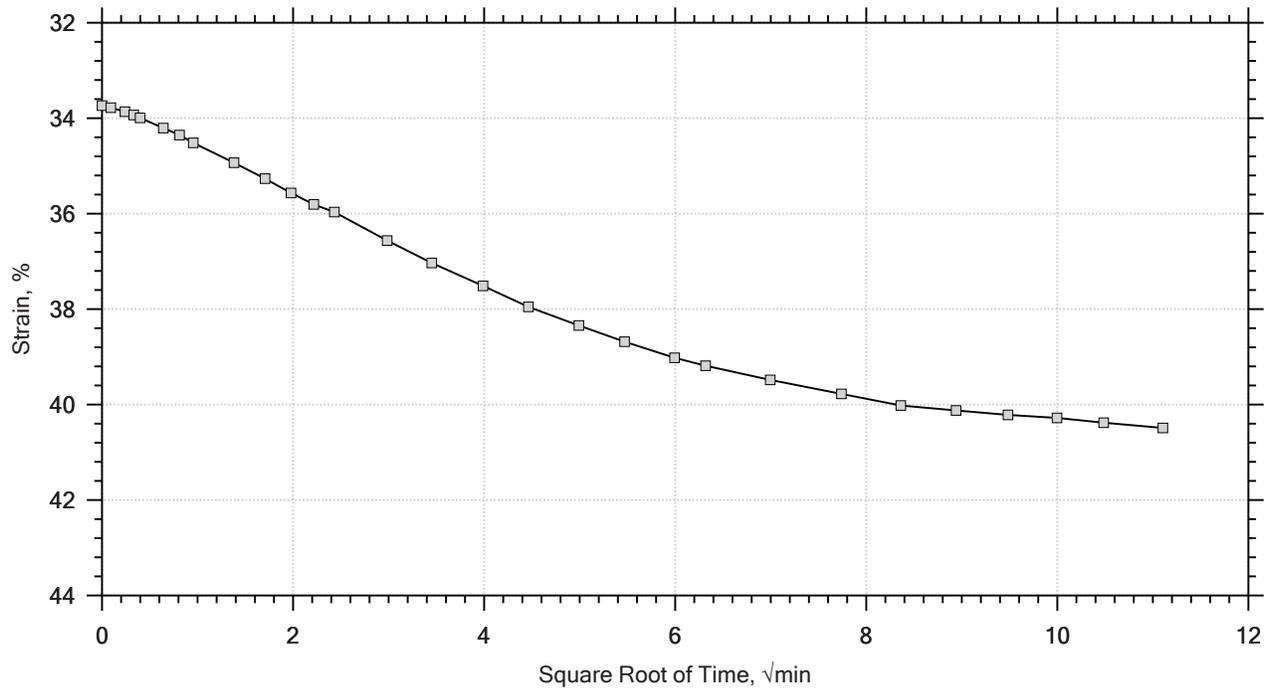
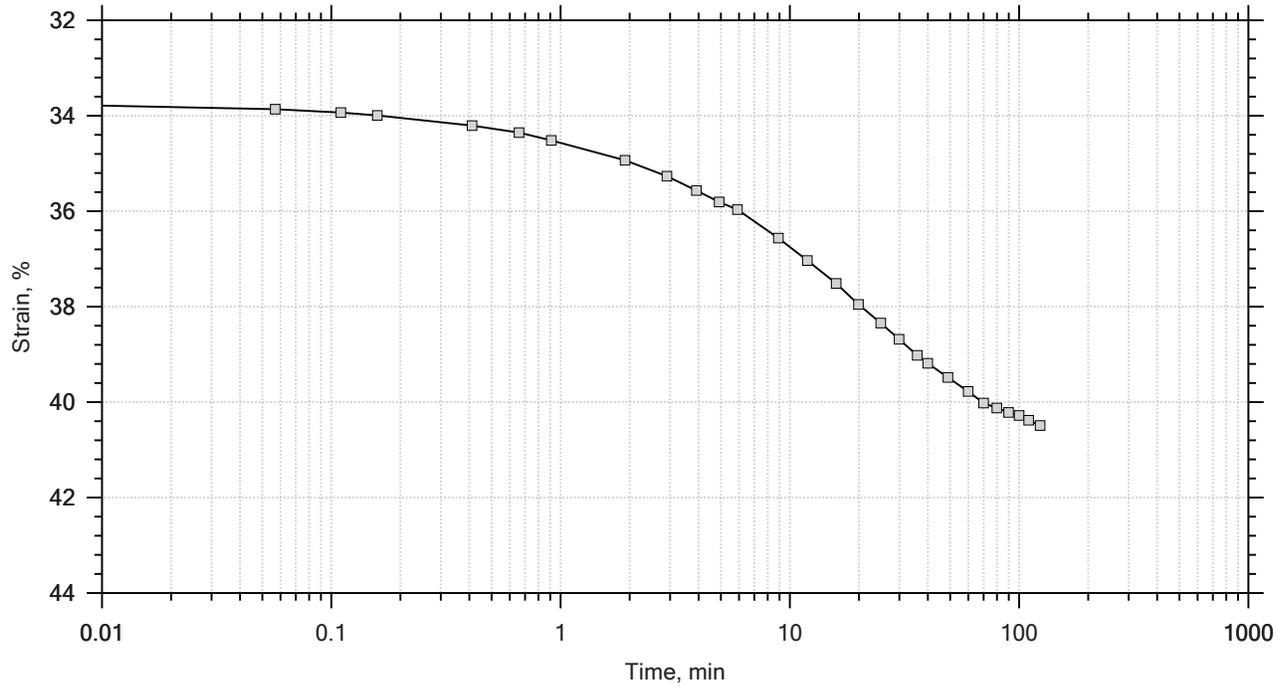
Time Curve 7 of 11  
 Constant Load Step  
 Stress: 4 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

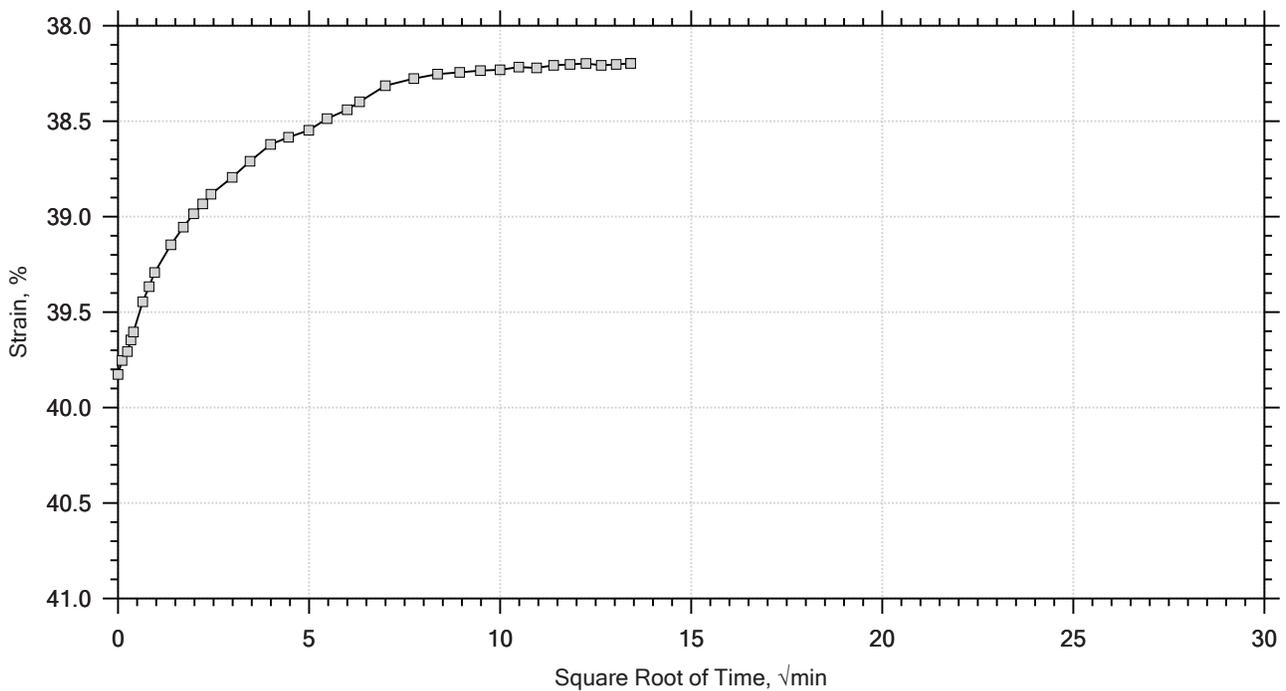
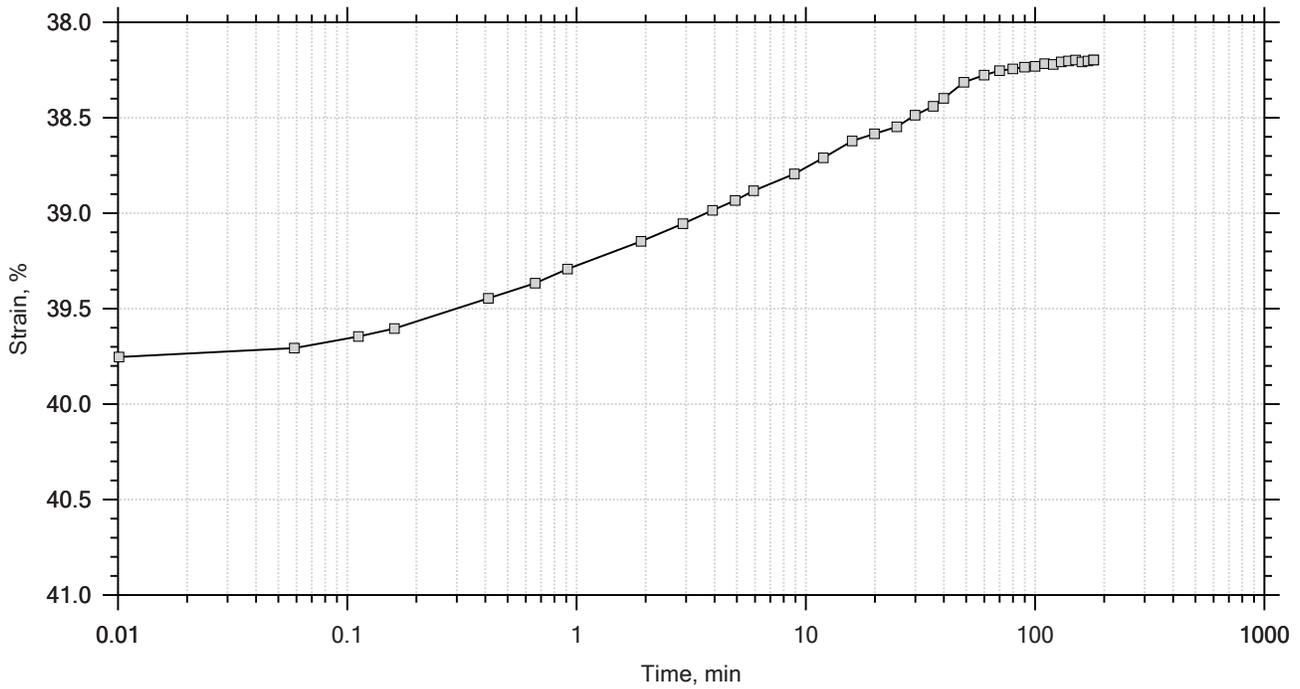
Time Curve 8 of 11  
 Constant Load Step  
 Stress: 8 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

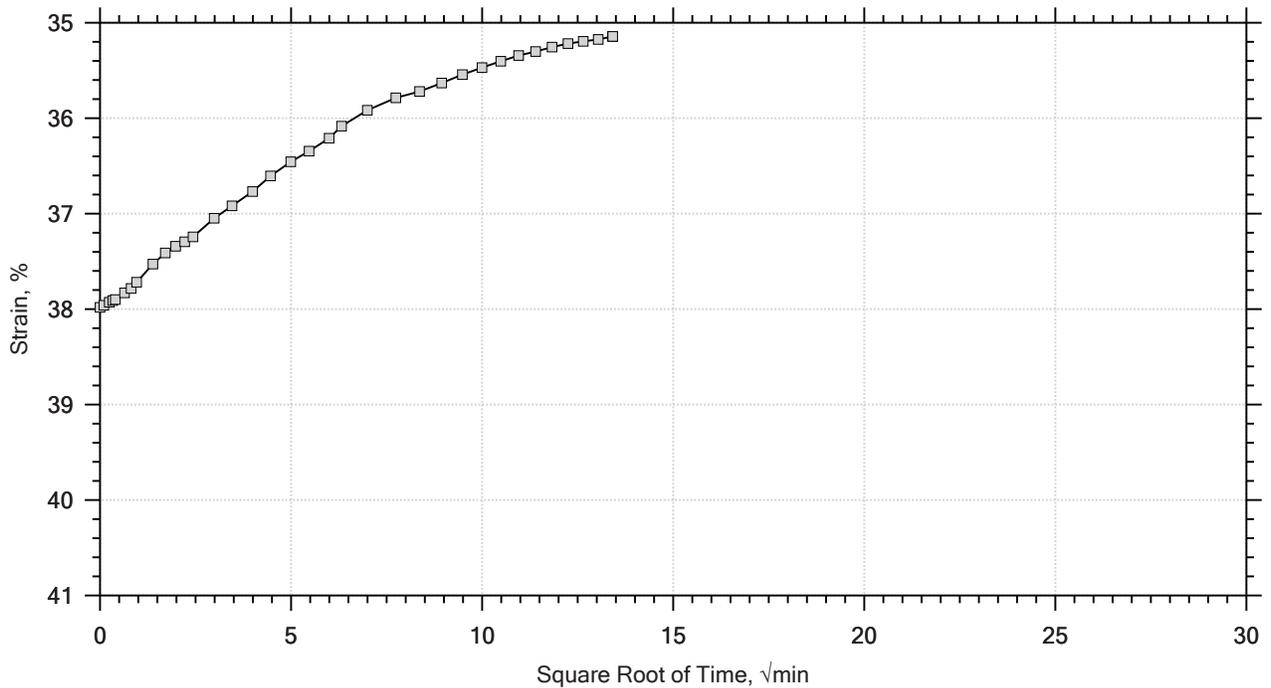
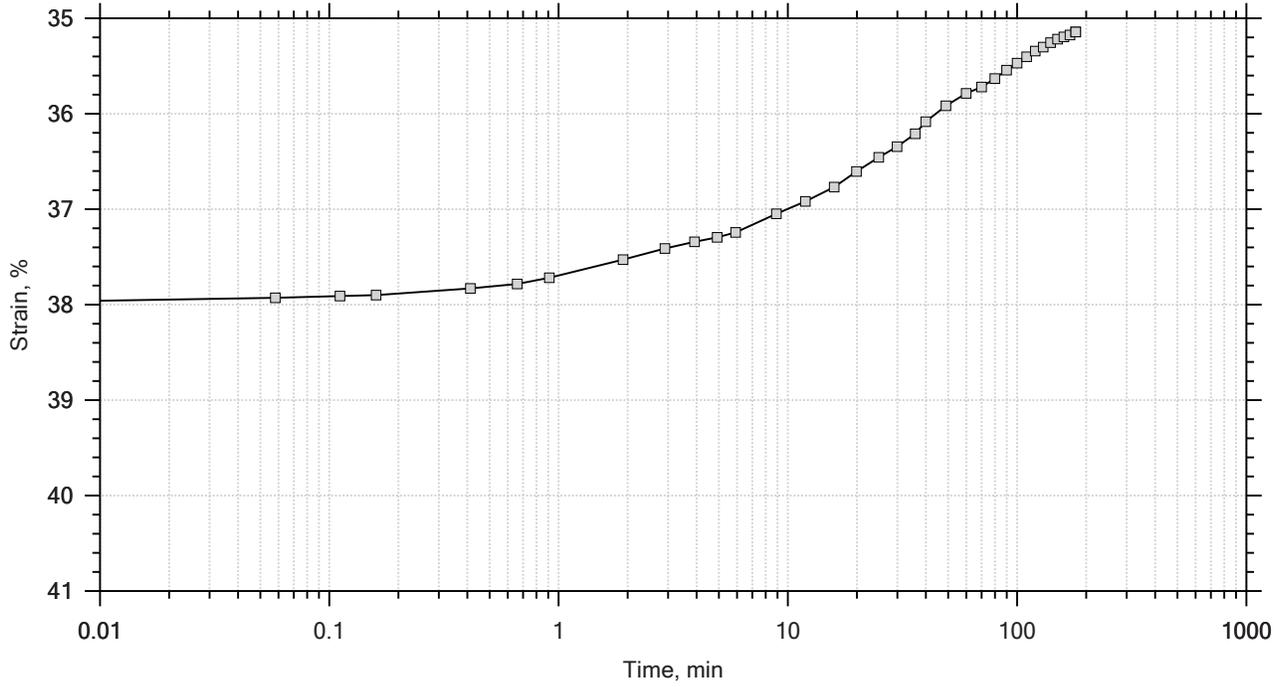
Time Curve 9 of 11  
 Constant Load Step  
 Stress: 2 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 11  
 Constant Load Step  
 Stress: 0.5 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

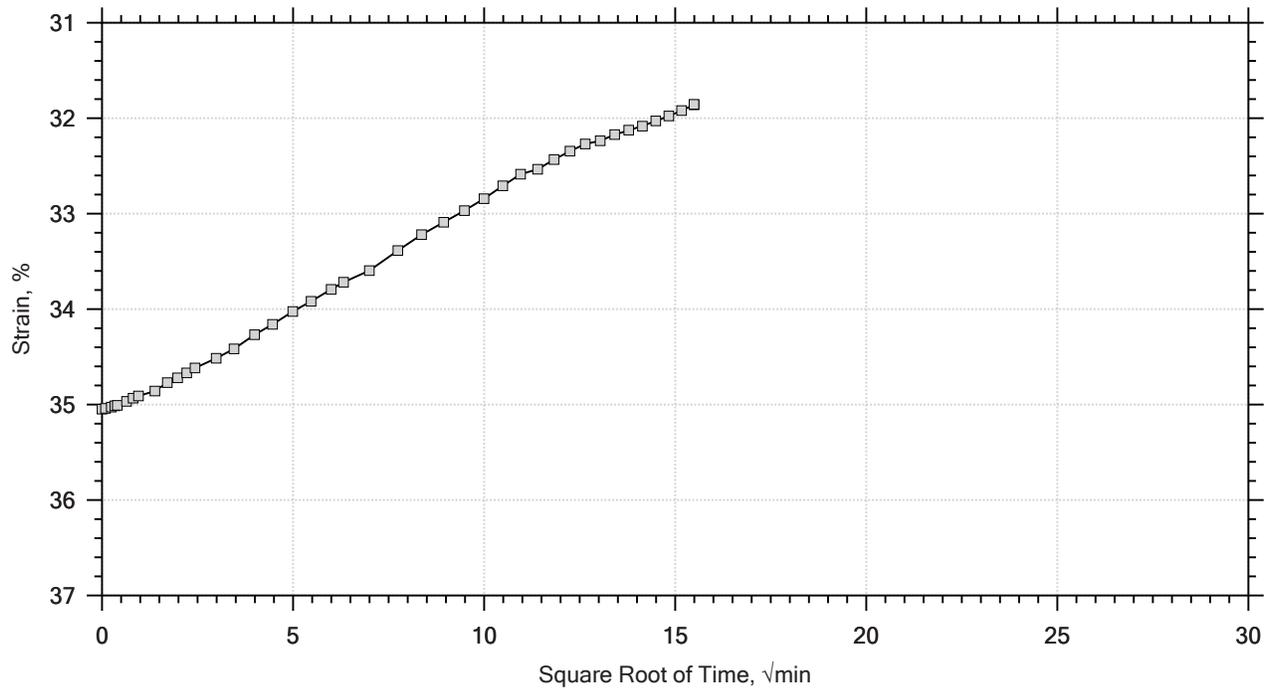
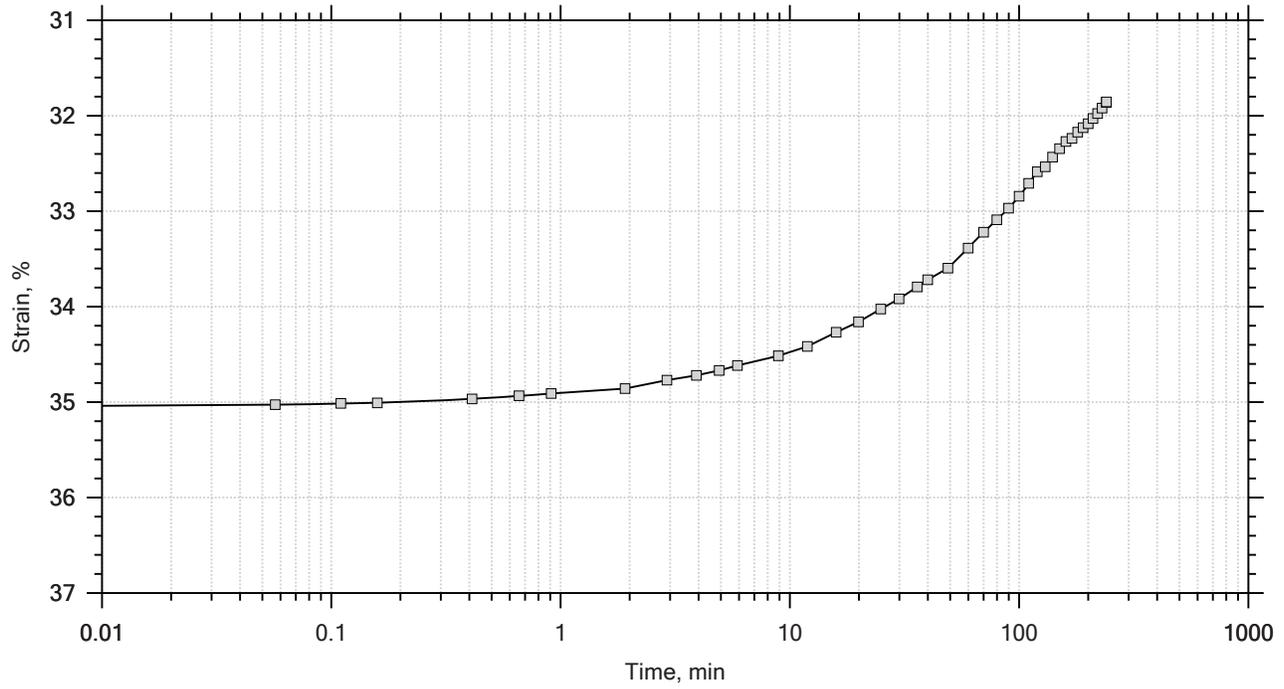


# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 11

Constant Load Step

Stress: 0.125 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

|                            |                                  |                      |
|----------------------------|----------------------------------|----------------------|
| Specimen Diameter: 2.50 in | Estimated Specific Gravity: 2.72 | Liquid Limit: 111    |
| Initial Height: 1.00 in    | Initial Void Ratio: 2.48         | Plastic Limit: 34    |
| Final Height: 0.70 in      | Final Void Ratio: 1.43           | Plasticity Index: 77 |

|                               | Before Test<br>Trimmings | Before Test<br>Specimen | After Test<br>Specimen | After Test<br>Trimmings |
|-------------------------------|--------------------------|-------------------------|------------------------|-------------------------|
| Container ID                  | 15389                    | RING                    |                        | C-1647                  |
| Mass Container, gm            | 8.21                     | 109.02                  | 109.02                 | 8.42                    |
| Mass Container + Wet Soil, gm | 241.13                   | 228.23                  | 205.21                 | 99.61                   |
| Mass Container + Dry Soil, gm | 141.82                   | 172.05                  | 172.05                 | 68.17                   |
| Mass Dry Soil, gm             | 133.61                   | 63.026                  | 63.026                 | 59.75                   |
| Water Content, %              | 74.33                    | 89.14                   | 52.62                  | 52.62                   |
| Void Ratio                    | ---                      | 2.48                    | 1.43                   | ---                     |
| Degree of Saturation, %       | ---                      | 98.06                   | 100.00                 | ---                     |
| Dry Unit Weight, pcf          | ---                      | 48.913                  | 69.876                 | ---                     |

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-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-1                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-3                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System R, Swell Pressure = 0.0919 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |







|            |                                            |              |            |
|------------|--------------------------------------------|--------------|------------|
| Client:    | F&ME Consultants                           | Project No:  | GTX-305005 |
| Project:   | US-21 Replacement Bridge over Harbor River |              |            |
| Location:  | ---                                        |              |            |
| Boring ID: | ---                                        | Sample Type: | ---        |
| Sample ID: | ---                                        | Test Date:   | 08/30/16   |
| Depth :    | ---                                        | Test Id:     | 387124     |
|            |                                            | Tested By:   | jbr        |
|            |                                            | Checked By:  | mcm        |

## Moisture Content of Soil and Rock - ASTM D2216

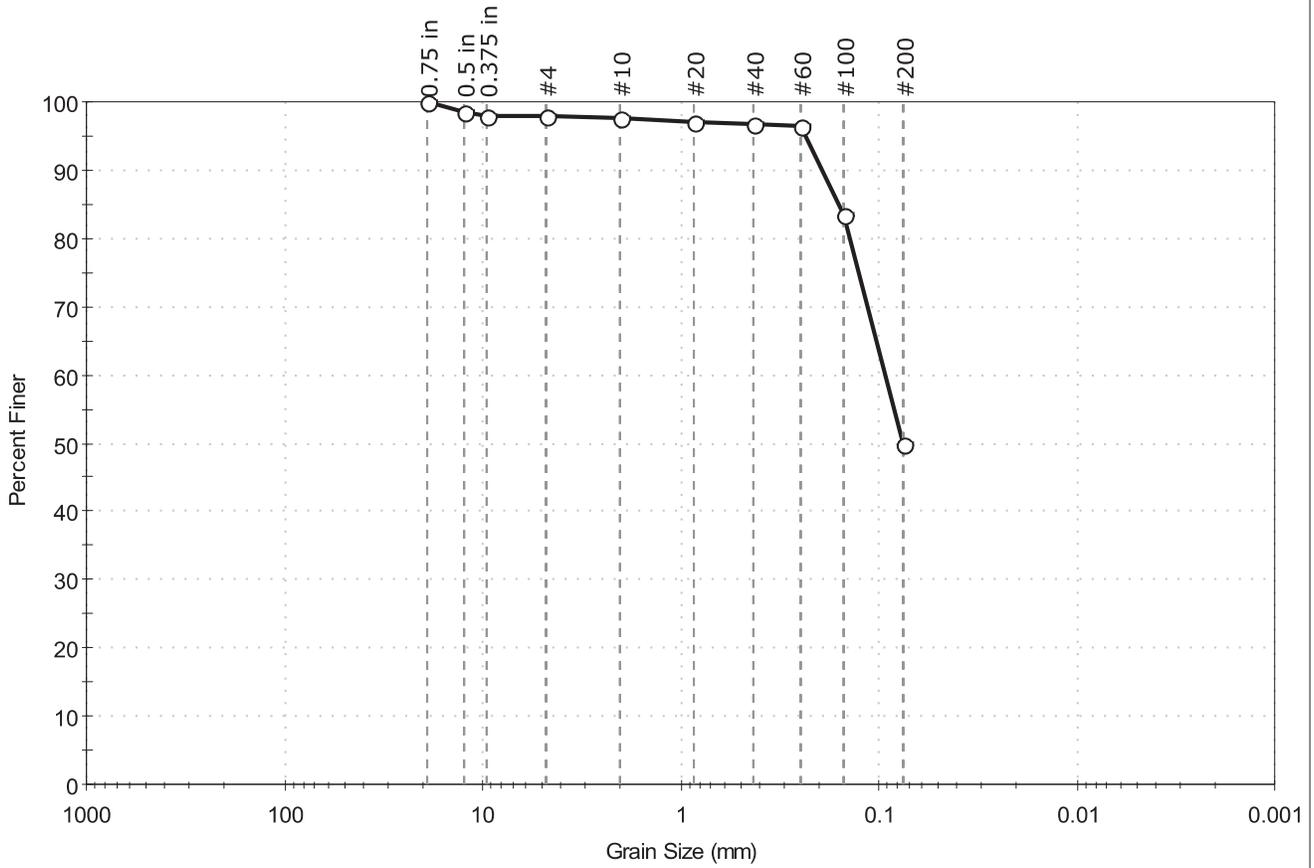
| Boring ID | Sample ID | Depth        | Description              | Moisture Content, % |
|-----------|-----------|--------------|--------------------------|---------------------|
| AP-2      | UD-1      | 16.0-18.0 ft | Moist, olive clayey sand | 56.0                |

Notes: Temperature of Drying : 110° Celsius



|                          |                                                     |                        |
|--------------------------|-----------------------------------------------------|------------------------|
| Client: F&ME Consultants | Project: US-21 Replacement Bridge over Harbor River | Project No: GTX-305005 |
| Location: ---            | Boring ID: AP-2                                     | Sample Type: tube      |
| Sample ID: UD-1          | Test Date: 08/23/16                                 | Tested By: jbr         |
| Depth: 16.0-18.0 ft      | Test Id: 387103                                     | Checked By: mcm        |
| Test Comment: ---        | Visual Description: Moist, olive clayey sand        | Sample Comment: ---    |

## Particle Size Analysis - ASTM D422



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 2.1      | 48.0   | 49.9               |

| 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           | 98            |               |          |
| #10        | 2.00           | 98            |               |          |
| #20        | 0.85           | 97            |               |          |
| #40        | 0.42           | 97            |               |          |
| #60        | 0.25           | 96            |               |          |
| #100       | 0.15           | 83            |               |          |
| #200       | 0.075          | 50            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.1600 mm | D <sub>30</sub> = N/A |
| D <sub>60</sub> = 0.0925 mm | D <sub>15</sub> = N/A |
| D <sub>50</sub> = 0.0752 mm | D <sub>10</sub> = N/A |
| C <sub>u</sub> = N/A        | C <sub>c</sub> = N/A  |

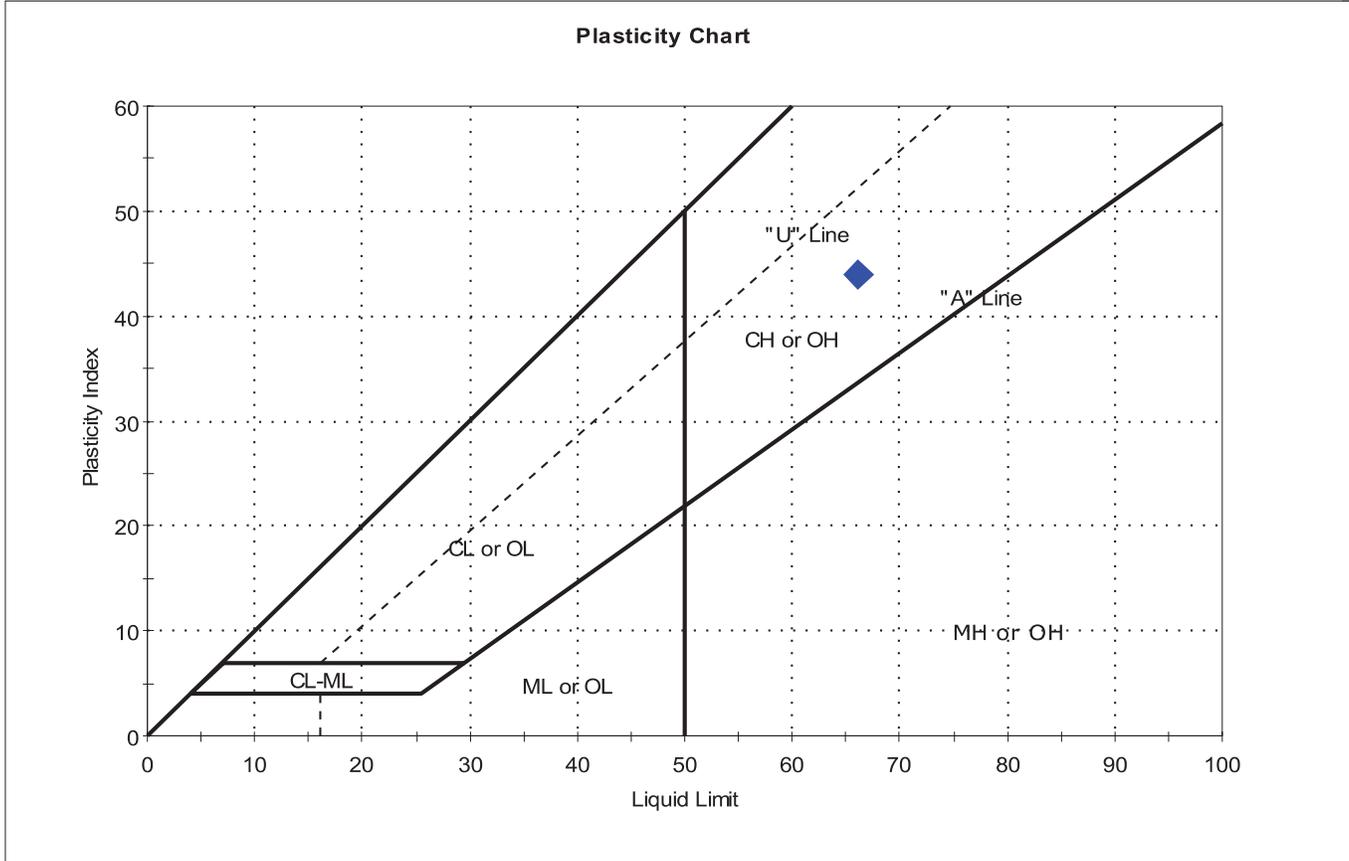
| <u>Classification</u> |                           |
|-----------------------|---------------------------|
| <u>ASTM</u>           | Clayey sand (SC)          |
| <u>AASHTO</u>         | Clayey Soils (A-7-6 (17)) |

| <u>Sample/Test Description</u> |     |
|--------------------------------|-----|
| Sand/Gravel Particle Shape :   | --- |
| Sand/Gravel Hardness :         | --- |



|                     |                                            |              |             |             |        |
|---------------------|--------------------------------------------|--------------|-------------|-------------|--------|
| Client:             | F&ME Consultants                           |              | Project No: | GTX-305005  |        |
| Project:            | US-21 Replacement Bridge over Harbor River |              |             |             |        |
| Location:           | ---                                        |              | Tested By:  | cam         |        |
| Boring ID:          | AP-2                                       | Sample Type: | tube        | Checked By: | mcm    |
| Sample ID:          | UD-1                                       | Test Date:   | 08/22/16    | Test Id:    | 387111 |
| Depth :             | 16.0-18.0 ft                               |              |             |             |        |
| Test Comment:       | ---                                        |              |             |             |        |
| Visual Description: | Moist, olive clayey sand                   |              |             |             |        |
| Sample Comment:     | ---                                        |              |             |             |        |

## Atterberg Limits - ASTM D4318



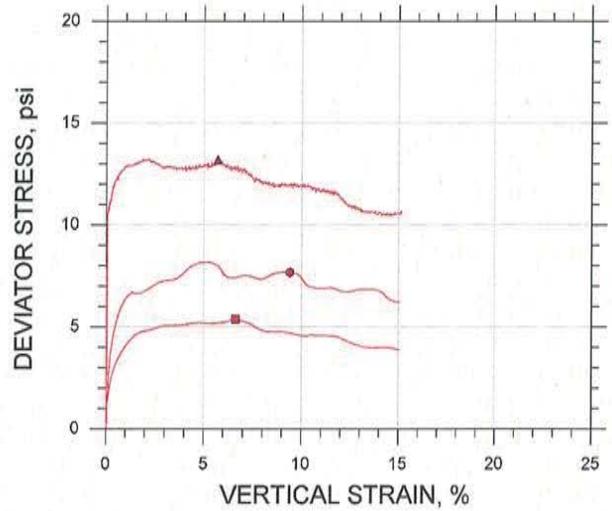
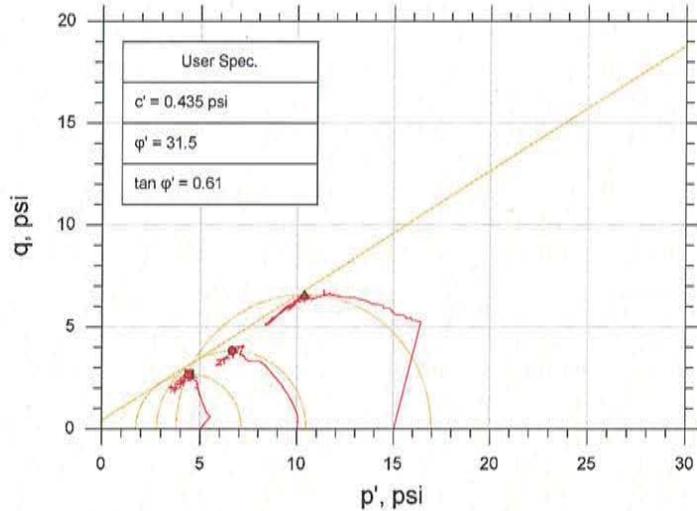
| Symbol | Sample ID | Boring | Depth        | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification |
|--------|-----------|--------|--------------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | UD-1      | AP-2   | 16.0-18.0 ft | 56                          | 66           | 22            | 44               | 0.8             | Clayey sand (SC)    |

Sample Prepared using the WET method  
 3% Retained on #40 Sieve  
 Dry Strength: VERY HIGH  
 Dilatancy: SLOW  
 Toughness: LOW



|                                        |                                 |
|----------------------------------------|---------------------------------|
| Client: F&M Consultants                |                                 |
| Project Name: US 21 Replacement Bridge |                                 |
| Project Location: ---                  |                                 |
| Project Number: GTX-305005             |                                 |
| Tested By: md                          | Checked By: mcm                 |
| Boring ID: AP-2                        |                                 |
| Preparation: intact                    |                                 |
| Description: Moist, olive clayey sand  |                                 |
| Classification: Clayey sand            |                                 |
| Group Symbol: SC                       |                                 |
| Liquid Limit: 66                       | Plastic Limit: 22               |
| Plasticity Index: 44                   | Estimated Specific Gravity: 2.7 |

**CONSOLIDATED DRAINED TRIAXIAL TEST by ASTM D4767**

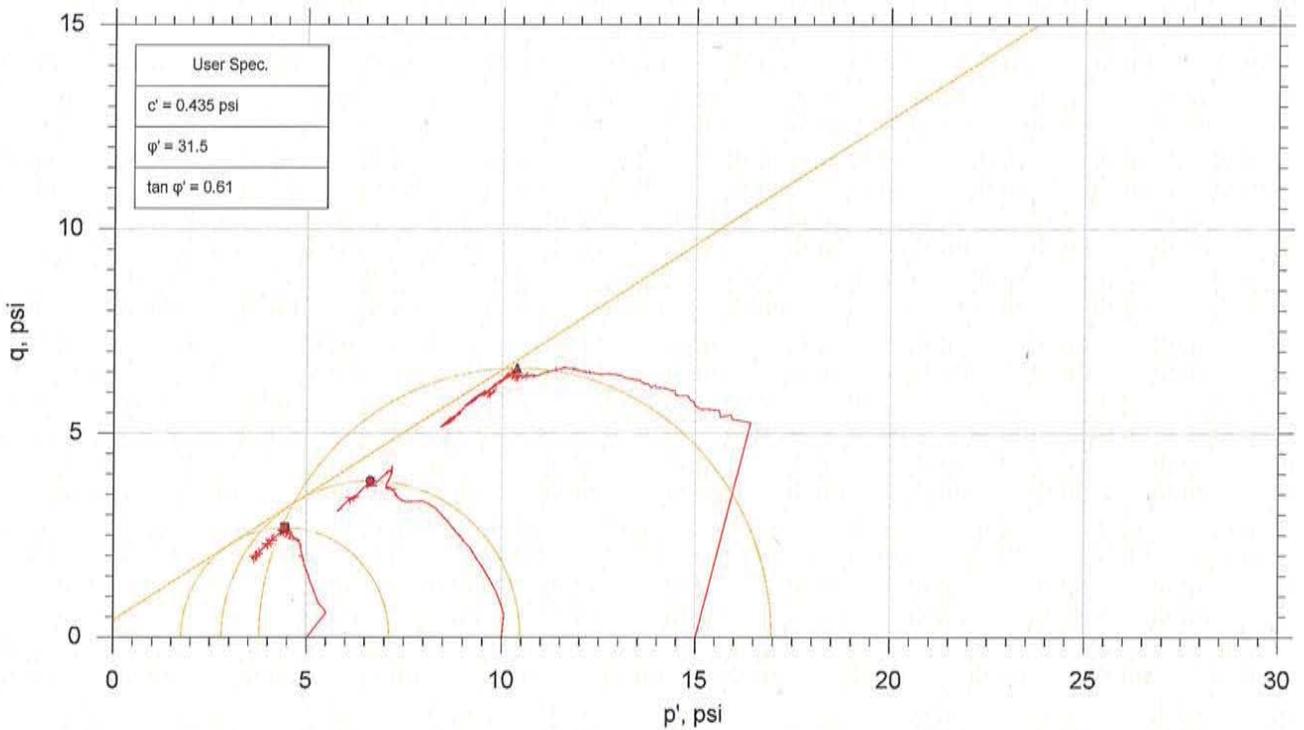
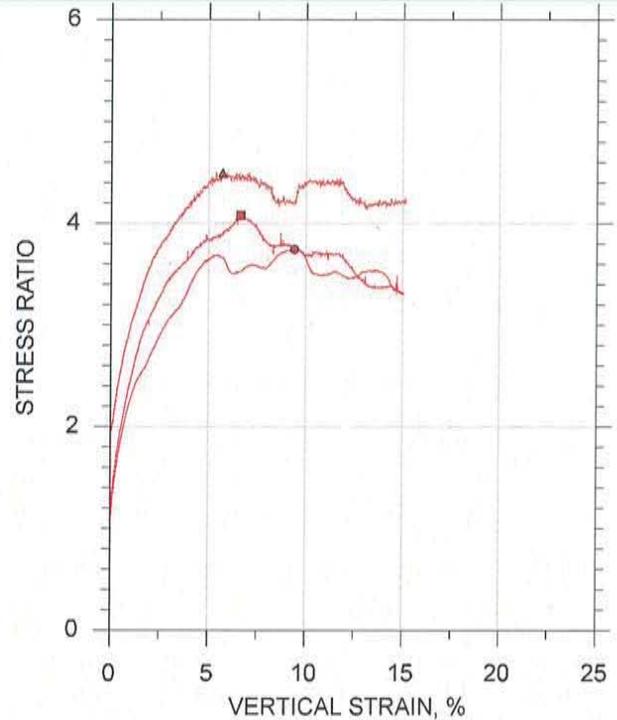
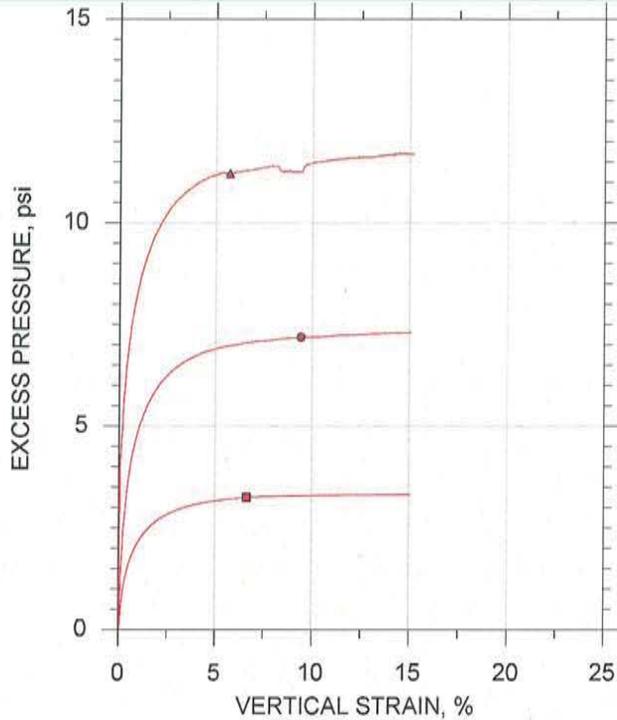


| Symbol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ■                                                | ●            | ▲            |       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|--------------|--------------|-------|
| Sample ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ST-1                                             | ST-1         | ST-1         |       |
| Depth, ft                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 16.0-18.0 ft                                     | 16.0-18.0 ft | 16.0-18.0 ft |       |
| Test Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | CU-2-1                                           | CU-2-2       | CU-2-3       |       |
| Initial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Height, in                                       | 4.650        | 4.720        | 4.390 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Diameter, in                                     | 2.050        | 2.030        | 2.030 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Moisture Content (from Cuttings), %              | 72.9         | 49.2         | 52.1  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Dry Density, pcf                                 | 56.4         | 69.3         | 66.4  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Saturation (Wet Method), %                       | 99.0         | 92.7         | 91.5  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Void Ratio                                       | 1.99         | 1.43         | 1.54  |
| Before Shear                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Moisture Content, %                              | 70.4         | 47.1         | 47.2  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Dry Density, pcf                                 | 58.1         | 74.2         | 74.1  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Cross-sectional Area (Method A), in <sup>2</sup> | 3.205        | 3.042        | 2.998 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Saturation, %                                    | 100.0        | 100.0        | 100.0 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Void Ratio                                       | 1.90         | 1.27         | 1.28  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Back Pressure, psi                               | 139.0        | 150.8        | 150.9 |
| Vertical Effective Consolidation Stress, psi                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5.002                                            | 9.937        | 14.76        |       |
| Horizontal Effective Consolidation Stress, psi                                                                                                                                                                                                                                                                                                                                                                                                                                              | 5.002                                            | 9.987        | 14.99        |       |
| Vertical Strain after Consolidation, %                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.01752                                          | 0.6124       | 2.957        |       |
| Volumetric Strain after Consolidation, %                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3.012                                            | 6.546        | 9.651        |       |
| Time to 50% Consolidation, min                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 92.16                                            | 45.56        | 161.3        |       |
| Shear Strength, psi                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2.690                                            | 3.838        | 6.597        |       |
| Strain at Failure, %                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 6.63                                             | 9.40         | 5.69         |       |
| Strain Rate, %/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.01600                                          | 0.01600      | 0.01600      |       |
| Deviator Stress at Failure, psi                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5.381                                            | 7.677        | 13.19        |       |
| Effective Minor Principal Stress at Failure, psi                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.747                                            | 2.795        | 3.775        |       |
| Effective Major Principal Stress at Failure, psi                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7.128                                            | 10.47        | 16.97        |       |
| B-Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.95                                             | 0.95         | 0.95         |       |
| Notes:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |              |              |       |
| <ul style="list-style-type: none"> <li>- Before Shear Saturation set to 100% for phase calculation.</li> <li>- Moisture Content determined by ASTM D2216.</li> <li>- Atterberg Limits determined by ASTM D4318.</li> <li>- Deviator Stress includes membrane correction.</li> <li>- 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.</li> </ul> |                                                  |              |              |       |
| Remarks:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                  |              |              |       |

System B. Note CU-2-3 test specimen was not used in determining cohesion or friction values.



CONSOLIDATED DRAINED TRIAXIAL TEST by ASTM D4767

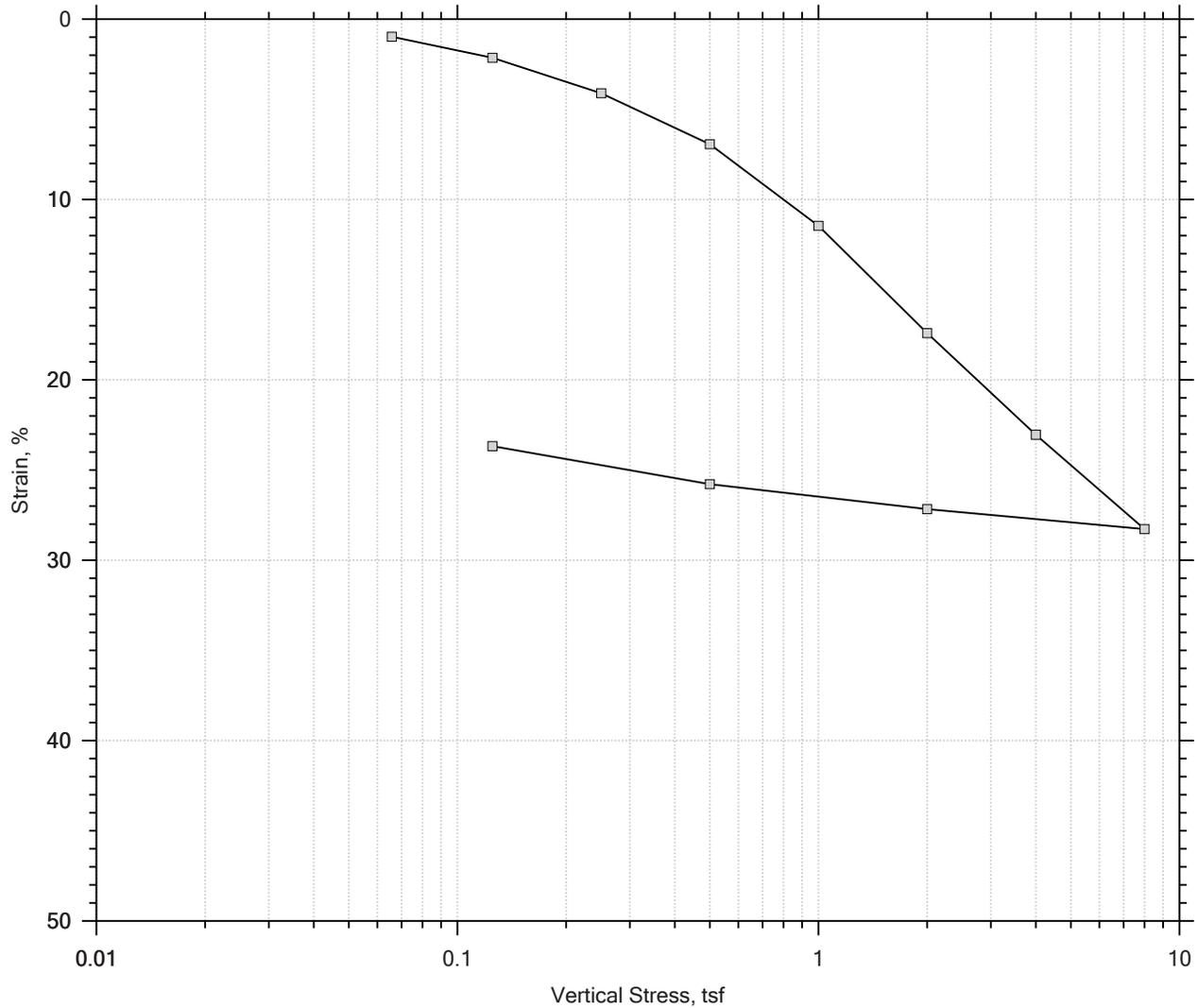


| Sample No. | Test No. | Depth        | Tested By | Test Date | Checked By | Check Date | Test File          |
|------------|----------|--------------|-----------|-----------|------------|------------|--------------------|
| ■ ST-1     | CU-2-1   | 16.0-18.0 ft | md        | 8/19/16   | mcm        | 8/31/16    | 305005-CU-2-1m.dat |
| ● ST-1     | CU-2-2   | 16.0-18.0 ft | md        | 8/18/16   | mcm        | 8/31/16    | 305005-CU-2-2m.dat |
| ▲ ST-1     | CU-2-3   | 16.0-18.0 ft | md        | 8/18/16   | mcm        | 8/31/16    | 305005-CU-2-3m.dat |

|  |                                                                                                       |                     |                         |
|--|-------------------------------------------------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US 21 Replacement Bridge                                                                     | Location: ---       | Project No.: GTX-305005 |
|  | Boring No.: AP-2                                                                                      | Sample Type: intact |                         |
|  | Description: Moist, olive clayey sand                                                                 |                     |                         |
|  | Remarks: System B. Note CU-2-3 test specimen was not used in determining cohesion or friction values. |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

## Summary Report

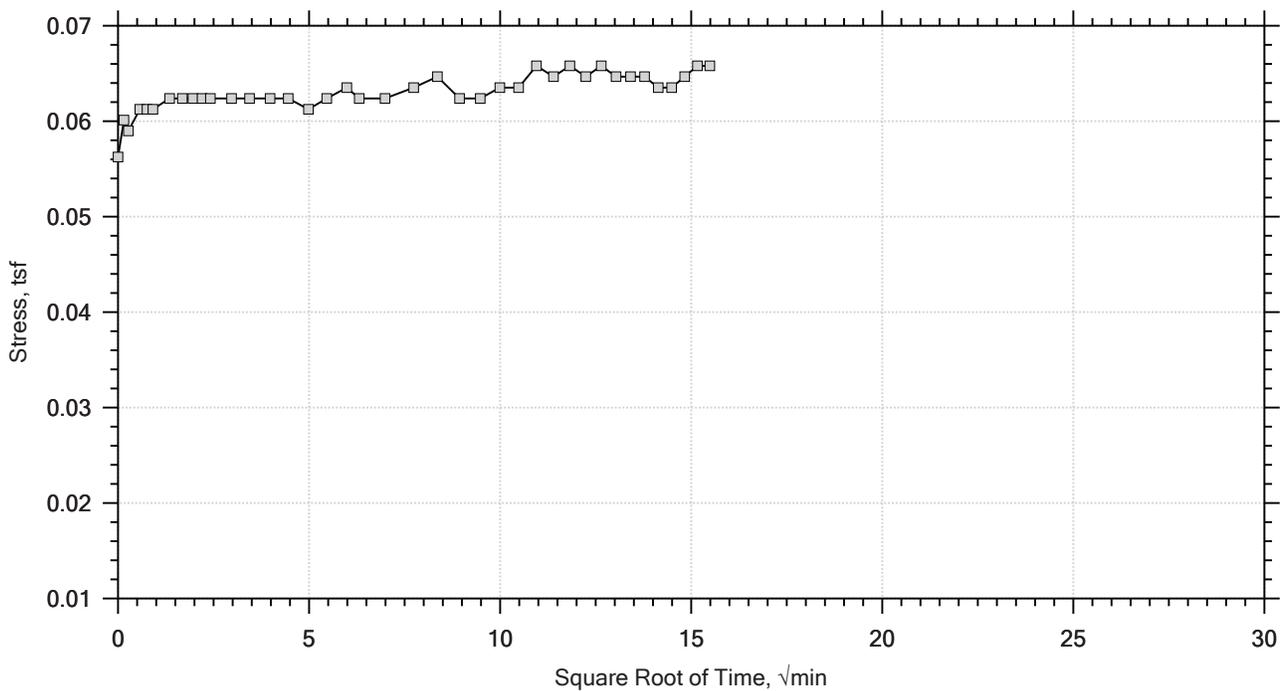
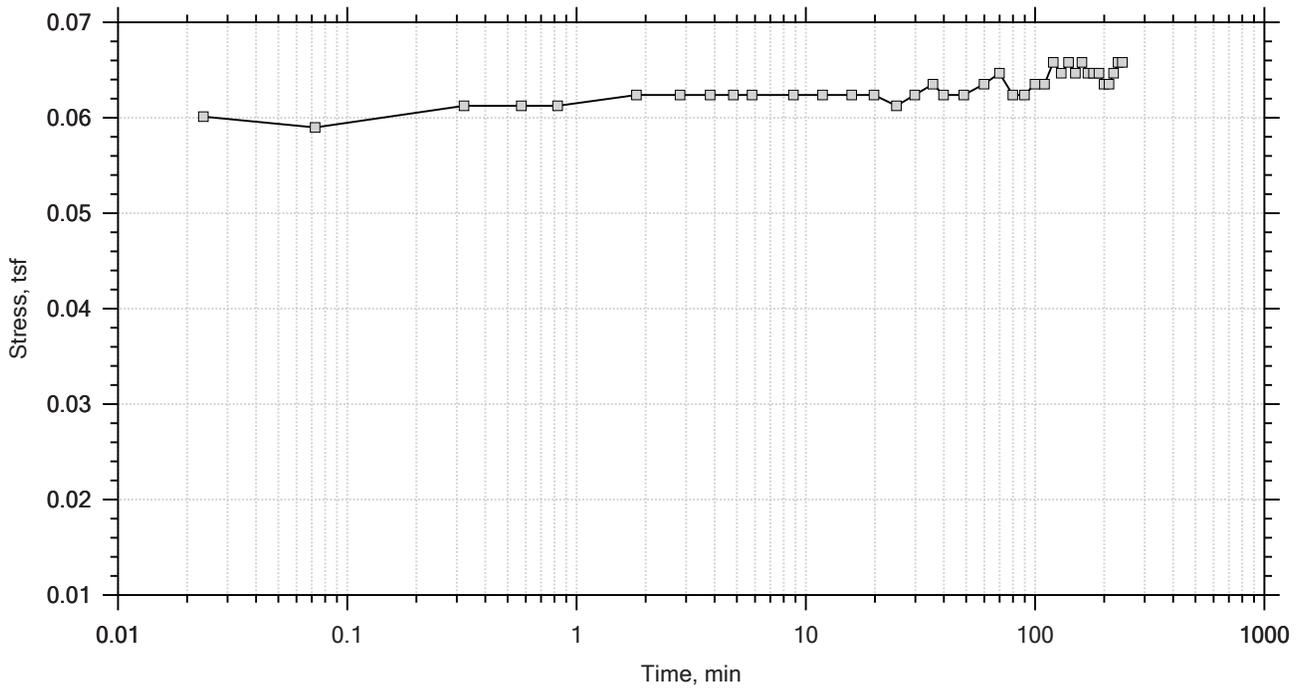


|                                        |        |              |          | Before Test          | After Test |        |
|----------------------------------------|--------|--------------|----------|----------------------|------------|--------|
| Current Vertical Effective Stress: --- |        |              |          | Water Content, %     | 51.80      | 34.90  |
| Preconsolidation Stress: ---           |        |              |          | Dry Unit Weight, pcf | 69.92      | 87.4   |
| Compression Ratio: ---                 |        |              |          | Saturation, %        | 98.17      | 100.00 |
| Diameter: 2.5 in                       |        | Height: 1 in |          | Void Ratio           | 1.44       | 0.96   |
| LL: 66                                 | PL: 22 | PI: 44       | GS: 2.74 |                      |            |        |

|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
| Displacement at End of Increment                                                    |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

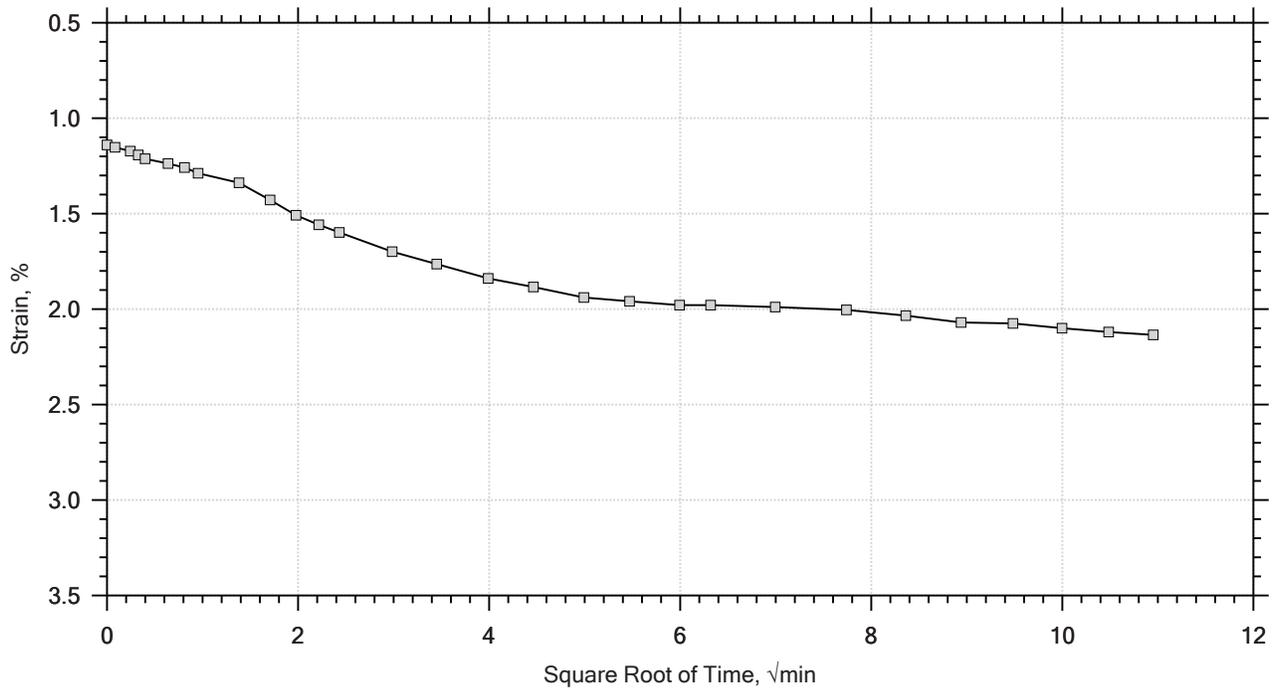
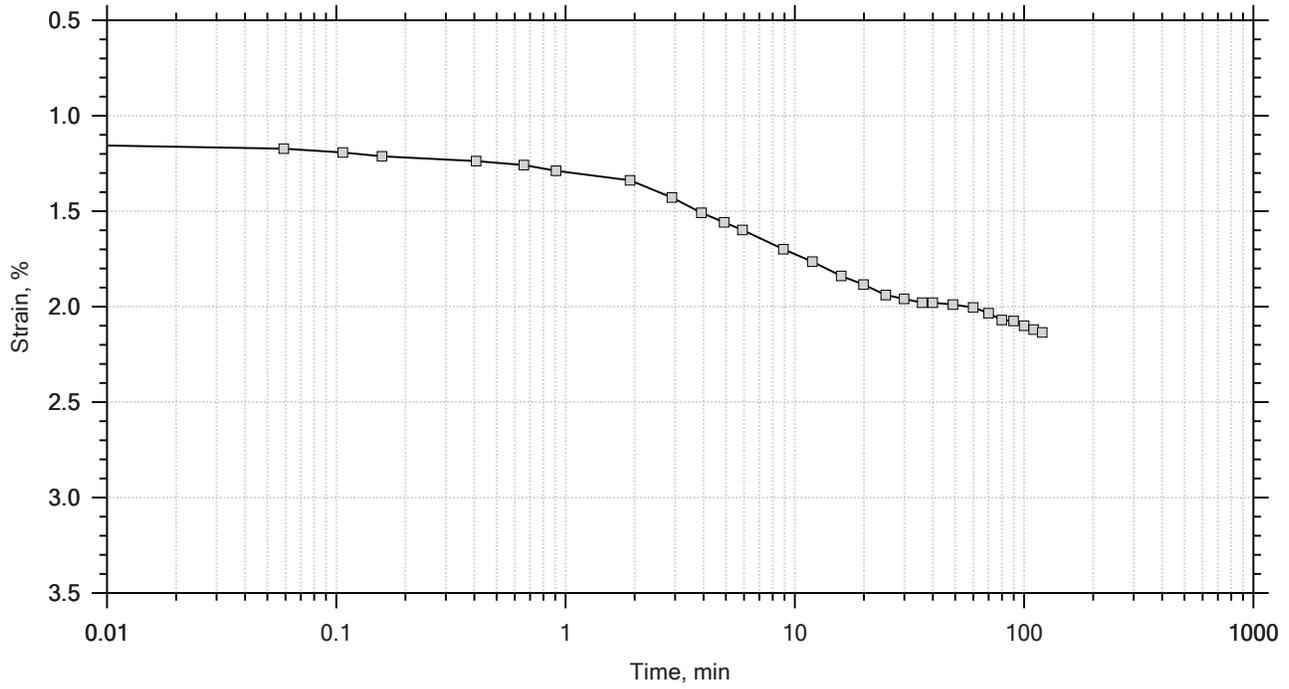
Time Curve 1 of 11  
 Constant Volume Step  
 Stress: 0.0658 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

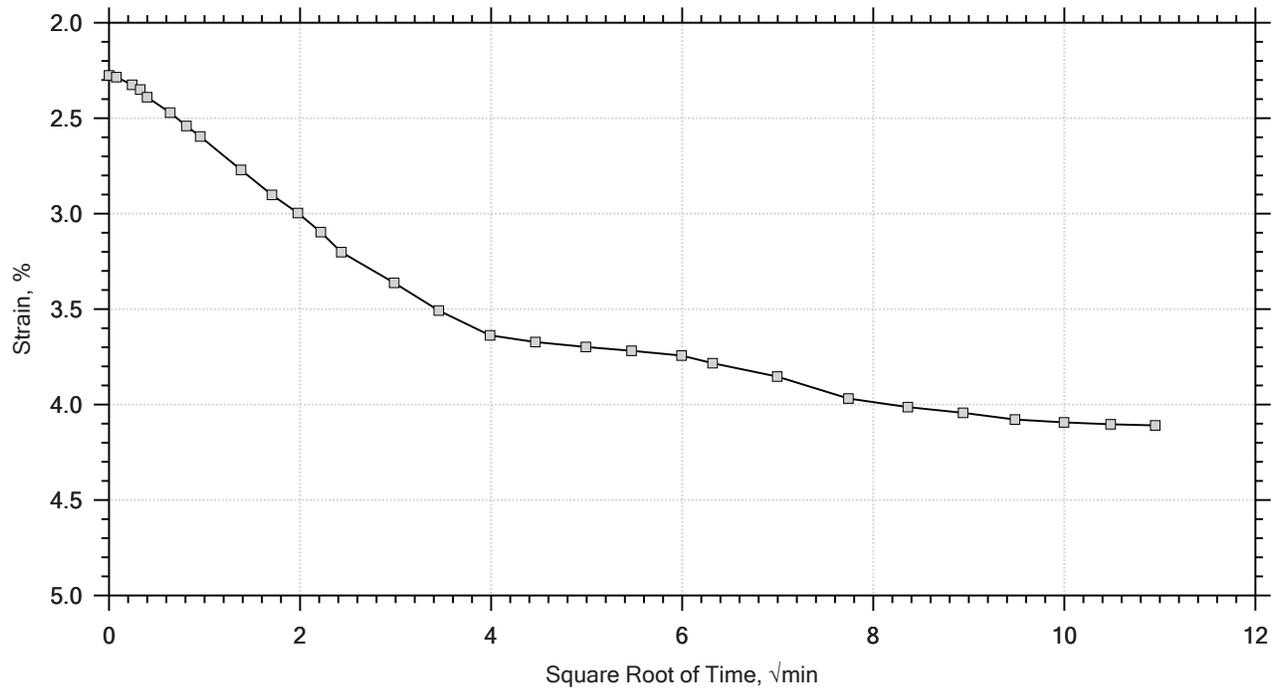
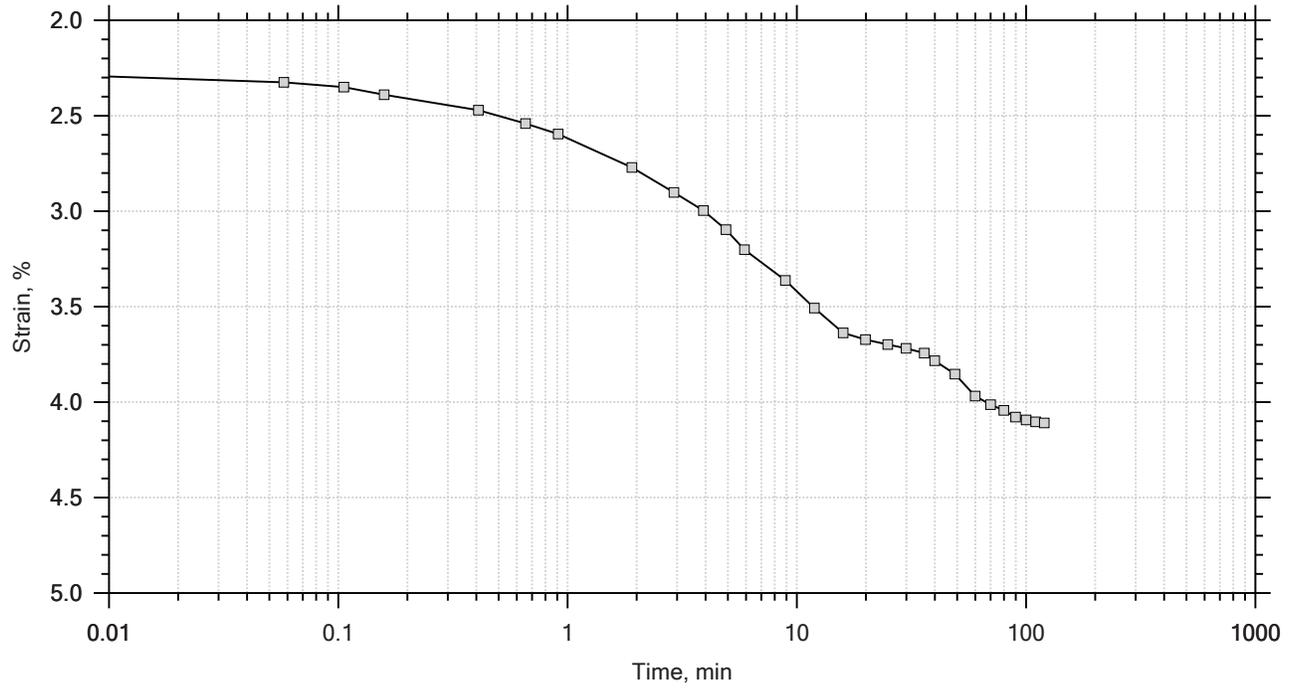
Time Curve 2 of 11  
 Constant Load Step  
 Stress: 0.125 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

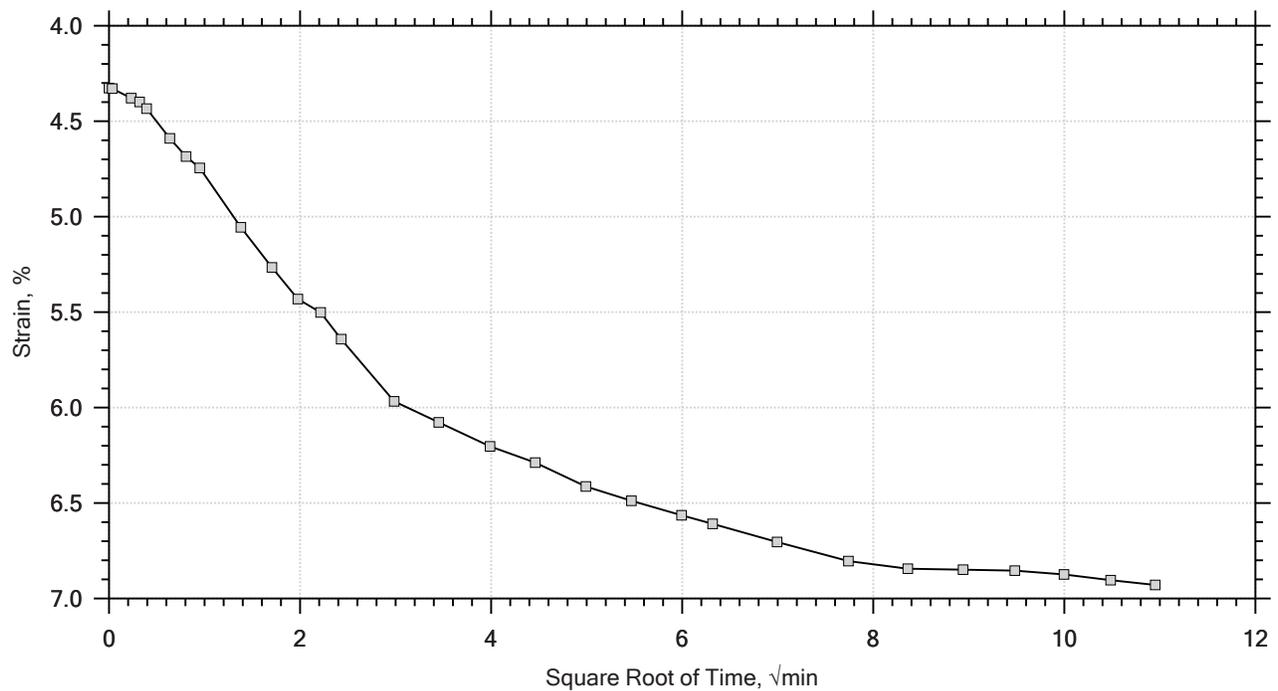
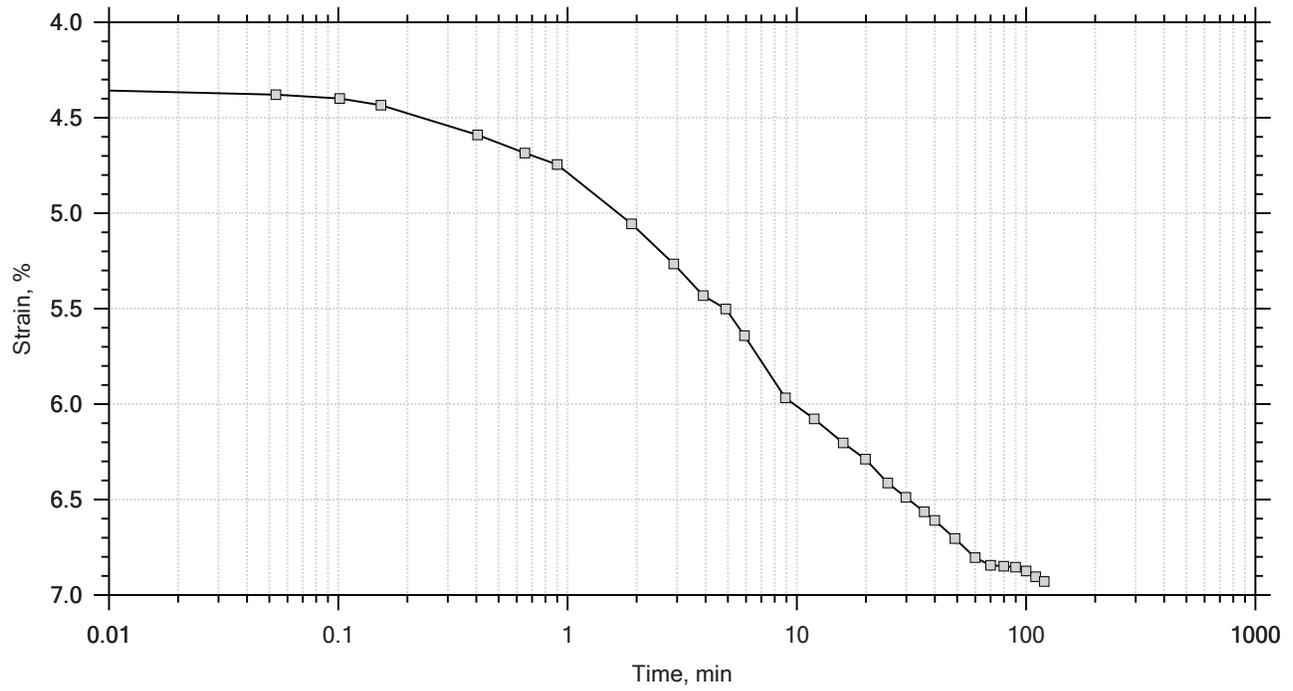
Time Curve 3 of 11  
 Constant Load Step  
 Stress: 0.25 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

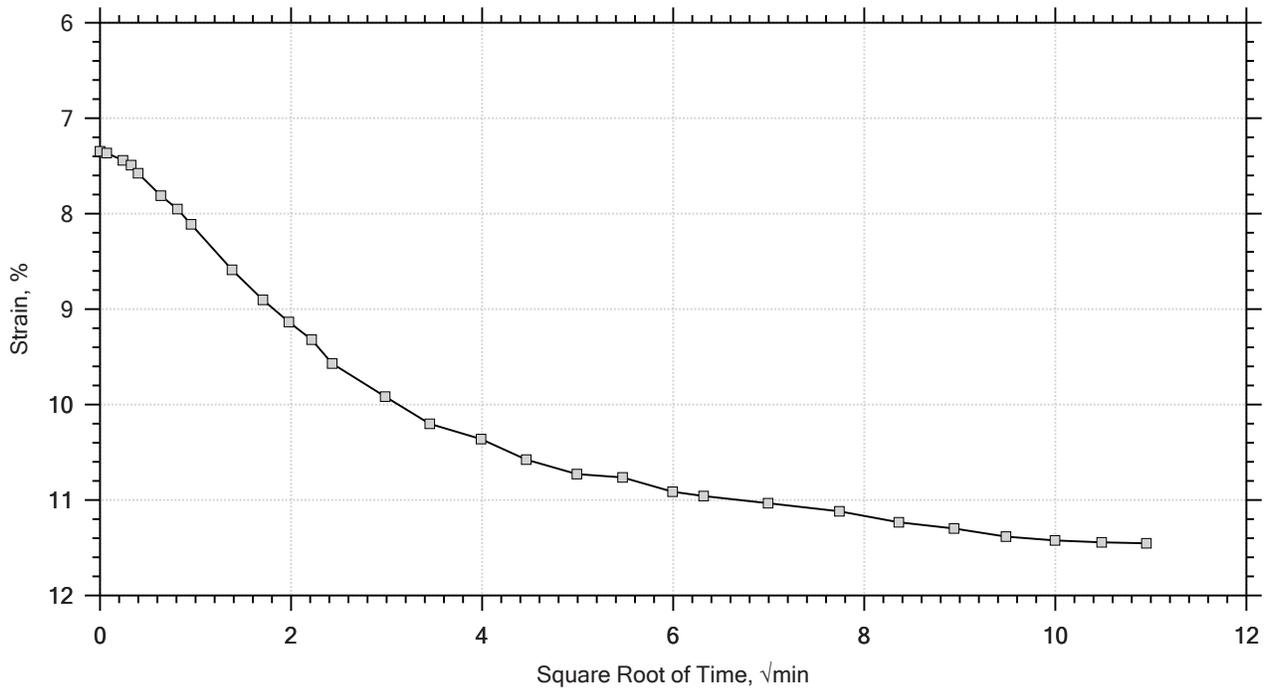
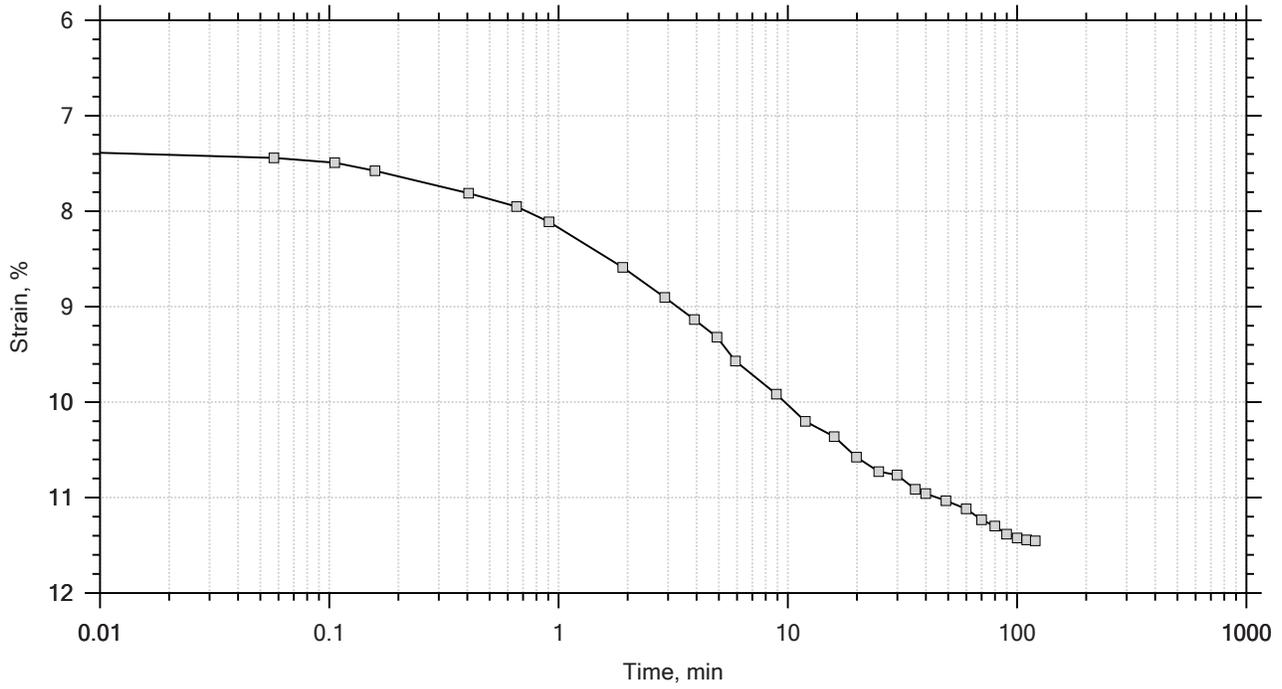
Time Curve 4 of 11  
 Constant Load Step  
 Stress: 0.5 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

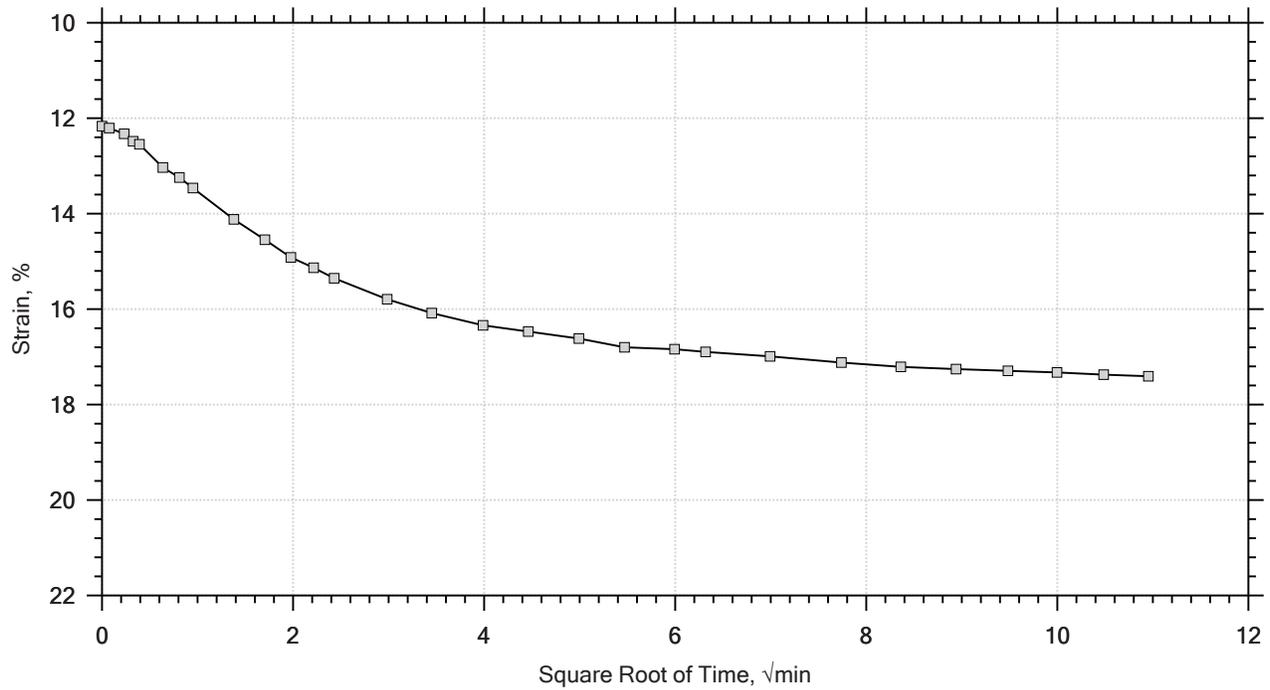
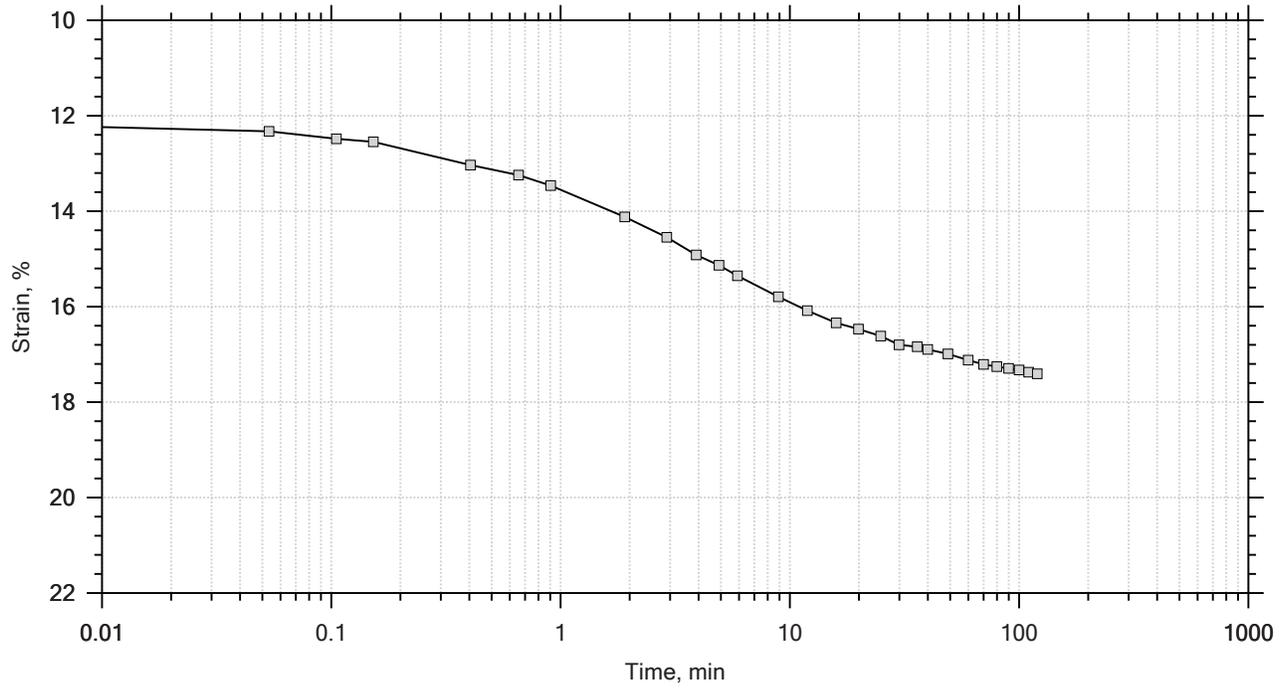
Time Curve 5 of 11  
 Constant Load Step  
 Stress: 1 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 11  
 Constant Load Step  
 Stress: 2 tsf

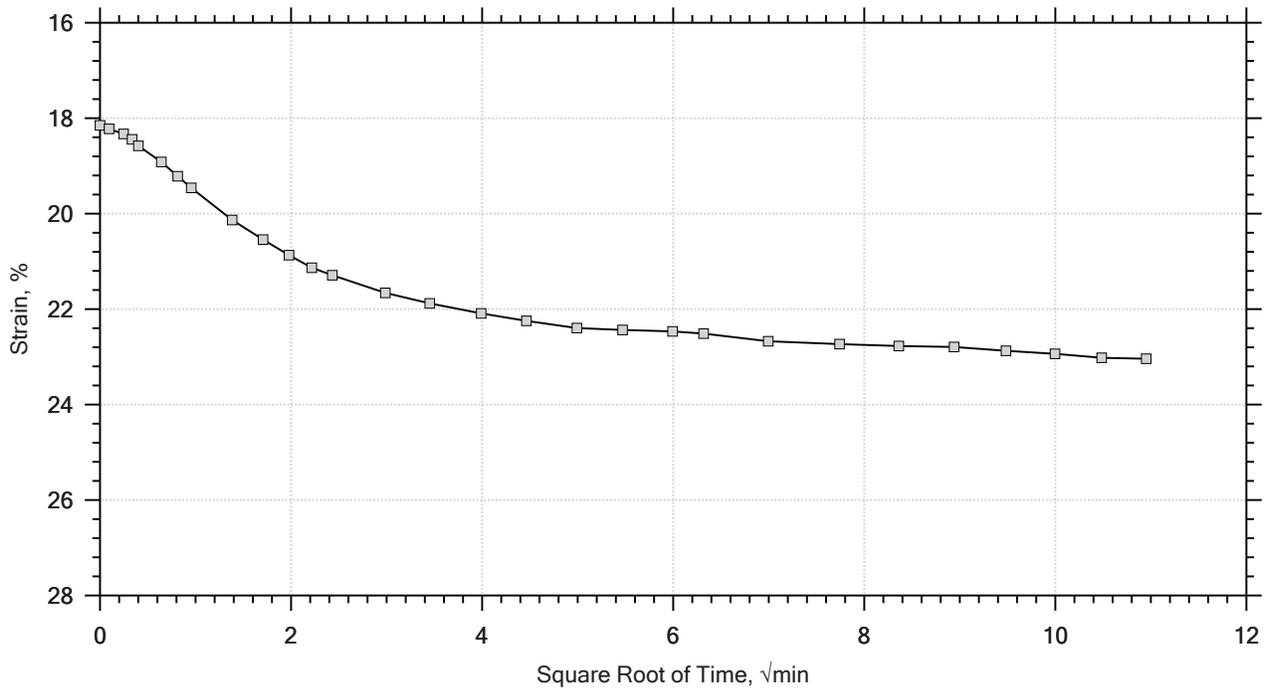
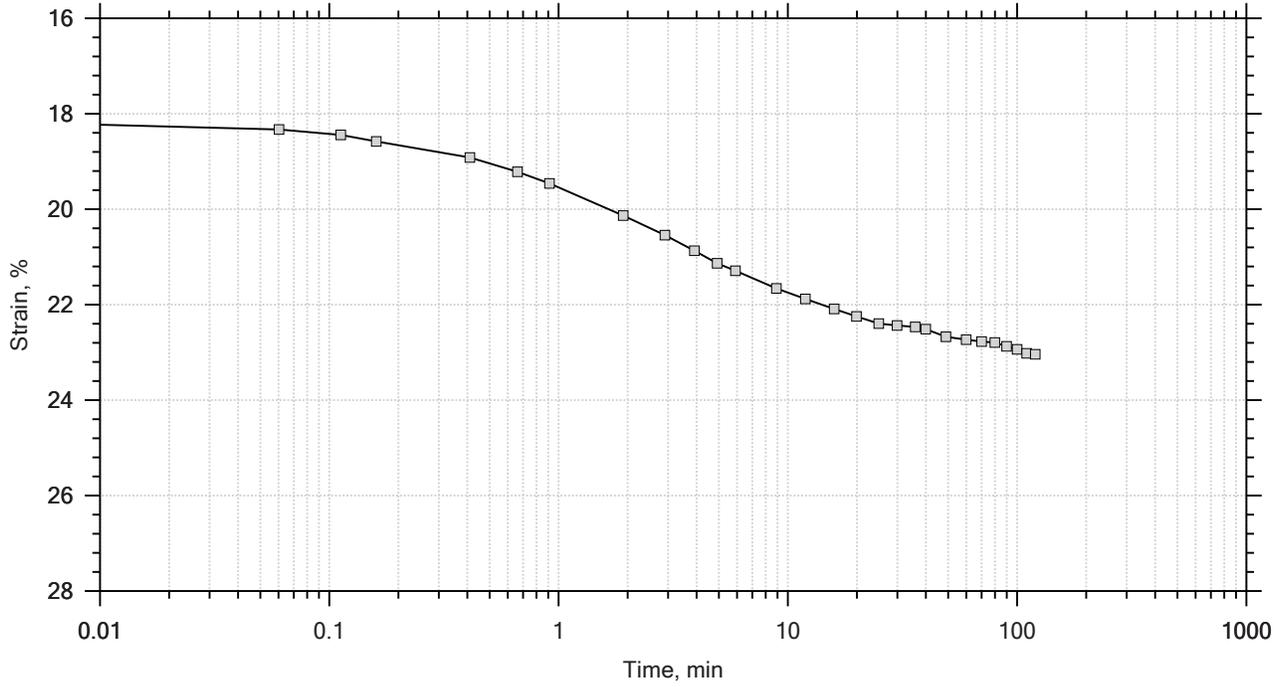


|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |



# One-Dimensional Consolidation by ASTM D2435 - Method B

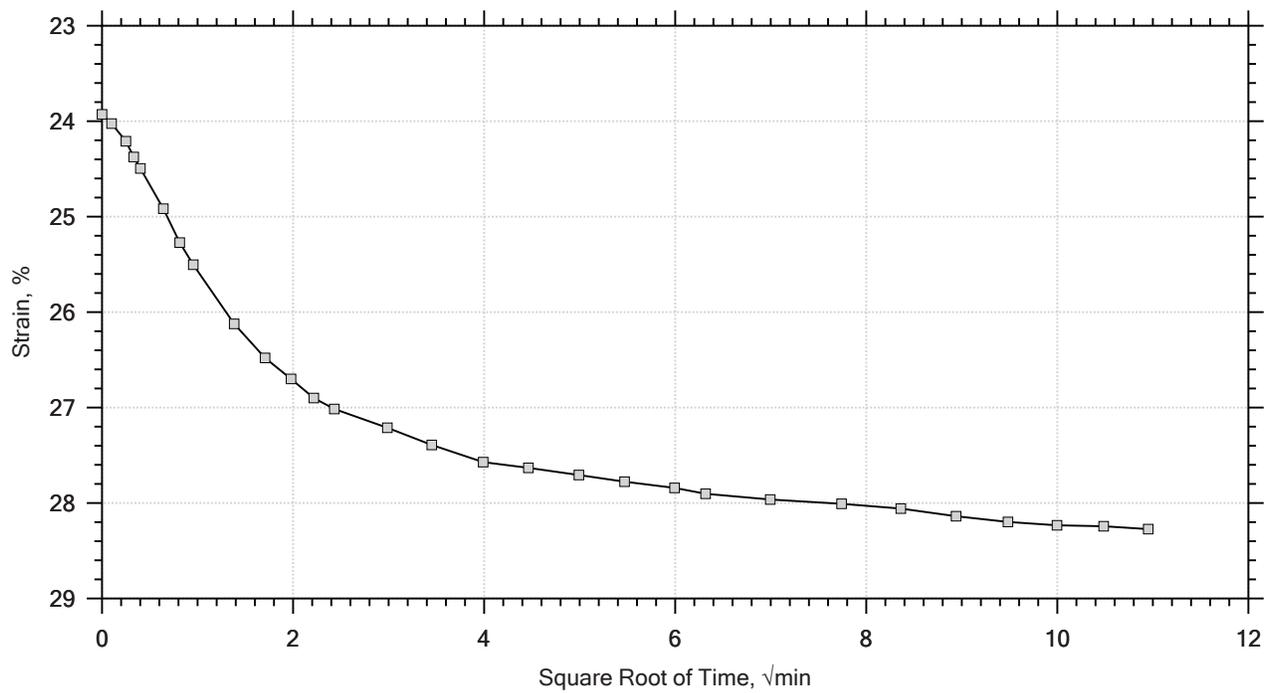
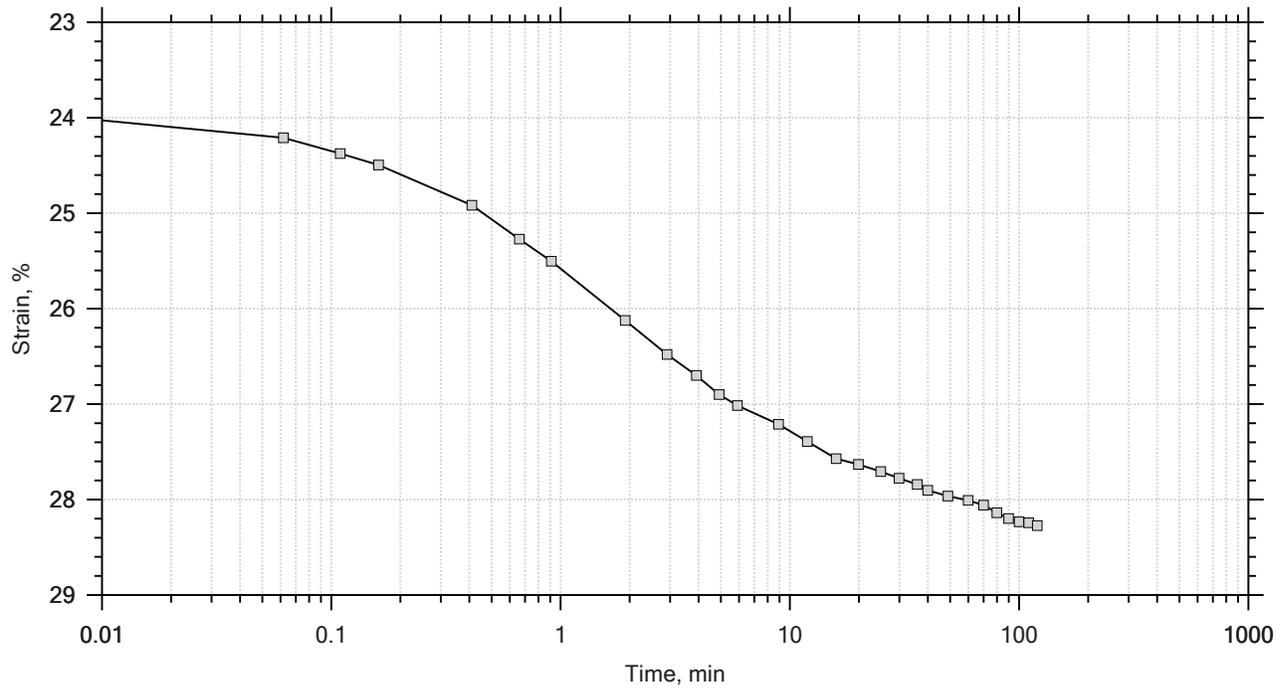
Time Curve 7 of 11  
 Constant Load Step  
 Stress: 4 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

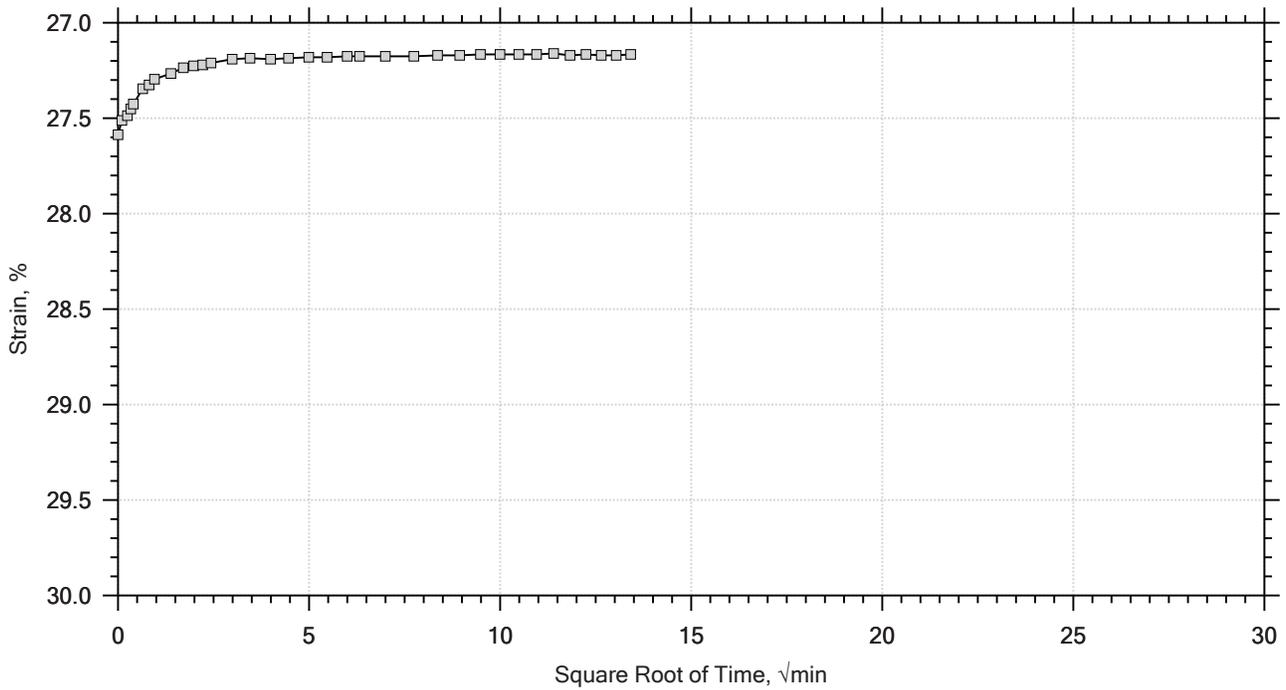
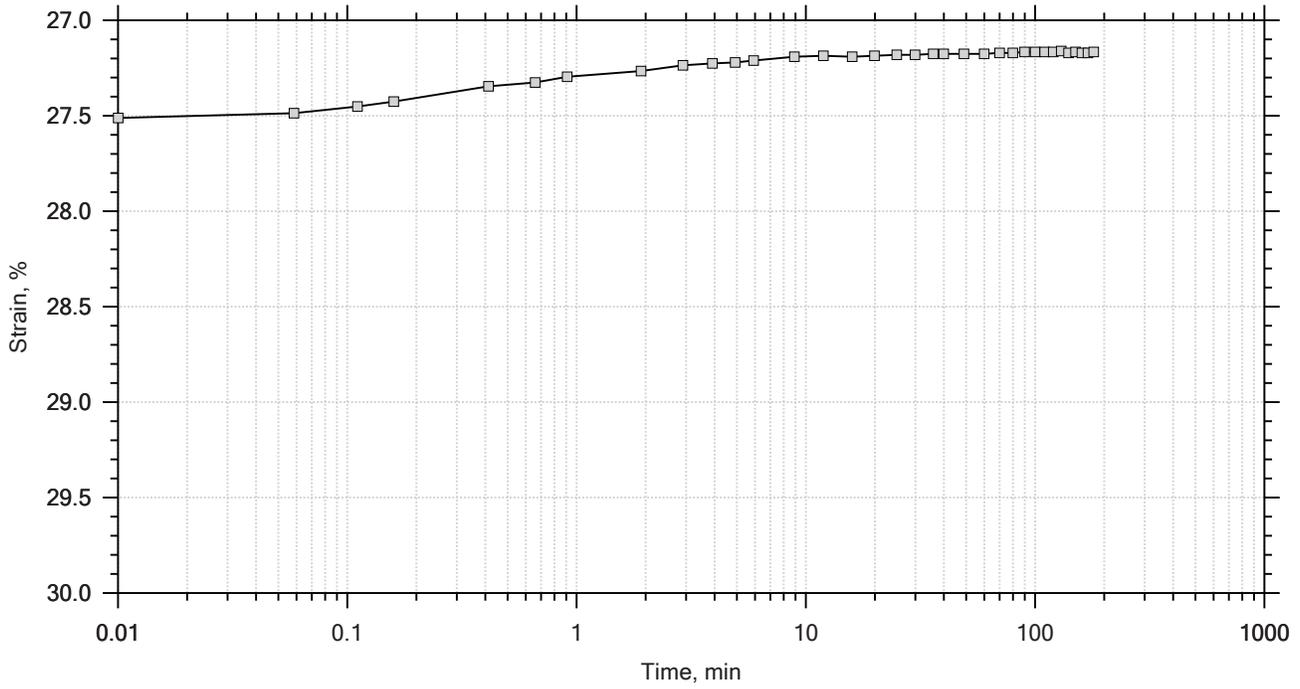
Time Curve 8 of 11  
 Constant Load Step  
 Stress: 8 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 11  
 Constant Load Step  
 Stress: 2 tsf



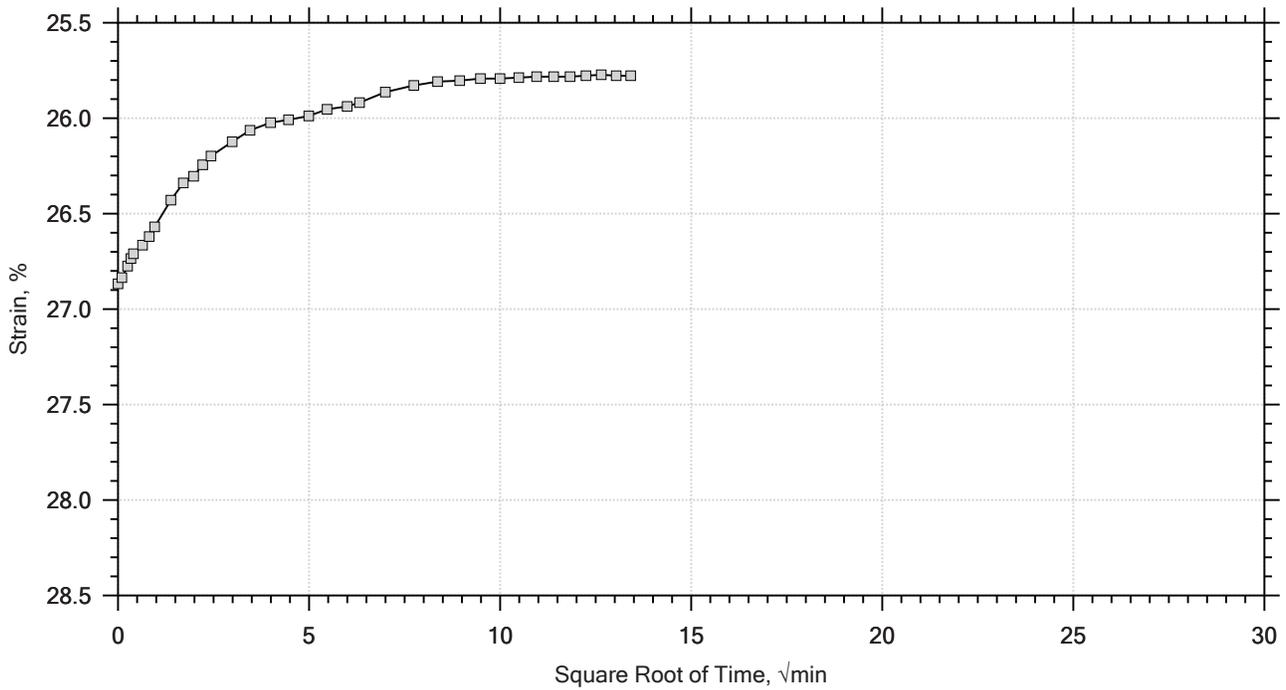
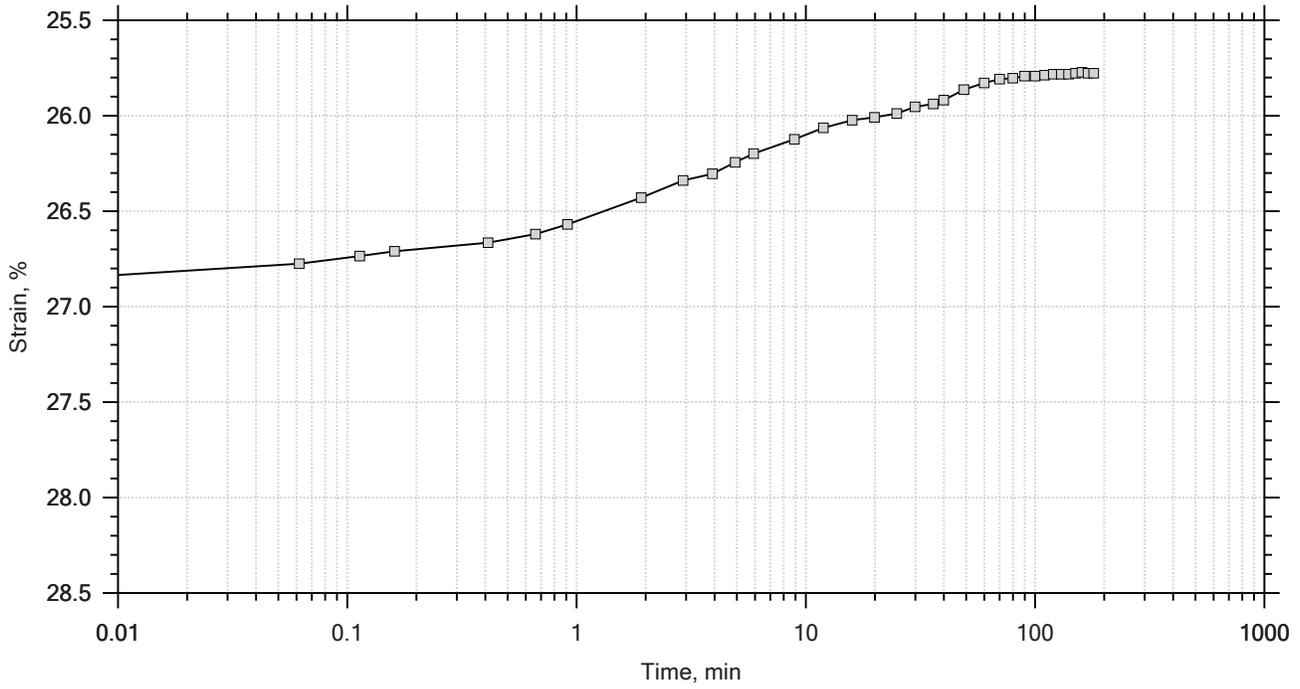
|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 11

Constant Load Step

Stress: 0.5 tsf



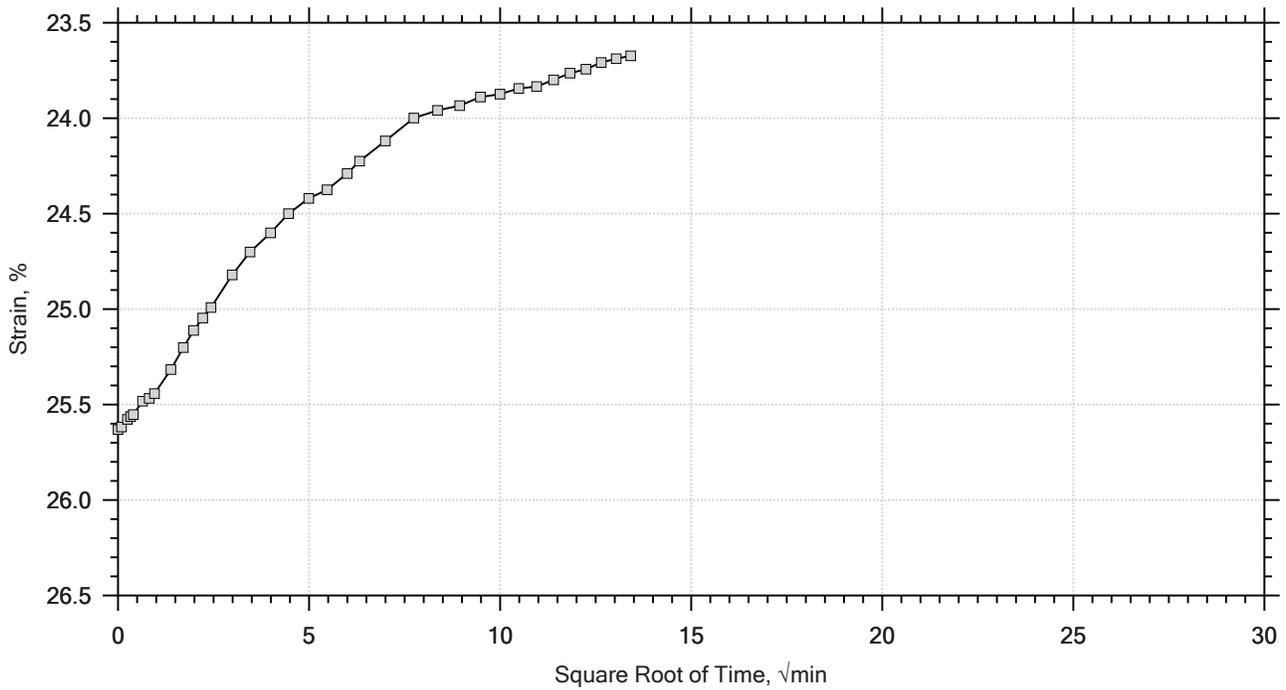
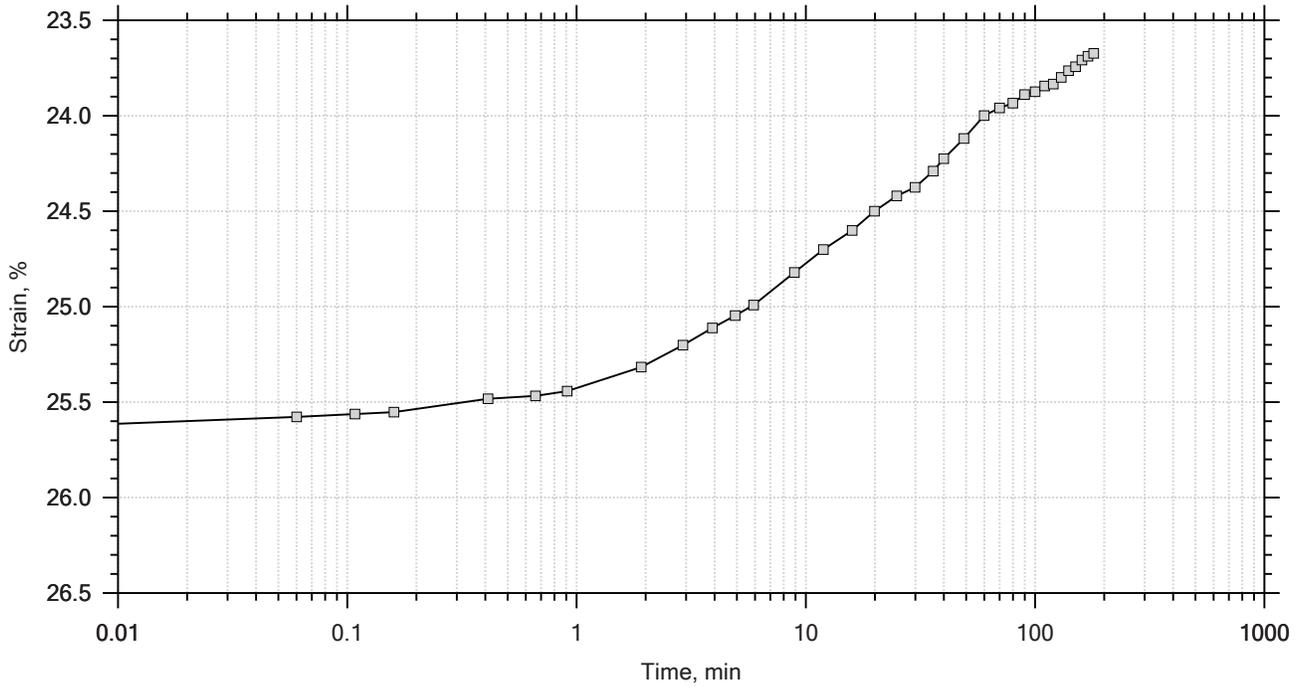
|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 11

Constant Load Step

Stress: 0.125 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

|                            |                                  |                      |
|----------------------------|----------------------------------|----------------------|
| Specimen Diameter: 2.50 in | Estimated Specific Gravity: 2.74 | Liquid Limit: 66     |
| Initial Height: 1.00 in    | Initial Void Ratio: 1.44         | Plastic Limit: 22    |
| Final Height: 0.80 in      | Final Void Ratio: 0.956          | Plasticity Index: 44 |

|                               | Before Test<br>Trimmings | Before Test<br>Specimen | After Test<br>Specimen | After Test<br>Trimmings |
|-------------------------------|--------------------------|-------------------------|------------------------|-------------------------|
| Container ID                  | 16719                    | RING                    |                        | 9370                    |
| Mass Container, gm            | 8.86                     | 111.44                  | 111.44                 | 8.57                    |
| Mass Container + Wet Soil, gm | 211.34                   | 248.2                   | 232.98                 | 128.77                  |
| Mass Container + Dry Soil, gm | 128.42                   | 201.53                  | 201.53                 | 97.67                   |
| Mass Dry Soil, gm             | 119.56                   | 90.093                  | 90.093                 | 89.1                    |
| Water Content, %              | 69.35                    | 51.80                   | 34.90                  | 34.90                   |
| Void Ratio                    | ---                      | 1.44                    | 0.96                   | ---                     |
| Degree of Saturation, %       | ---                      | 98.17                   | 100.00                 | ---                     |
| Dry Unit Weight, pcf          | ---                      | 69.92                   | 87.4                   | ---                     |

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-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                               | Test Date: 08/19/16 | Depth: 16.0-18.0 ft     |
|                                                                                     | Test No.: IP-2                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clayey sand          |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = 0.0658 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |









|            |                                            |             |            |
|------------|--------------------------------------------|-------------|------------|
| Client:    | F&ME Consultants                           | Project No: | GTX-305005 |
| Project:   | US-21 Replacement Bridge over Harbor River |             |            |
| Location:  | ---                                        | Tested By:  | jbr        |
| Boring ID: | ---                                        | Test Date:  | 08/30/16   |
| Sample ID: | ---                                        | Checked By: | mcm        |
| Depth :    | ---                                        | Test Id:    | 387124     |

## Moisture Content of Soil and Rock - ASTM D2216

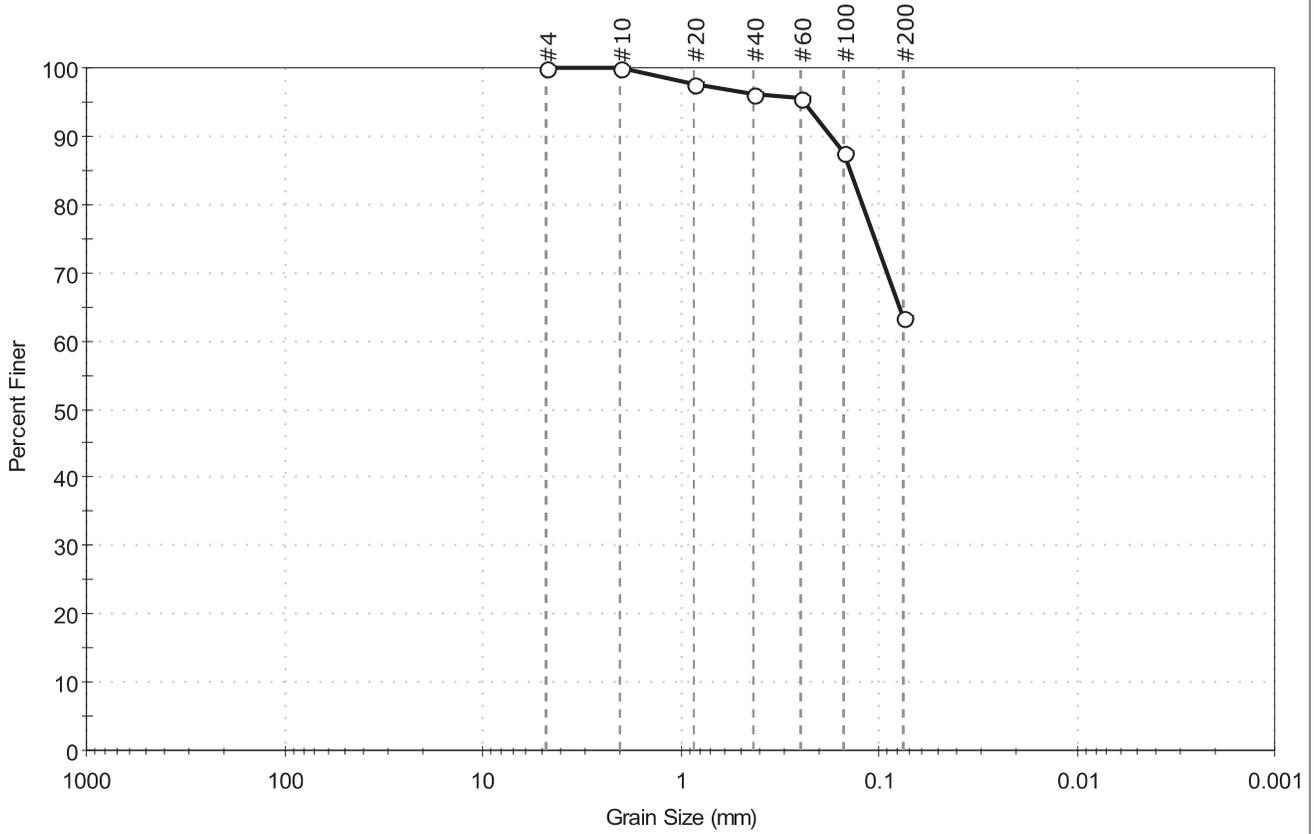
| Boring ID | Sample ID | Depth        | Description             | Moisture Content, % |
|-----------|-----------|--------------|-------------------------|---------------------|
| AP-2      | UD-2      | 18.0-20.0 ft | Moist, olive sandy clay | 69.3                |

Notes: Temperature of Drying : 110° Celsius



|                          |                                                     |                        |
|--------------------------|-----------------------------------------------------|------------------------|
| Client: F&ME Consultants | Project: US-21 Replacement Bridge over Harbor River | Project No: GTX-305005 |
| Location: ---            | Boring ID: AP-2                                     | Sample Type: tube      |
| Sample ID: UD-2          | Test Date: 08/26/16                                 | Tested By: jbr         |
| Depth: 18.0-20.0 ft      | Test Id: 387104                                     | Checked By: mcm        |
| Test Comment: ---        | Visual Description: Moist, olive sandy clay         | Sample Comment: ---    |

## Particle Size Analysis - ASTM D422



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 0.0      | 36.5   | 63.5               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 100           |               |          |
| #20        | 0.85           | 98            |               |          |
| #40        | 0.42           | 96            |               |          |
| #60        | 0.25           | 96            |               |          |
| #100       | 0.15           | 88            |               |          |
| #200       | 0.075          | 64            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.1387 mm | 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  |

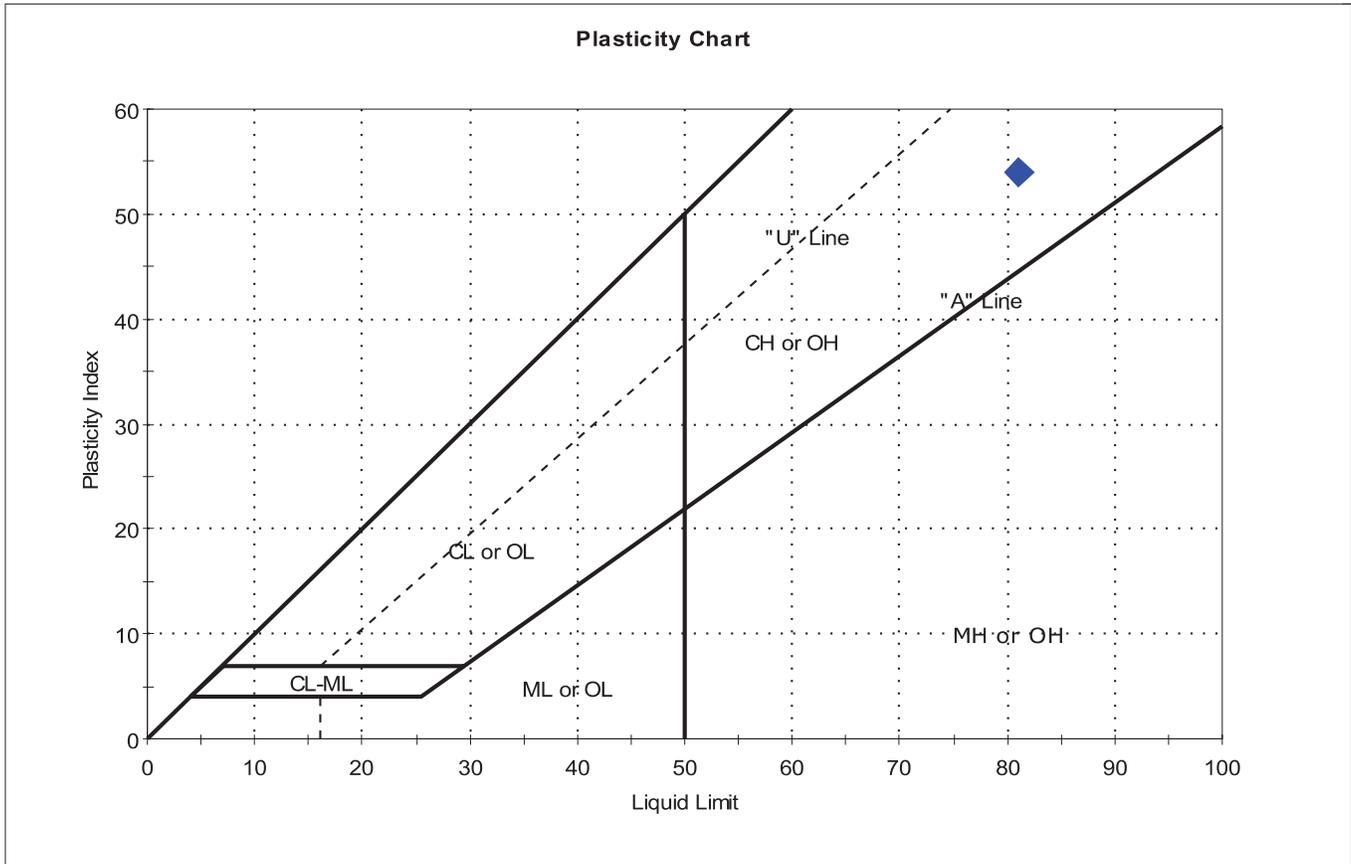
| <u>Classification</u> |                           |
|-----------------------|---------------------------|
| <u>ASTM</u>           | Sandy Fat clay (CH)       |
| <u>AASHTO</u>         | Clayey Soils (A-7-6 (33)) |

| <u>Sample/Test Description</u>   |
|----------------------------------|
| Sand/Gravel Particle Shape : --- |
| Sand/Gravel Hardness : ---       |



|                     |                                            |              |             |             |     |
|---------------------|--------------------------------------------|--------------|-------------|-------------|-----|
| Client:             | F&ME Consultants                           |              | Project No: | GTX-305005  |     |
| Project:            | US-21 Replacement Bridge over Harbor River |              |             |             |     |
| Location:           | ---                                        | Sample Type: | tube        | Tested By:  | cam |
| Boring ID:          | AP-2                                       | Test Date:   | 08/29/16    | Checked By: | mcm |
| Sample ID:          | UD-2                                       | Test Id:     | 387112      |             |     |
| Depth :             | 18.0-20.0 ft                               |              |             |             |     |
| Test Comment:       | ---                                        |              |             |             |     |
| Visual Description: | Moist, olive sandy 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 |
|--------|-----------|--------|--------------|-----------------------------|--------------|---------------|------------------|-----------------|---------------------|
| ◆      | UD-2      | AP-2   | 18.0-20.0 ft | 69                          | 81           | 27            | 54               | 0.8             | Sandy Fat clay (CH) |

Sample Prepared using the WET method  
 4% Retained on #40 Sieve  
 Dry Strength: VERY HIGH  
 Dilatancy: SLOW  
 Toughness: LOW



Client: F&ME Consultants

Project Name: US-21 Replacement Bridge

Project Location: ---

Project Number: GTX-305005

Tested By: md

Checked By: mcm

Boring ID: AP-2

Preparation: intact

Description: Moist, olive sandy clay

Classification: Sandy Fat clay

Group Symbol: CH

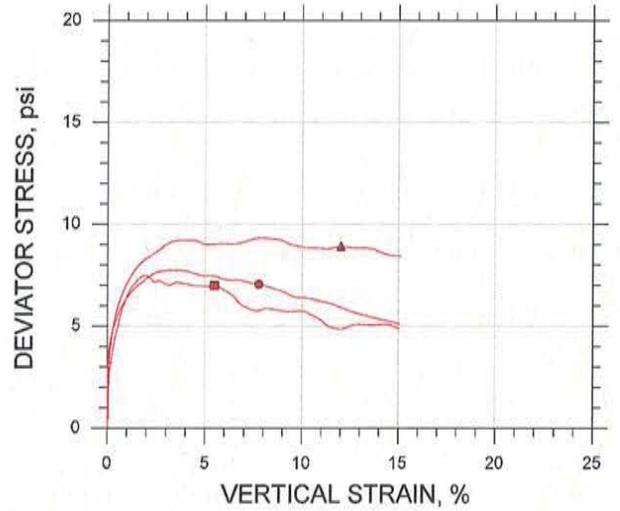
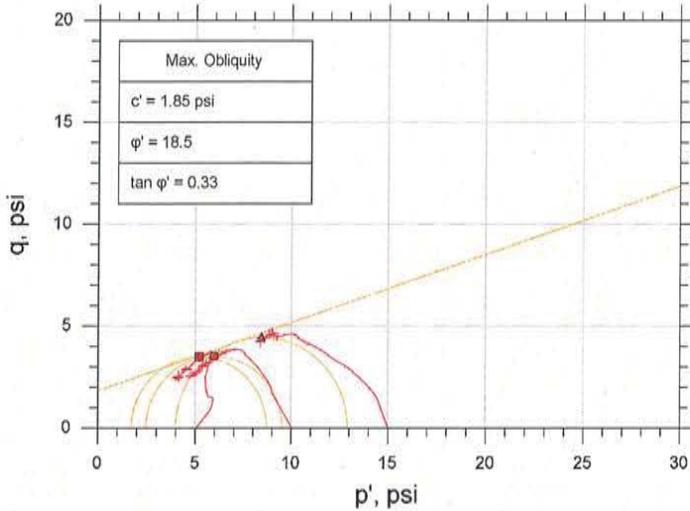
Liquid Limit: 81

Plastic Limit: 27

Plasticity Index: 54

Estimated Specific Gravity: 2.7

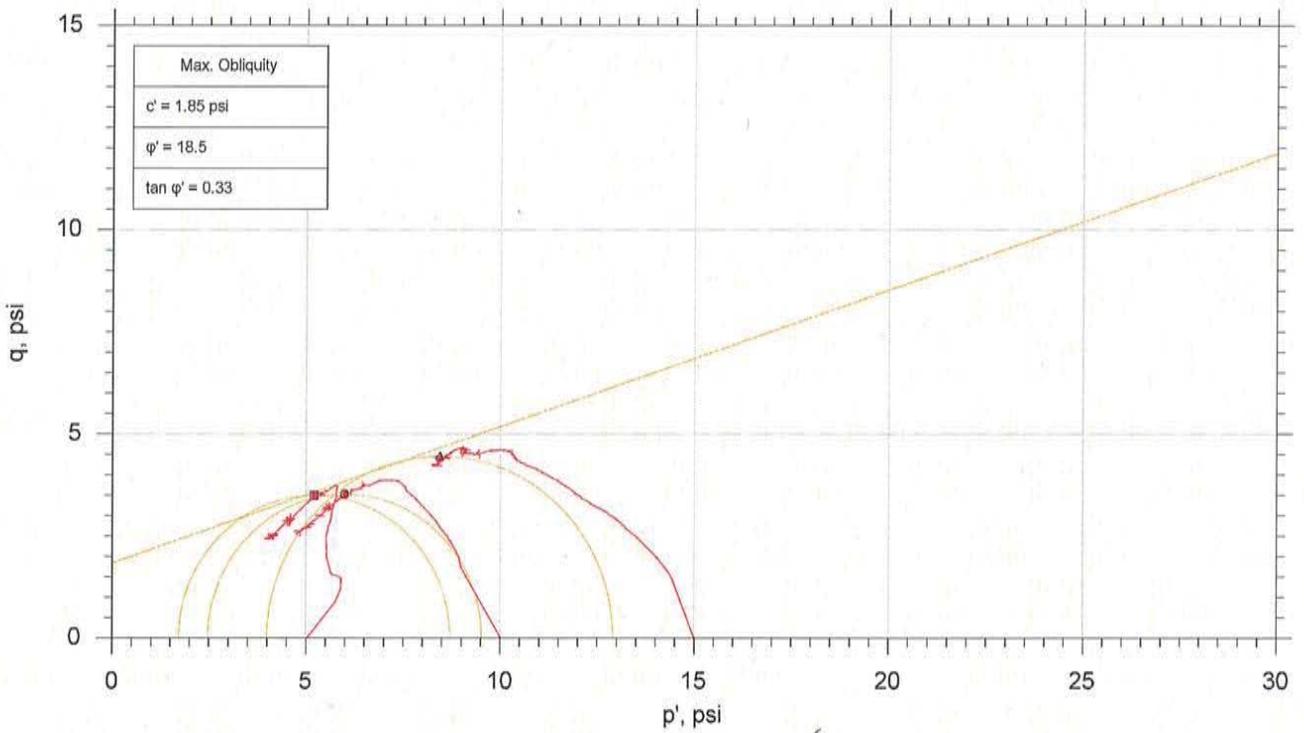
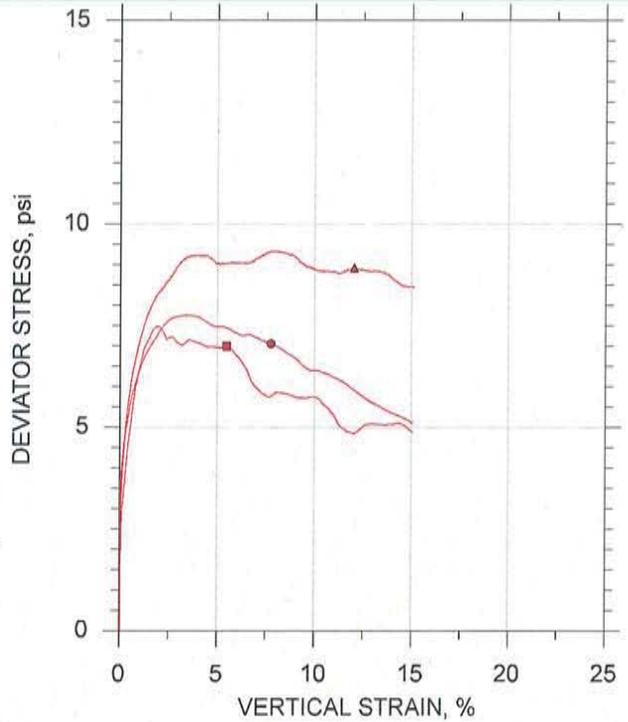
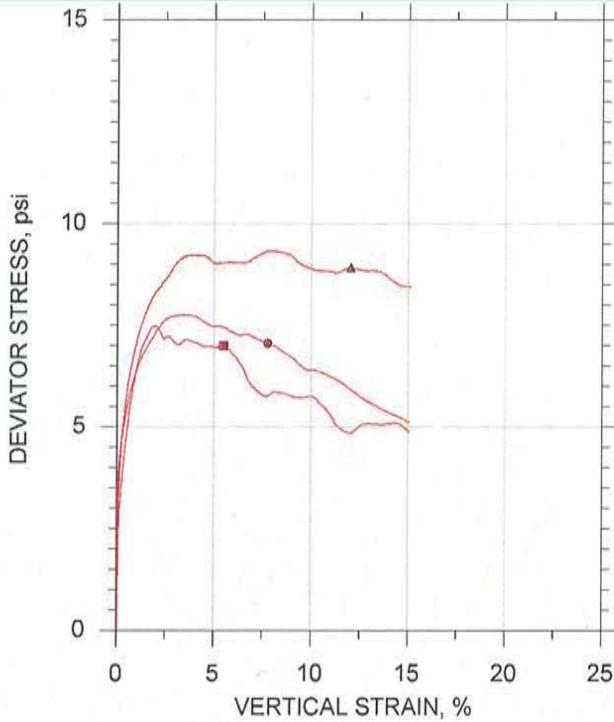
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



| Symbol                                           | ■                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ●            | ▲            |       |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-------|
| Sample ID                                        | ST-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ST-2         | ST-2         |       |
| Depth, ft                                        | 18.0-20.0 ft                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 18.0-20.0 ft | 18.0-20.0 ft |       |
| Test Number                                      | CU-4-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CU-4-2       | CU-4-3       |       |
| Initial                                          | Height, in                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 4.500        | 4.350        | 4.380 |
|                                                  | Diameter, in                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2.030        | 2.010        | 2.030 |
|                                                  | Moisture Content (from Cuttings), %                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 64.9         | 70.2         | 80.2  |
|                                                  | Dry Density, pcf                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 60.5         | 54.4         | 52.1  |
|                                                  | Saturation (Wet Method), %                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 98.2         | 90.4         | 96.8  |
|                                                  | Void Ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1.78         | 2.10         | 2.24  |
| Before Shear                                     | Moisture Content, %                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 63.4         | 70.4         | 70.2  |
|                                                  | Dry Density, pcf                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 62.1         | 58.1         | 58.2  |
|                                                  | Cross-sectional Area (Method A), in <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3.153        | 3.020        | 3.006 |
|                                                  | Saturation, %                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 100.0        | 100.0        | 100.0 |
|                                                  | Void Ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1.71         | 1.90         | 1.90  |
|                                                  | Back Pressure, psi                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 96.99        | 151.0        | 150.7 |
| Vertical Effective Consolidation Stress, psi     | 5.008                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9.886        | 14.67        |       |
| Horizontal Effective Consolidation Stress, psi   | 5.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10.00        | 14.97        |       |
| Vertical Strain after Consolidation, %           | 0.002069                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1.405        | 3.740        |       |
| Volumetric Strain after Consolidation, %         | 2.531                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5.704        | 10.72        |       |
| Time to 50% Consolidation, min                   | 72.25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 90.25        | 169.0        |       |
| Shear Strength, psi                              | 3.498                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3.528        | 4.459        |       |
| Strain at Failure, %                             | 5.48                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 7.76         | 12.0         |       |
| Strain Rate, %/min                               | 0.01600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.01600      | 0.01600      |       |
| Deviator Stress at Failure, psi                  | 6.995                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 7.055        | 8.918        |       |
| Effective Minor Principal Stress at Failure, psi | 1.703                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2.455        | 3.977        |       |
| Effective Major Principal Stress at Failure, psi | 8.698                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9.510        | 12.90        |       |
| B-Value                                          | 0.95                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.95         | 0.95         |       |
| Notes:                                           | <ul style="list-style-type: none"> <li>- Before Shear Saturation set to 100% for phase calculation.</li> <li>- Moisture Content determined by ASTM D2216.</li> <li>- Atterberg Limits determined by ASTM D4318.</li> <li>- Deviator Stress includes membrane correction.</li> <li>- 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.</li> </ul> |              |              |       |
| Remarks:                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |              |       |

System X. Note CU-1-1 test specimen was not used in determining cohesion or friction values.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

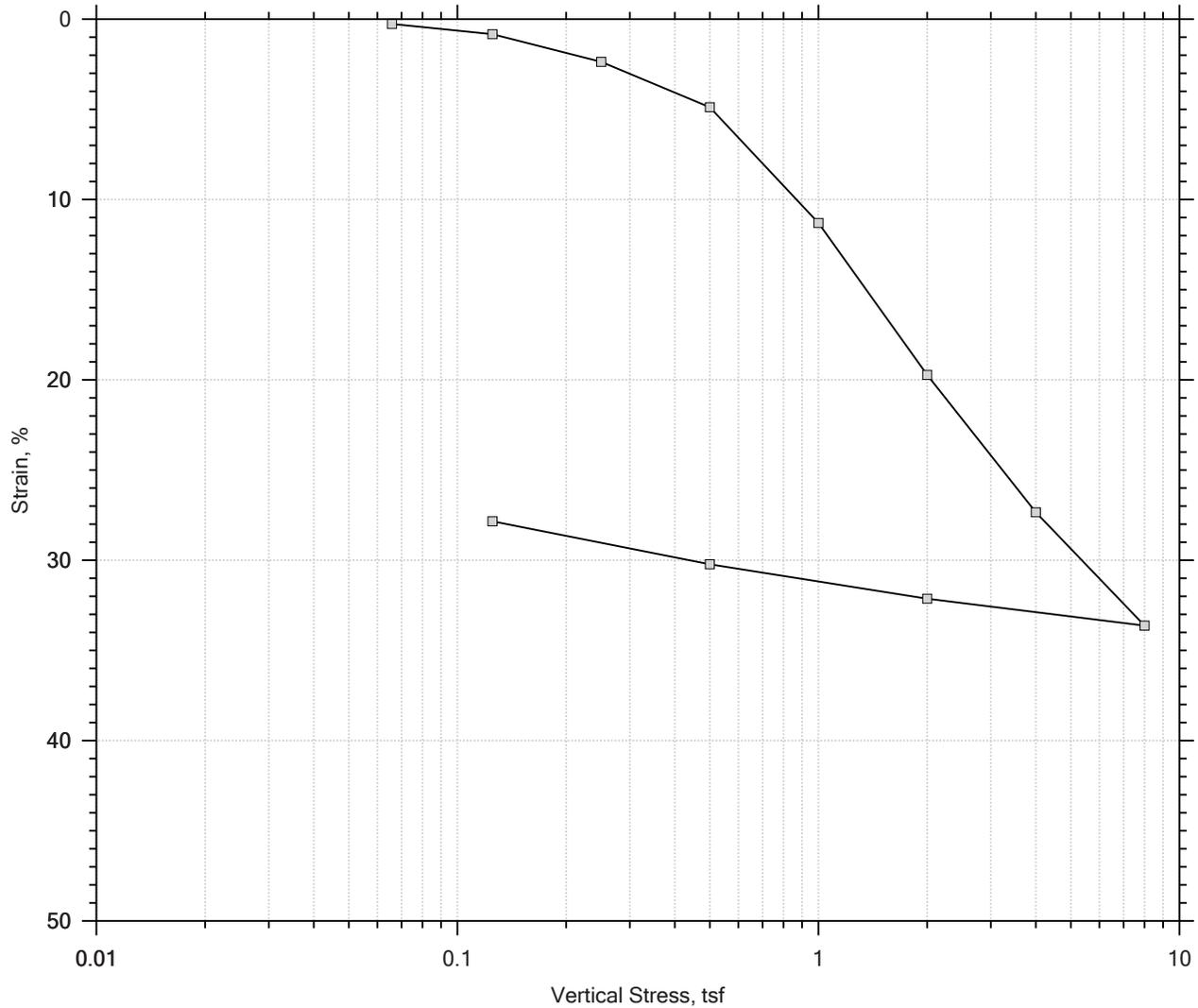


| Sample No. | Test No. | Depth  | Tested By    | Test Date | Checked By | Check Date | Test File |                    |
|------------|----------|--------|--------------|-----------|------------|------------|-----------|--------------------|
| ■          | ST-2     | CU-4-1 | 18.0-20.0 ft | md        | 8/23/16    | mcm        | 8/30/16   | 305005-CU-4-1m.dat |
| ●          | ST-2     | CU-4-2 | 18.0-20.0 ft | md        | 08/23/16   | mcm        | 8/30/16   | 305005-CU-4-2m.dat |
| ▲          | ST-2     | CU-4-3 | 18.0-20.0 ft | md        | 08/23/16   | mcm        | 8/30/16   | 305005-CU-4-3m.dat |

|  |                                                                                                       |                     |                         |
|--|-------------------------------------------------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                                                                     | Location: ---       | Project No.: GTX-305005 |
|  | Boring No.: AP-2                                                                                      | Sample Type: intact |                         |
|  | Description: Moist, olive sandy clay                                                                  |                     |                         |
|  | Remarks: System X. Note CU-1-1 test specimen was not used in determining cohesion or friction values. |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

## Summary Report

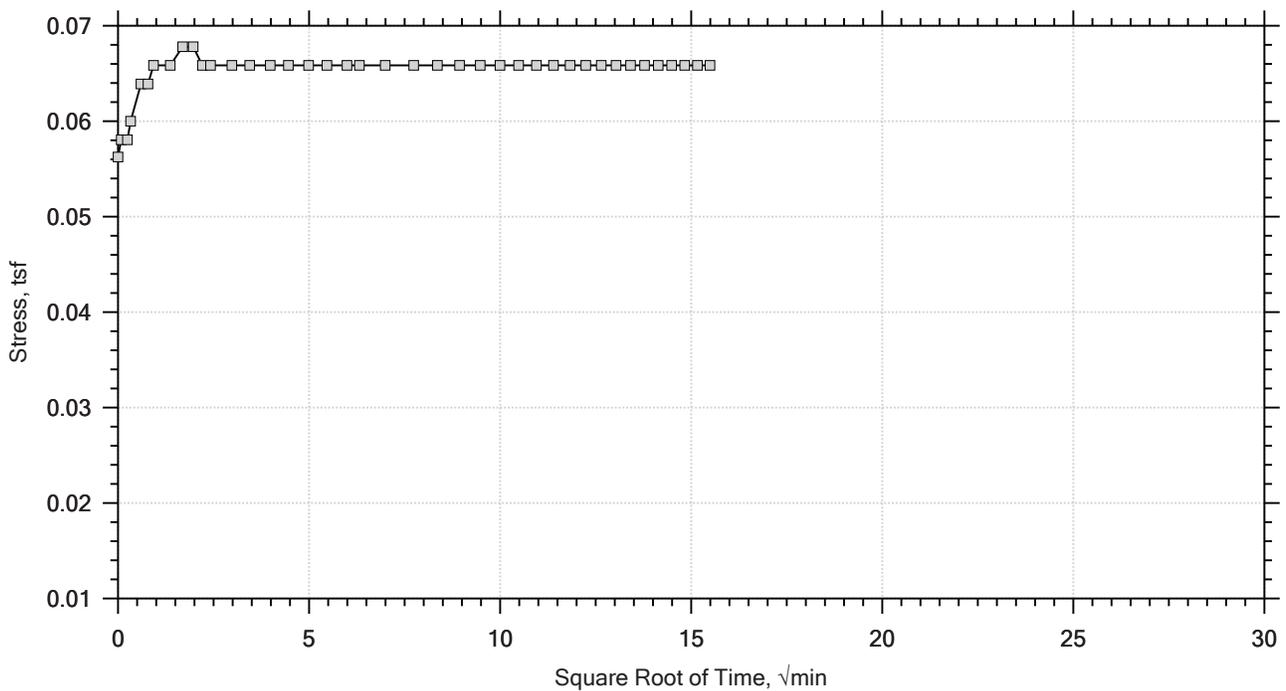
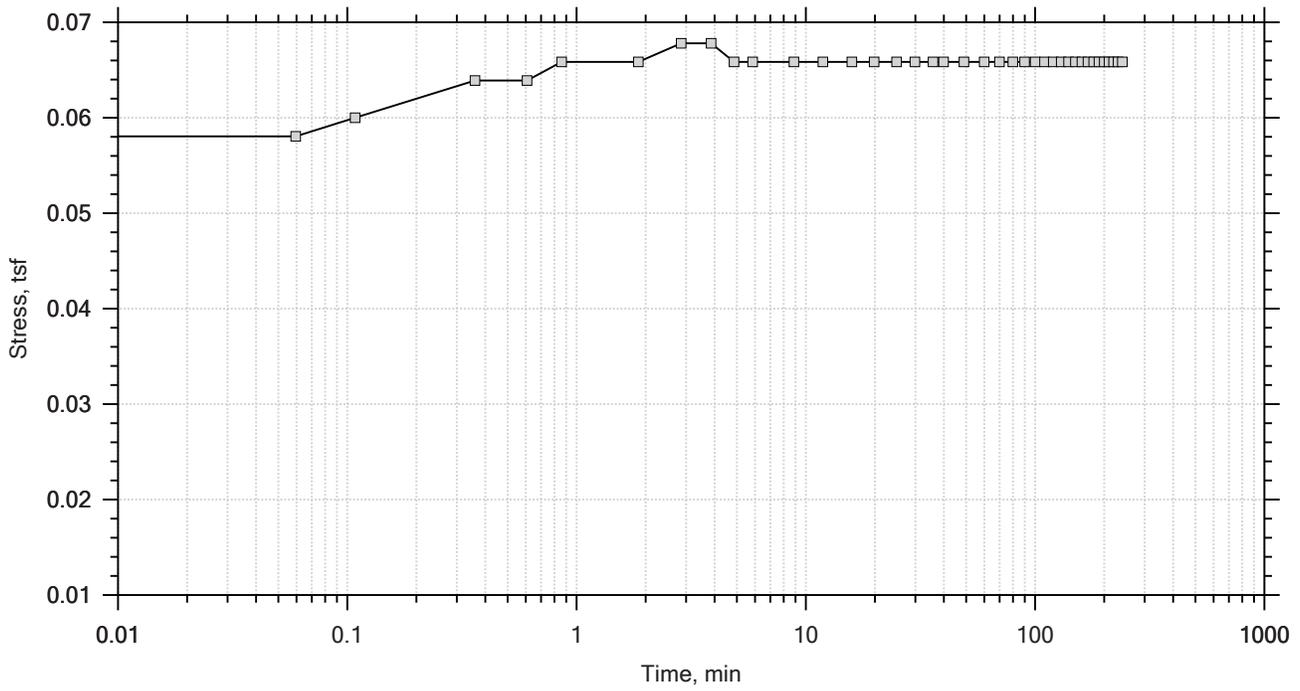


|                                        |        |              |          | Before Test          | After Test |        |
|----------------------------------------|--------|--------------|----------|----------------------|------------|--------|
| Current Vertical Effective Stress: --- |        |              |          | Water Content, %     | 57.55      | 32.34  |
| Preconsolidation Stress: ---           |        |              |          | Dry Unit Weight, pcf | 65.031     | 90.12  |
| Compression Ratio: ---                 |        |              |          | Saturation, %        | 97.45      | 100.00 |
| Diameter: 2.5 in                       |        | Height: 1 in |          | Void Ratio           | 1.60       | 0.88   |
| LL: 81                                 | PL: 27 | PI: 54       | GS: 2.71 |                      |            |        |

|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     | Displacement at End of Increment               |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

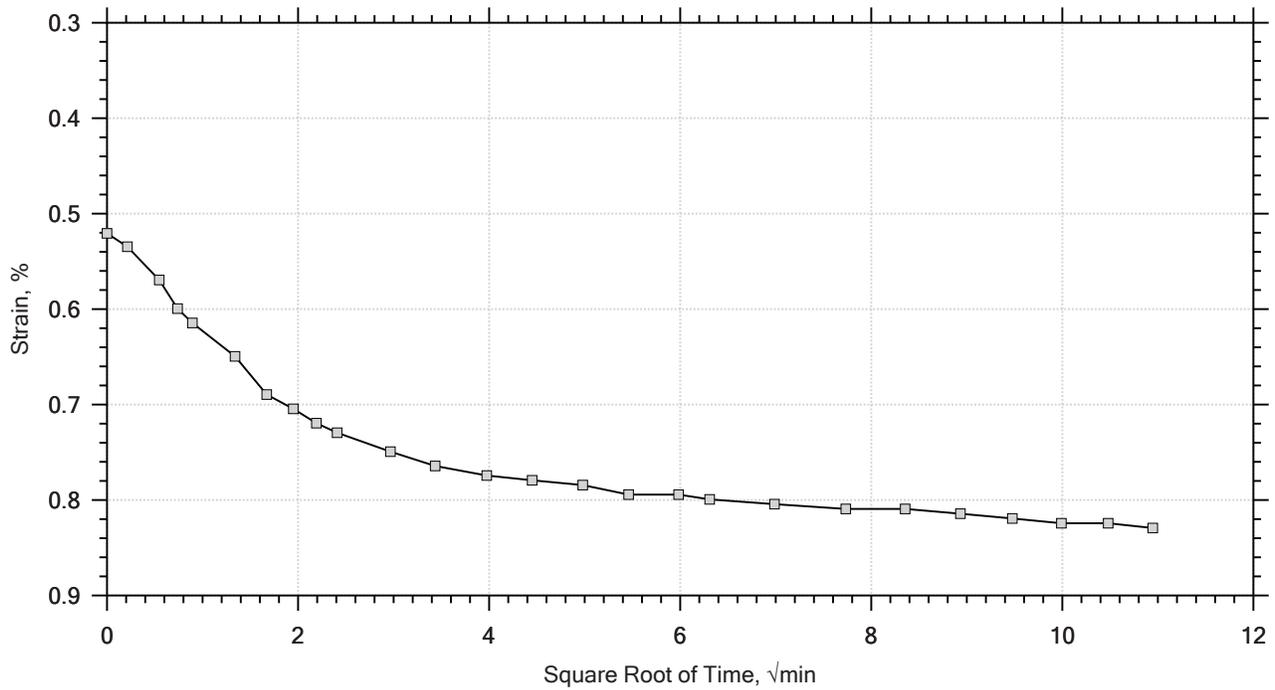
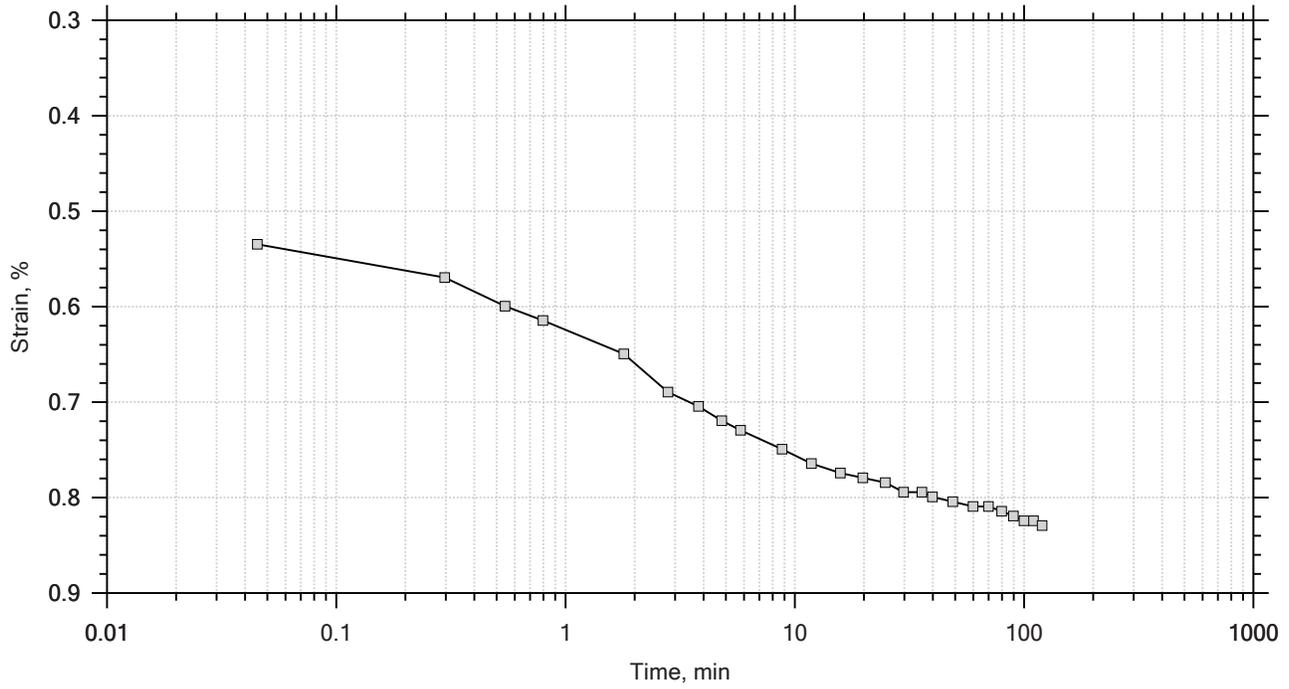
Time Curve 1 of 11  
 Constant Volume Step  
 Stress: 0.0659 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 11  
 Constant Load Step  
 Stress: 0.125 tsf

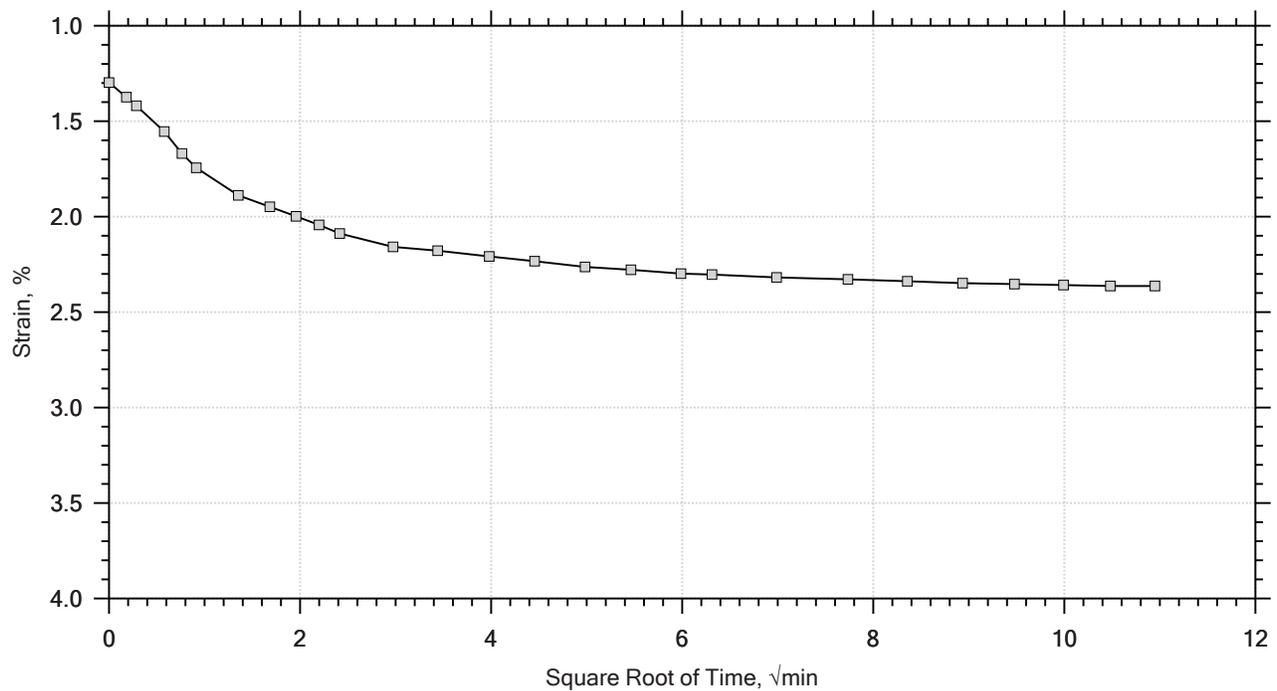
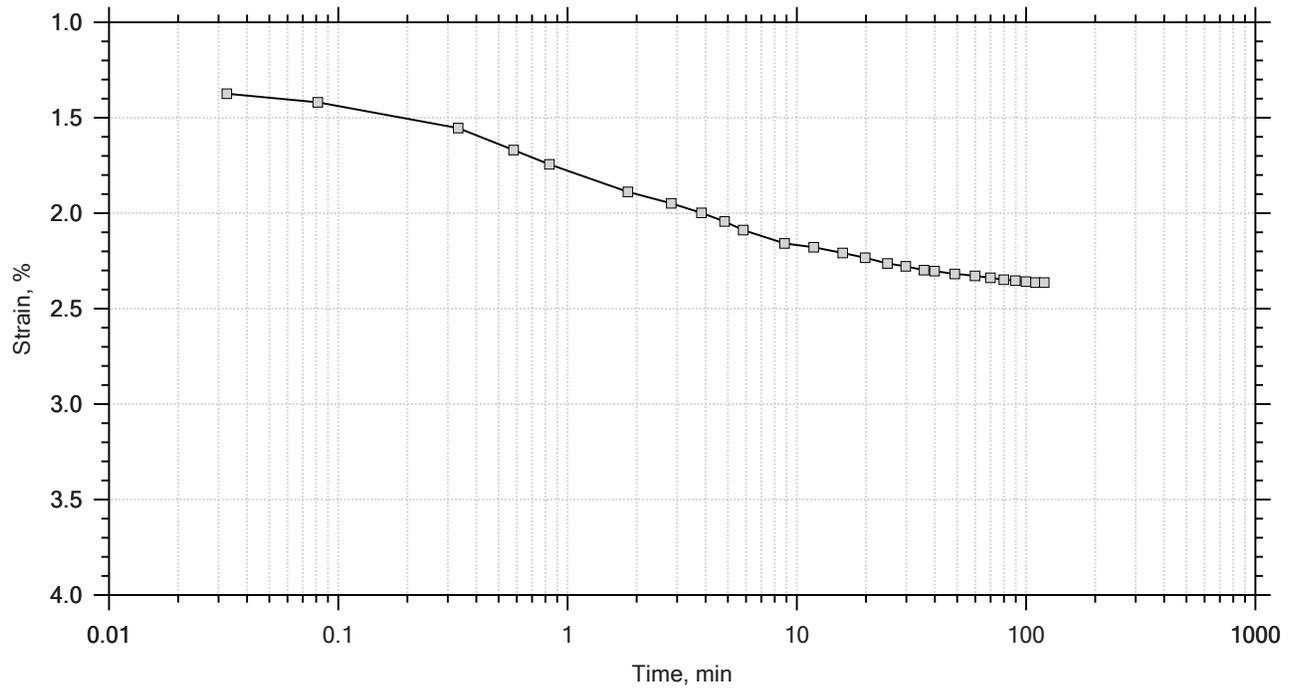


|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |



# One-Dimensional Consolidation by ASTM D2435 - Method B

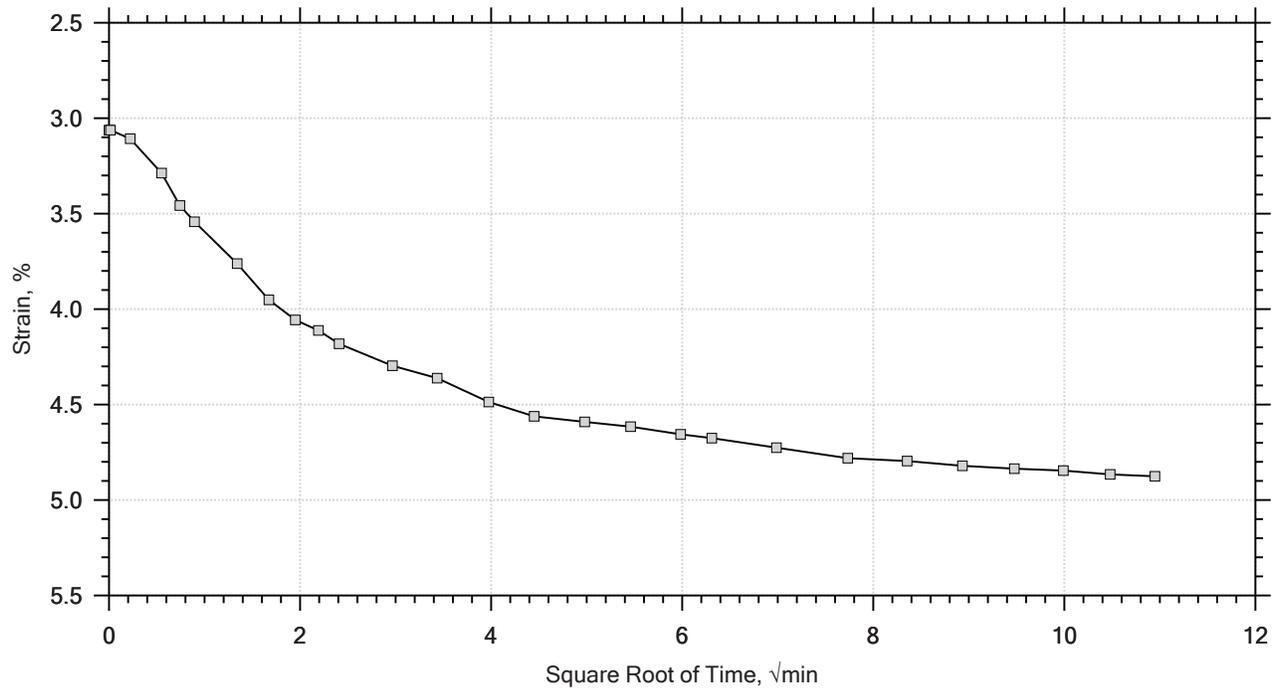
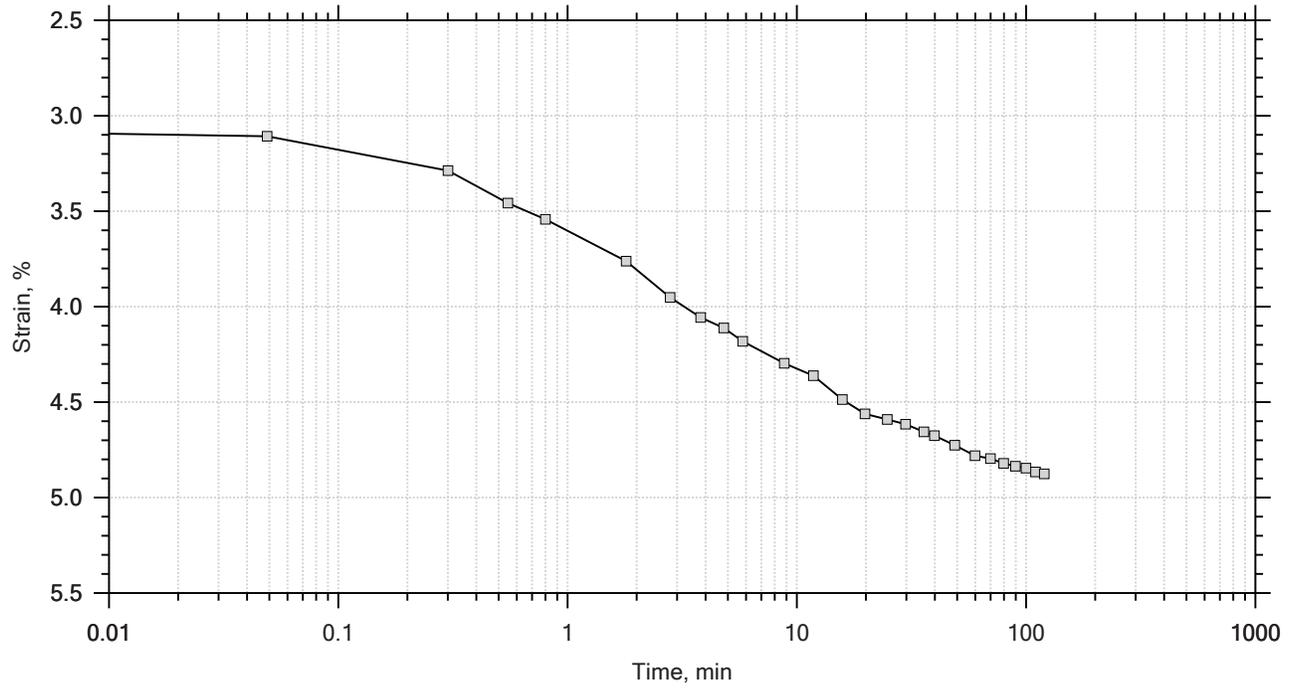
Time Curve 3 of 11  
 Constant Load Step  
 Stress: 0.25 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

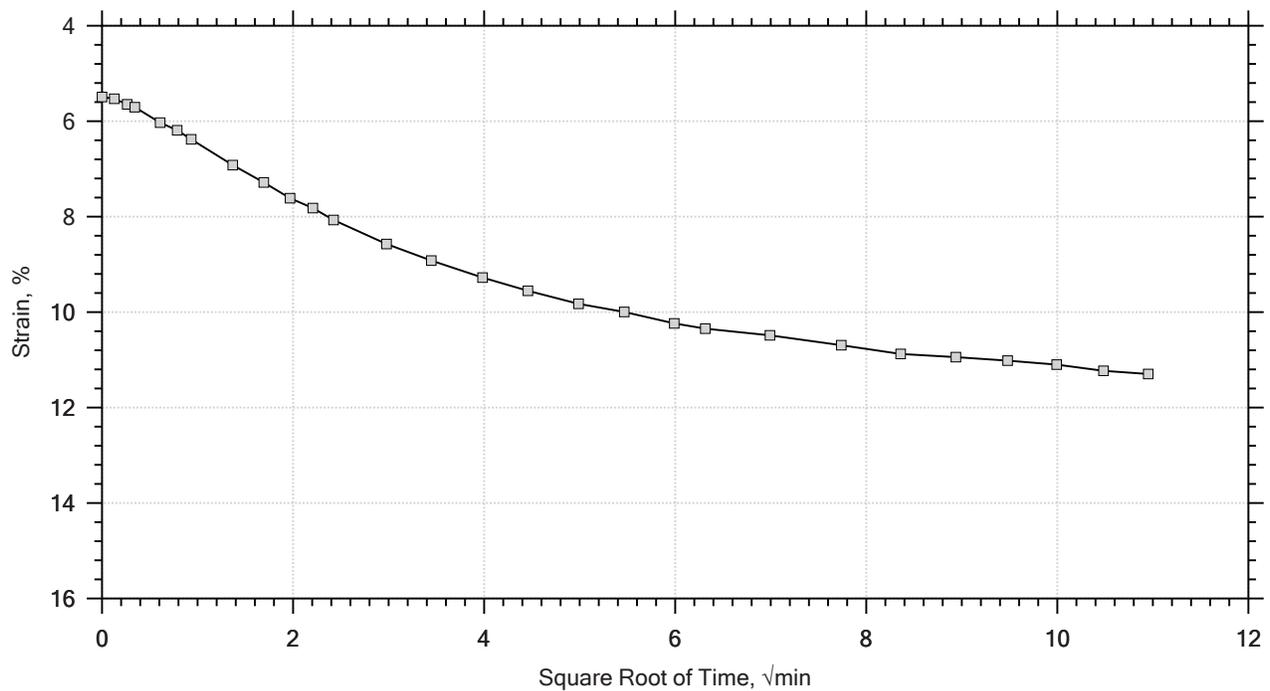
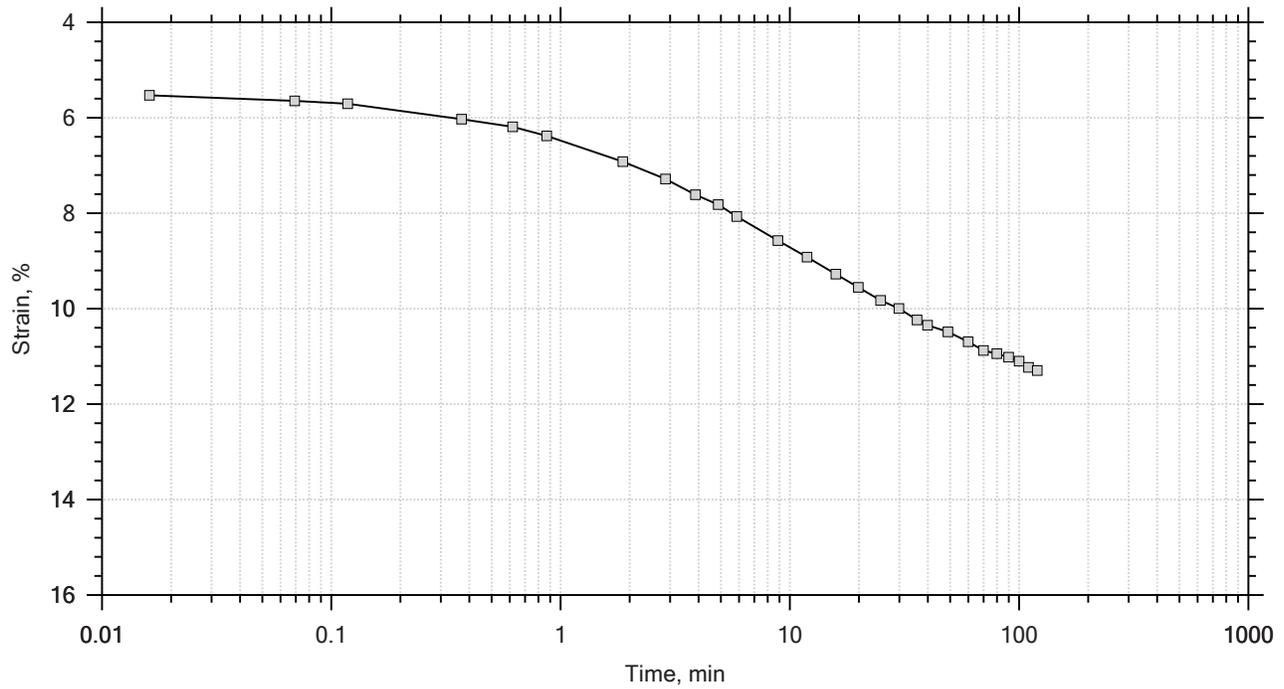
Time Curve 4 of 11  
 Constant Load Step  
 Stress: 0.5 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

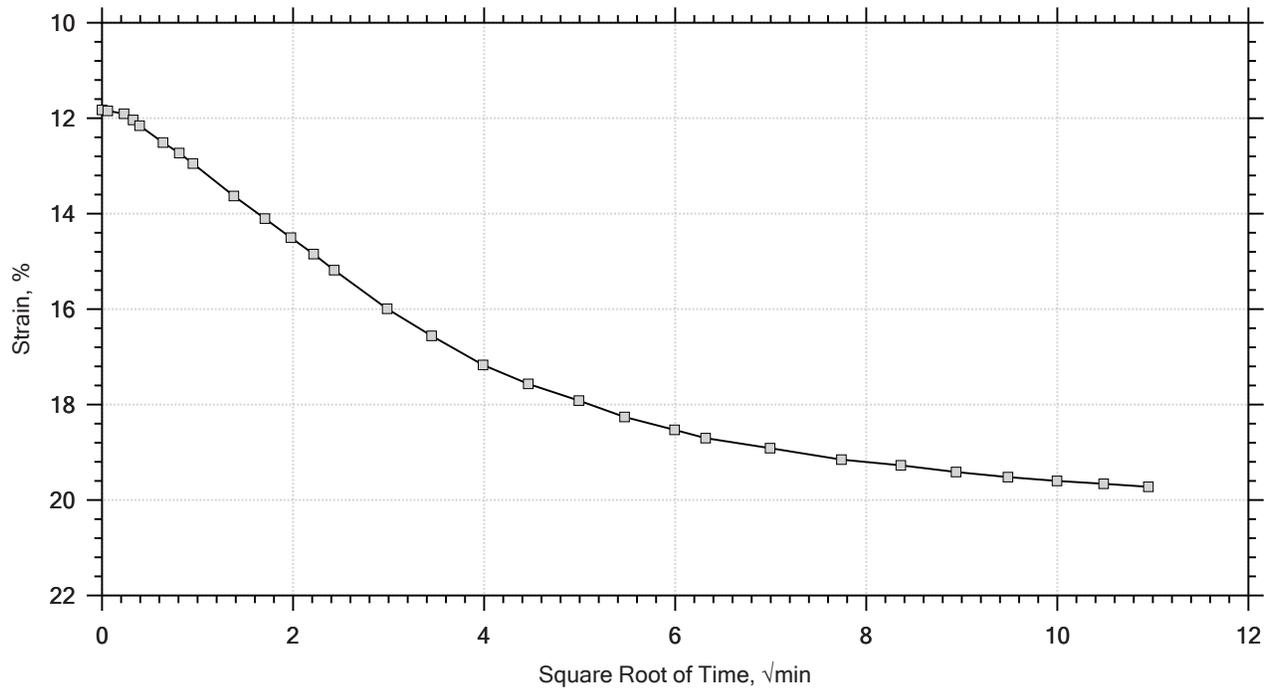
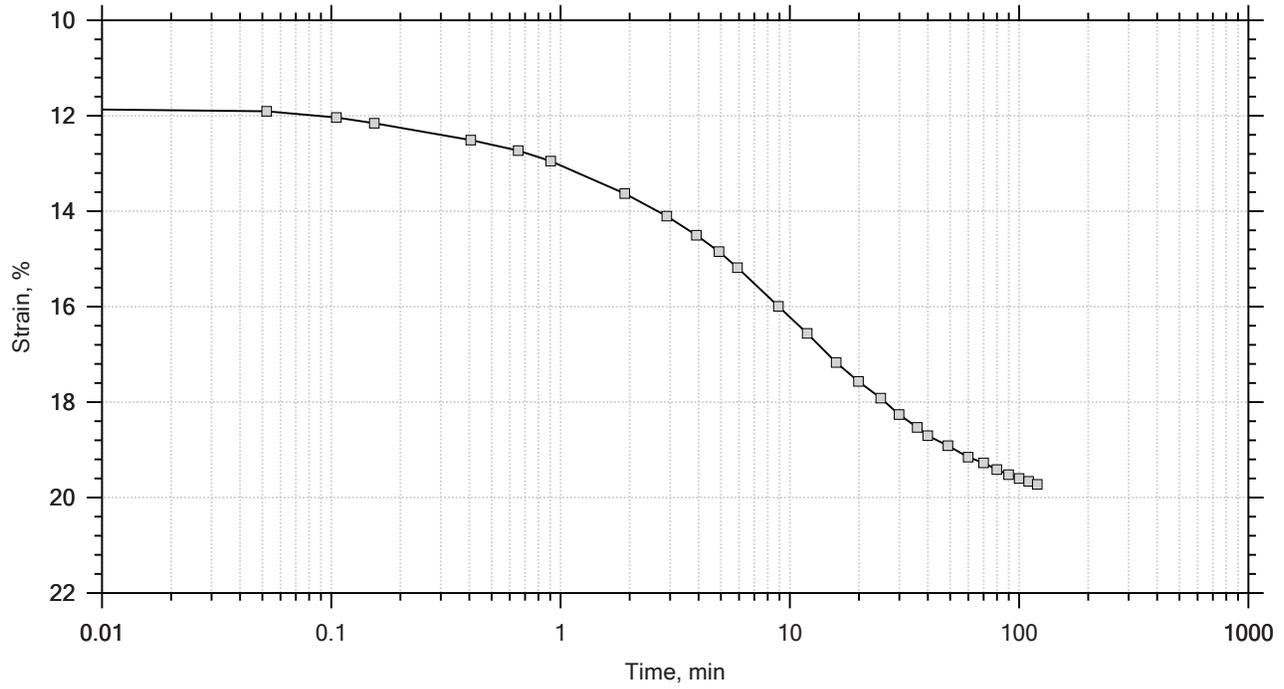
Time Curve 5 of 11  
 Constant Load Step  
 Stress: 1 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

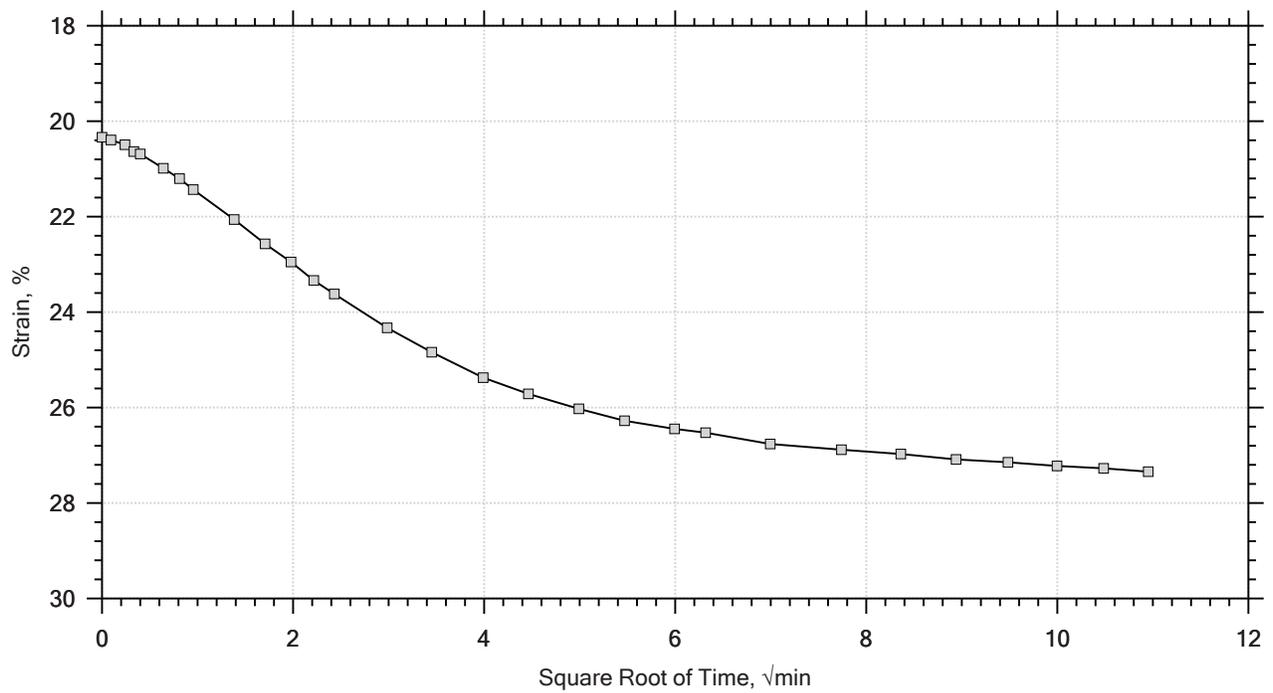
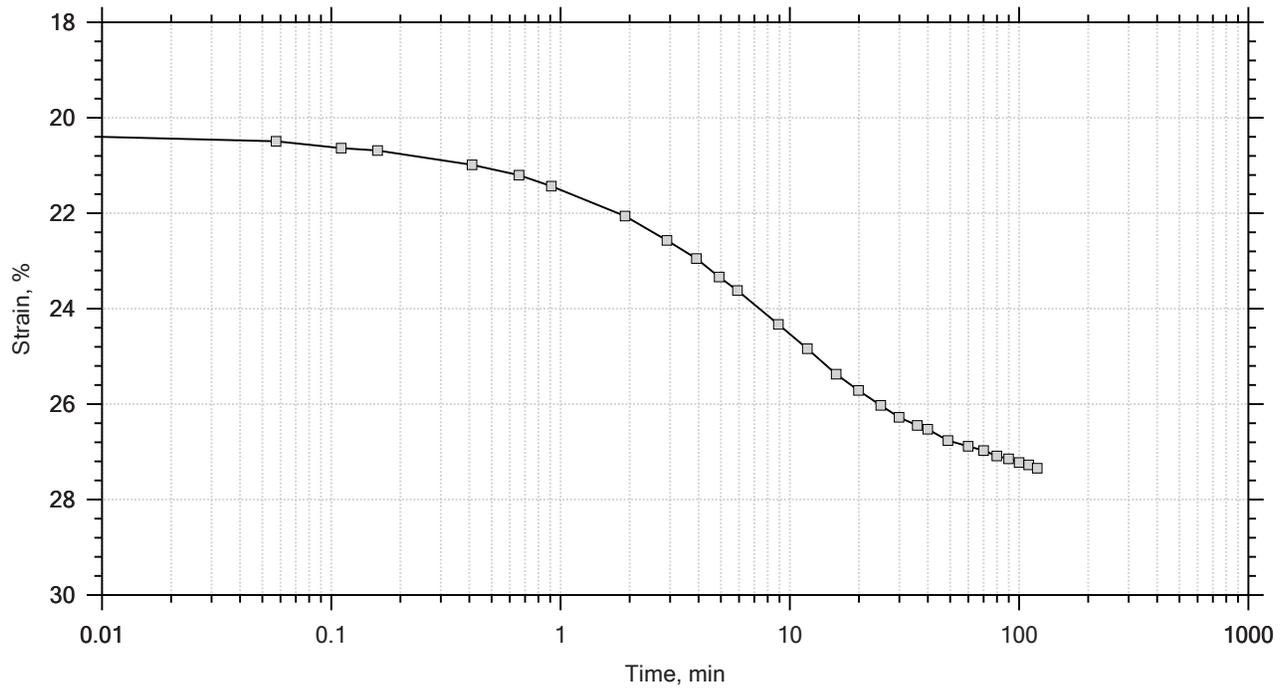
Time Curve 6 of 11  
 Constant Load Step  
 Stress: 2 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

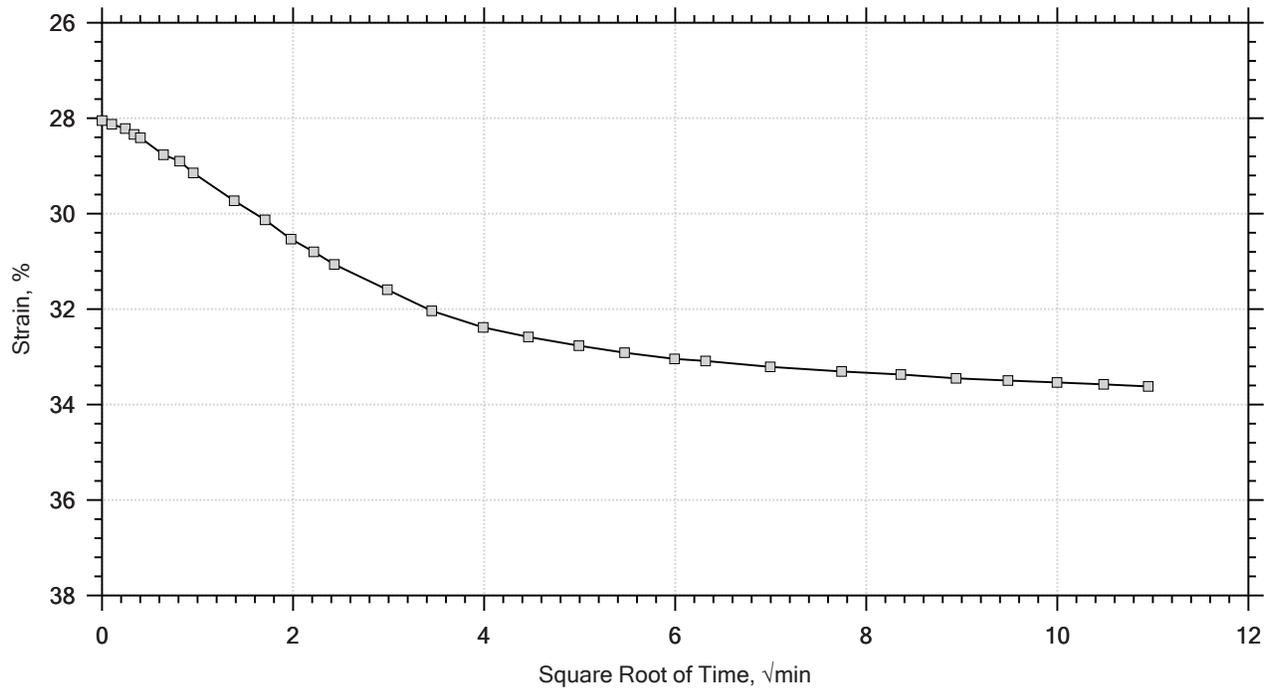
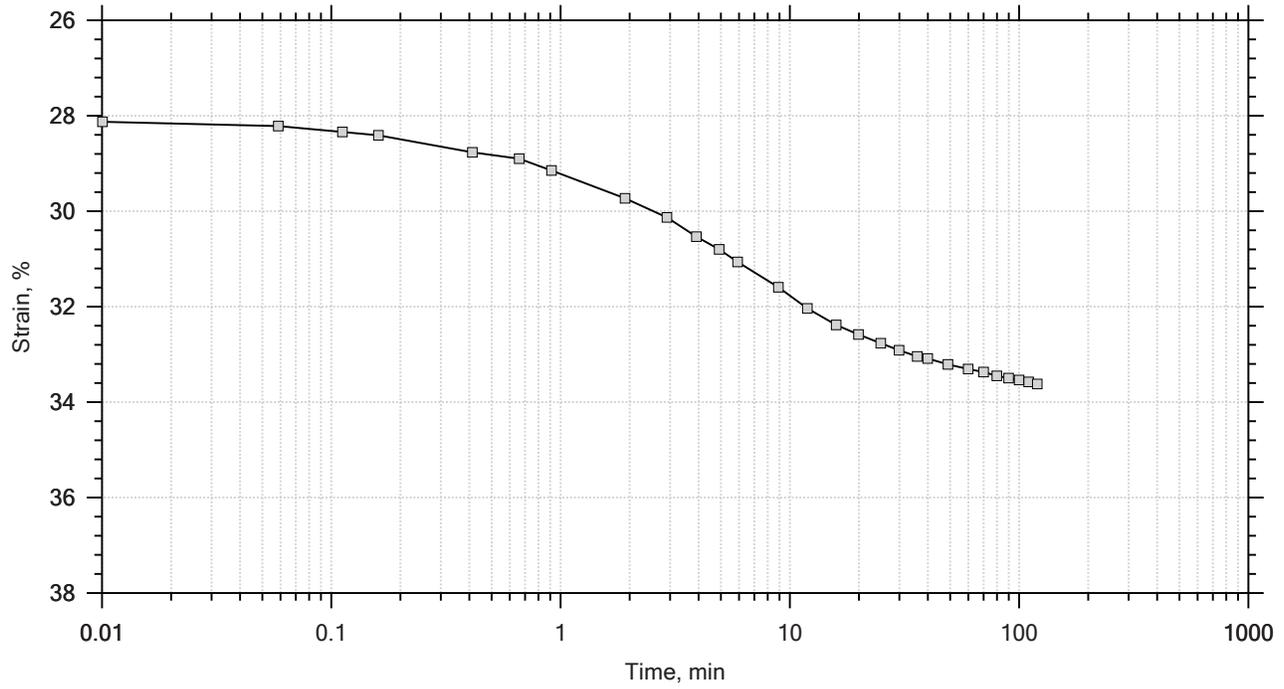
Time Curve 7 of 11  
 Constant Load Step  
 Stress: 4 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

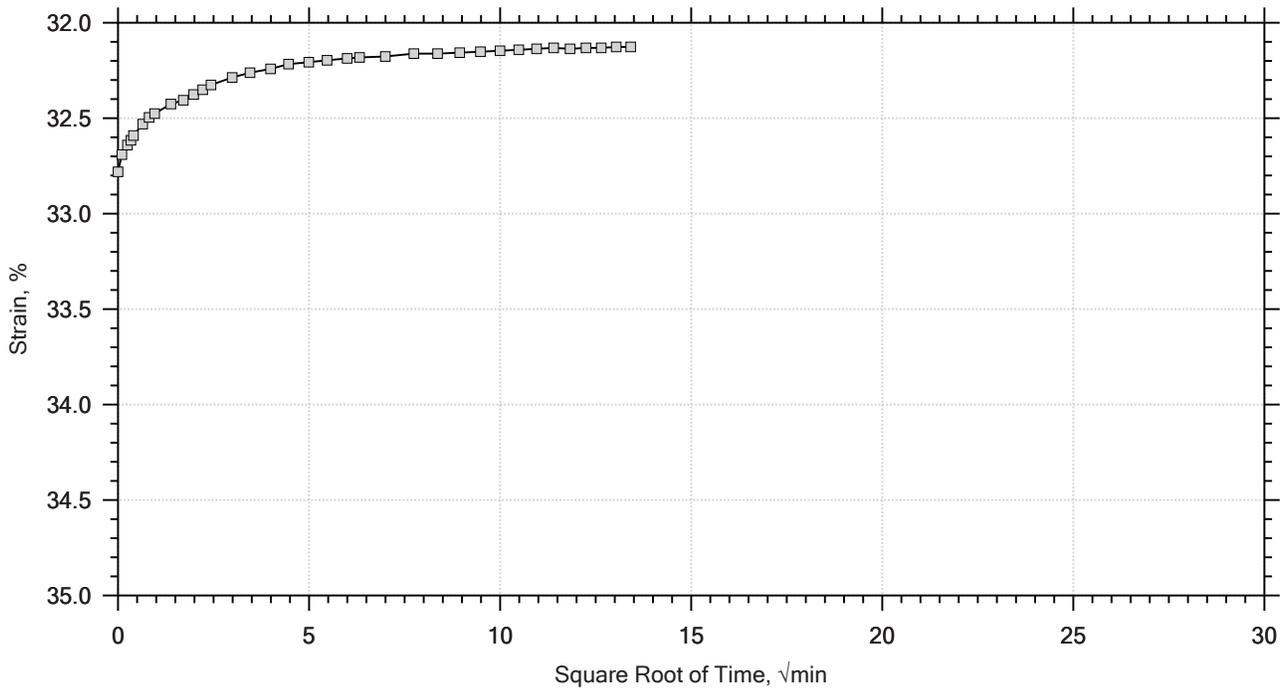
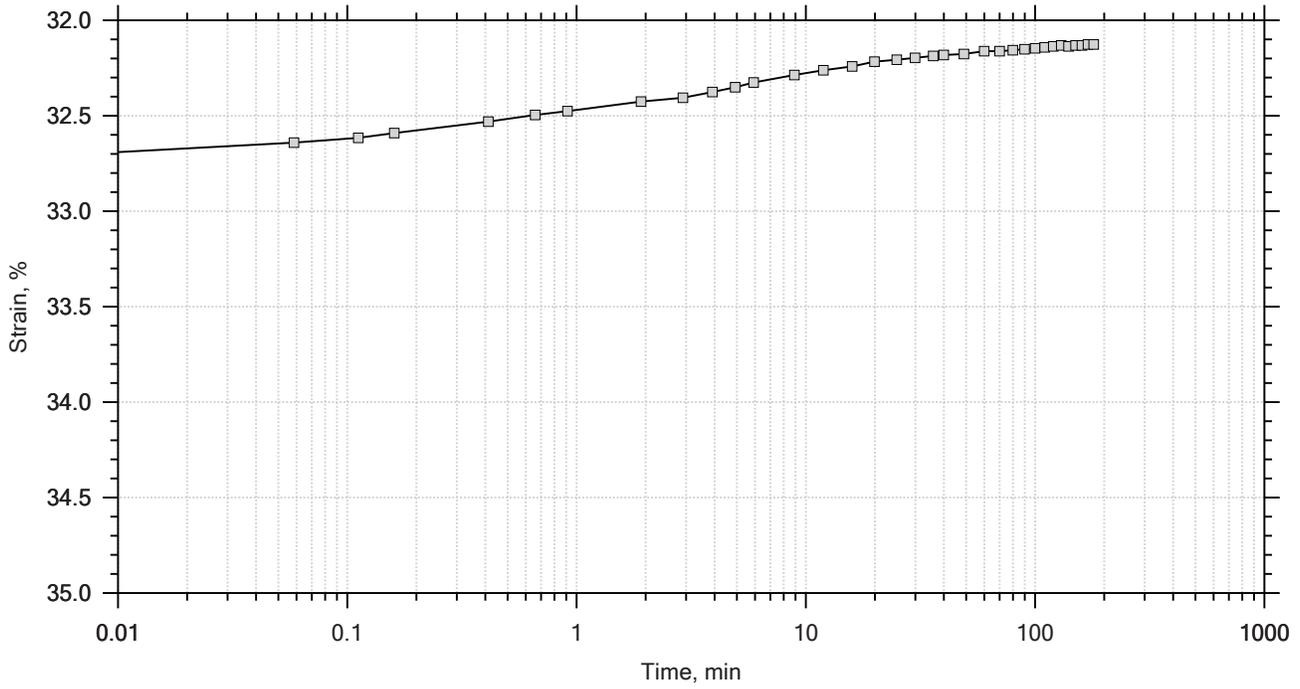
Time Curve 8 of 11  
 Constant Load Step  
 Stress: 8 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 11  
 Constant Load Step  
 Stress: 2 tsf



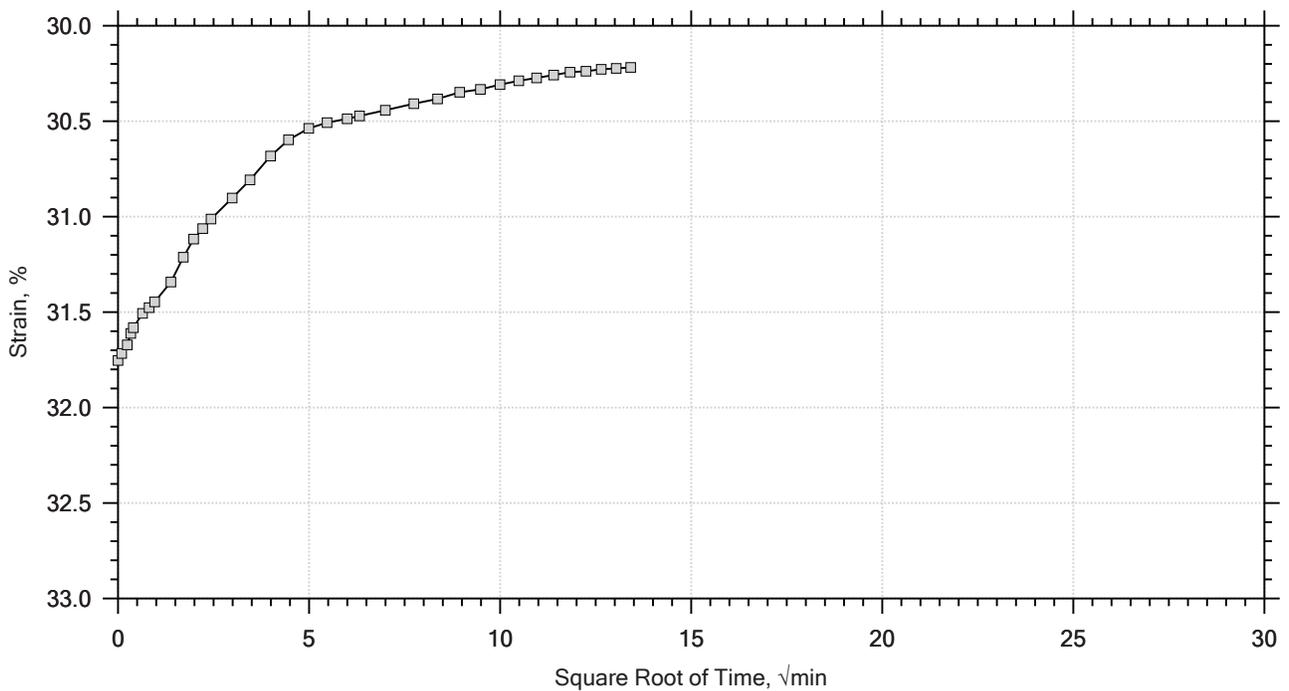
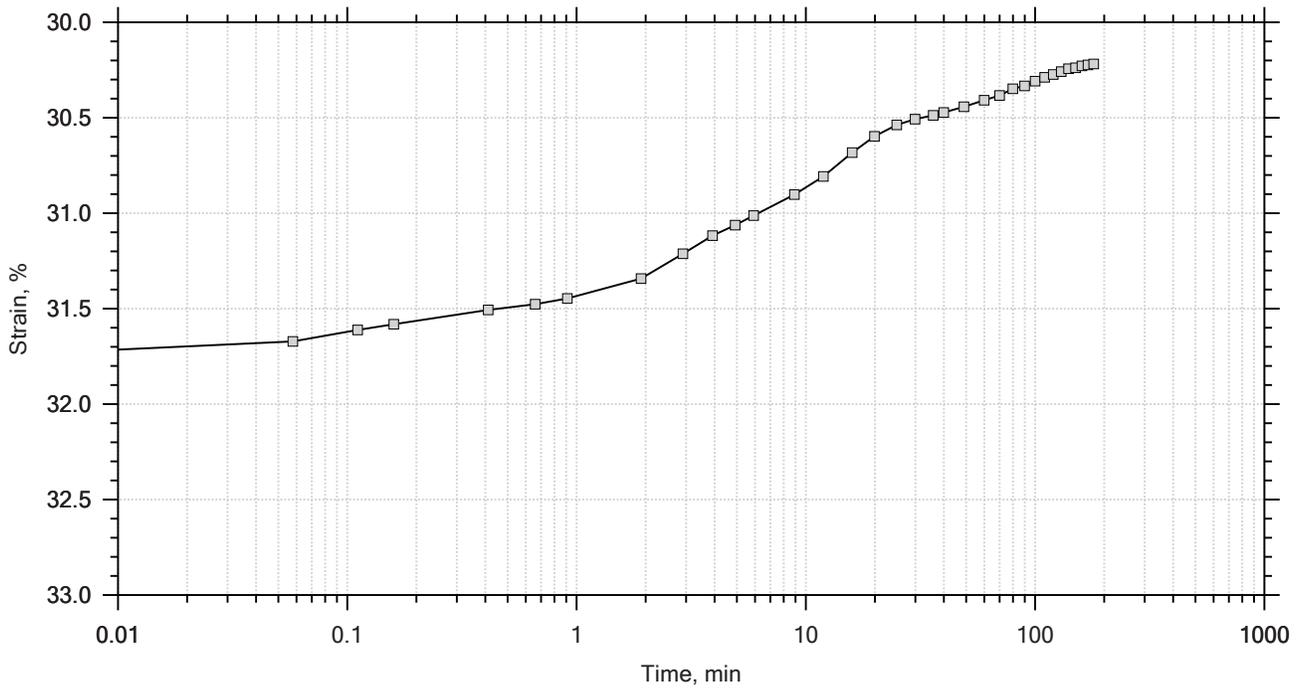
|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 11

Constant Load Step

Stress: 0.5 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

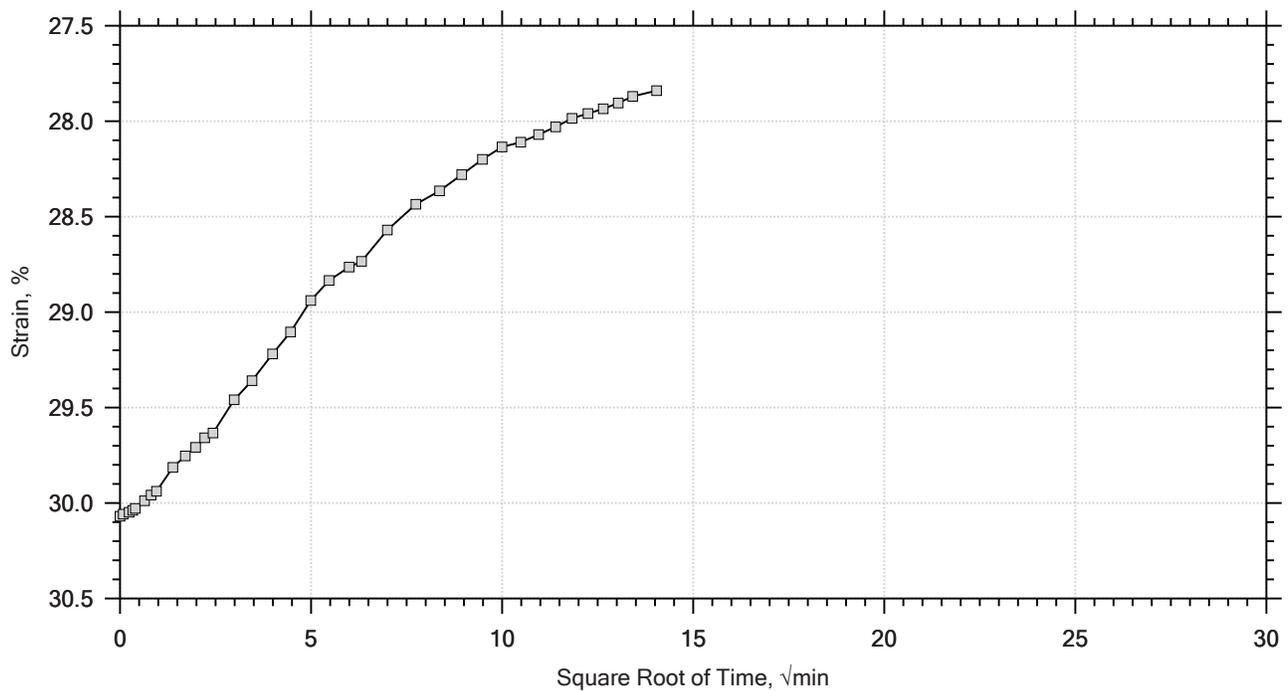
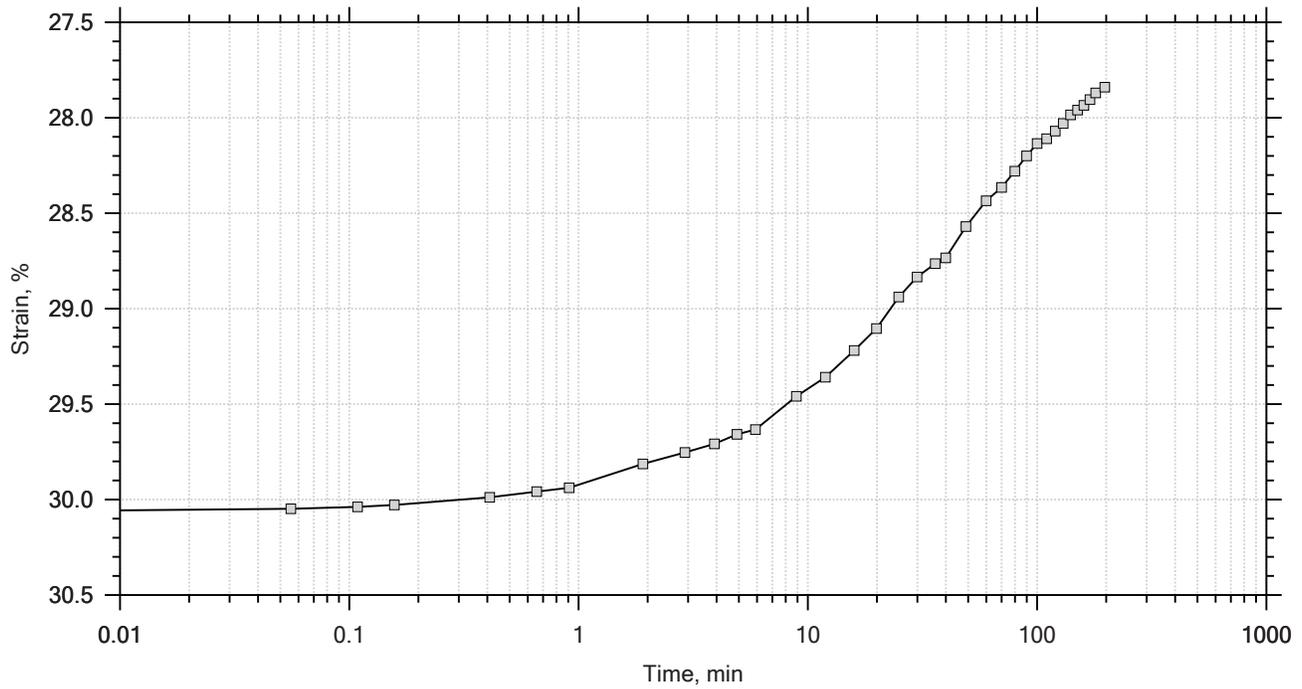


# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 11

Constant Load Step

Stress: 0.125 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

|                            |                                  |                      |
|----------------------------|----------------------------------|----------------------|
| Specimen Diameter: 2.50 in | Estimated Specific Gravity: 2.71 | Liquid Limit: 81     |
| Initial Height: 1.00 in    | Initial Void Ratio: 1.60         | Plastic Limit: 27    |
| Final Height: 0.72 in      | Final Void Ratio: 0.876          | Plasticity Index: 54 |

|                               | Before Test<br>Trimblings | Before Test<br>Specimen | After Test<br>Specimen | After Test<br>Trimblings |
|-------------------------------|---------------------------|-------------------------|------------------------|--------------------------|
| Container ID                  | C-2032                    | RING                    |                        | C-1962                   |
| Mass Container, gm            | 8.52                      | 111.14                  | 111.14                 | 8.44                     |
| Mass Container + Wet Soil, gm | 220                       | 243.16                  | 222.03                 | 119.18                   |
| Mass Container + Dry Soil, gm | 127.93                    | 194.93                  | 194.93                 | 92.12                    |
| Mass Dry Soil, gm             | 119.41                    | 83.793                  | 83.793                 | 83.68                    |
| Water Content, %              | 77.10                     | 57.55                   | 32.34                  | 32.34                    |
| Void Ratio                    | ---                       | 1.60                    | 0.88                   | ---                      |
| Degree of Saturation, %       | ---                       | 97.45                   | 100.00                 | ---                      |
| Dry Unit Weight, pcf          | ---                       | 65.031                  | 90.12                  | ---                      |

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-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-2                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 18.0-20.0 ft     |
|                                                                                     | Test No.: IP-4                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive sandy clay           |                     |                         |
|                                                                                     | Remarks: System Q, Swell Pressure = 0.0659 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |







|            |                                            |              |            |
|------------|--------------------------------------------|--------------|------------|
| Client:    | F&ME Consultants                           | Project No:  | GTX-305005 |
| Project:   | US-21 Replacement Bridge over Harbor River |              |            |
| Location:  | ---                                        |              |            |
| Boring ID: | ---                                        | Sample Type: | ---        |
| Sample ID: | ---                                        | Test Date:   | 08/30/16   |
| Depth :    | ---                                        | Test Id:     | 387124     |
|            |                                            | Tested By:   | jbr        |
|            |                                            | Checked By:  | mcm        |

## Moisture Content of Soil and Rock - ASTM D2216

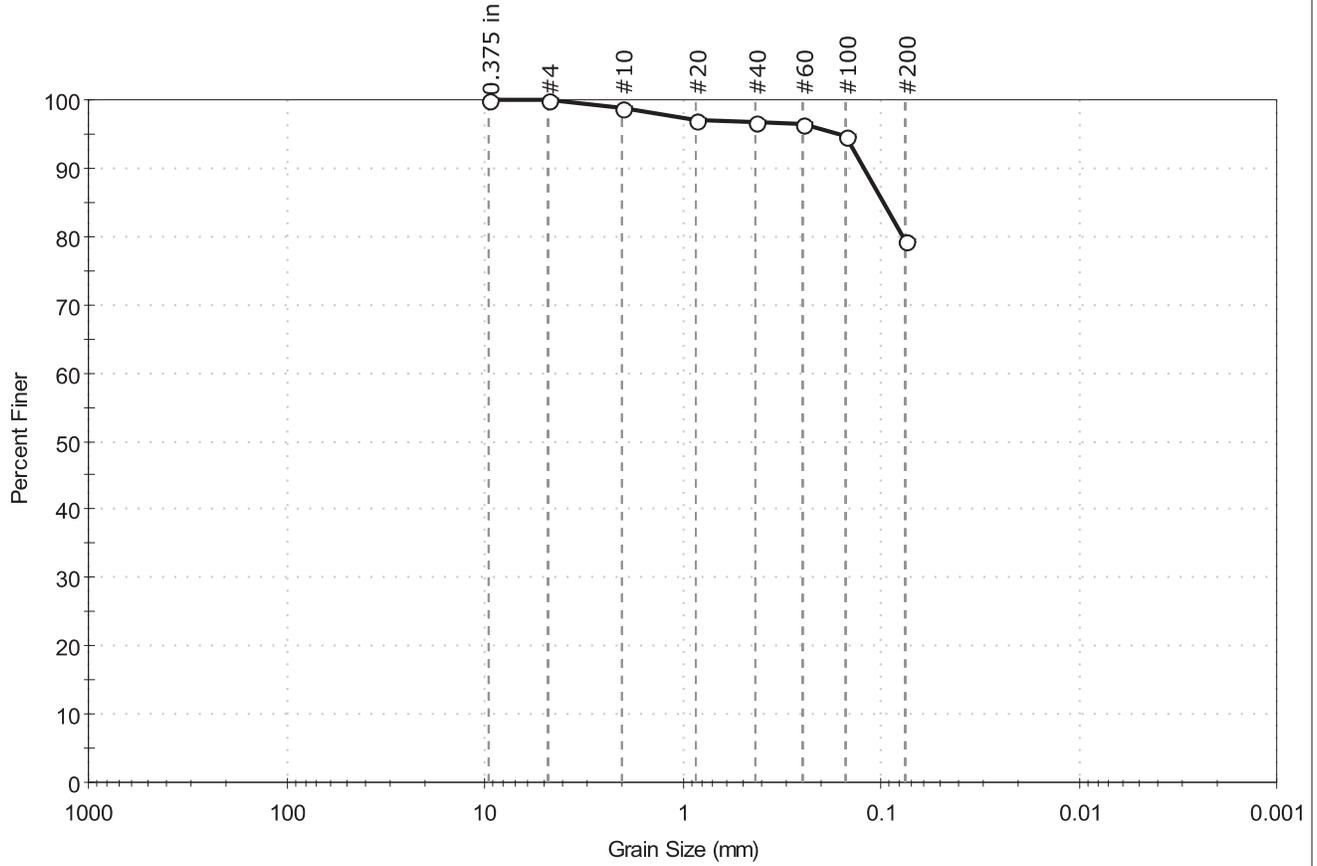
| Boring ID | Sample ID | Depth        | Description                 | Moisture Content, % |
|-----------|-----------|--------------|-----------------------------|---------------------|
| AP-3      | UD-1      | 25.0-27.0 ft | Moist, olive clay with sand | 83.0                |

Notes: Temperature of Drying : 110° Celsius



|                          |                                                     |                                                            |
|--------------------------|-----------------------------------------------------|------------------------------------------------------------|
| Client: F&ME Consultants | Project: US-21 Replacement Bridge over Harbor River | Project No: GTX-305005                                     |
| Location: ---            | Boring ID: AP-3                                     | Sample Type: tube                                          |
| Tested By: jbr           | Sample ID: UD-1                                     | Test Date: 08/29/16                                        |
| Checked By: mcm          | Depth: 25.0-27.0 ft                                 | Test Id: 387105                                            |
| Test Comment: ---        | Visual Description: Moist, olive clay with sand     | Sample Comment: Sample contains shells and shell fragments |

## Particle Size Analysis - ASTM D422



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 0.1      | 20.4   | 79.5               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| 0.375 in   | 9.50           | 100           |               |          |
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 99            |               |          |
| #20        | 0.85           | 97            |               |          |
| #40        | 0.42           | 97            |               |          |
| #60        | 0.25           | 96            |               |          |
| #100       | 0.15           | 95            |               |          |
| #200       | 0.075          | 79            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.0966 mm | 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  |

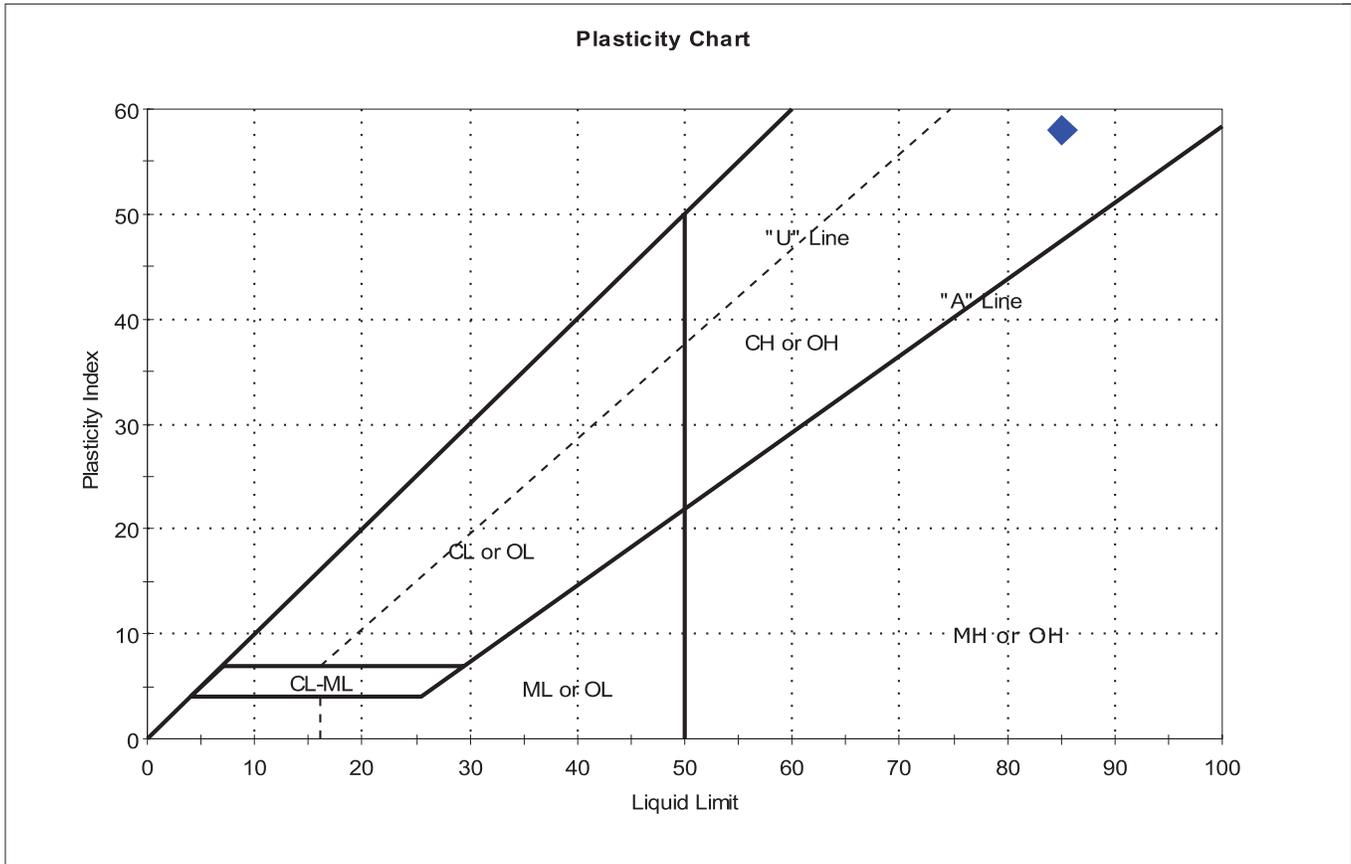
| <u>Classification</u> |                           |
|-----------------------|---------------------------|
| <u>ASTM</u>           | Fat clay with sand (CH)   |
| <u>AASHTO</u>         | Clayey Soils (A-7-6 (50)) |

| <u>Sample/Test Description</u>   |  |
|----------------------------------|--|
| Sand/Gravel Particle Shape : --- |  |
| Sand/Gravel Hardness : ---       |  |



|                     |                                            |              |            |
|---------------------|--------------------------------------------|--------------|------------|
| Client:             | F&ME Consultants                           |              |            |
| Project:            | US-21 Replacement Bridge over Harbor River |              |            |
| Location:           | ---                                        | Project No:  | GTX-305005 |
| Boring ID:          | AP-3                                       | Sample Type: | tube       |
| Sample ID:          | UD-1                                       | Test Date:   | 08/31/16   |
| Depth :             | 25.0-27.0 ft                               | Test Id:     | 387113     |
| Test Comment:       | ---                                        |              |            |
| Visual Description: | Moist, olive clay with sand                |              |            |
| Sample Comment:     | Sample contains shells and shell fragments |              |            |

## Atterberg Limits - ASTM D4318

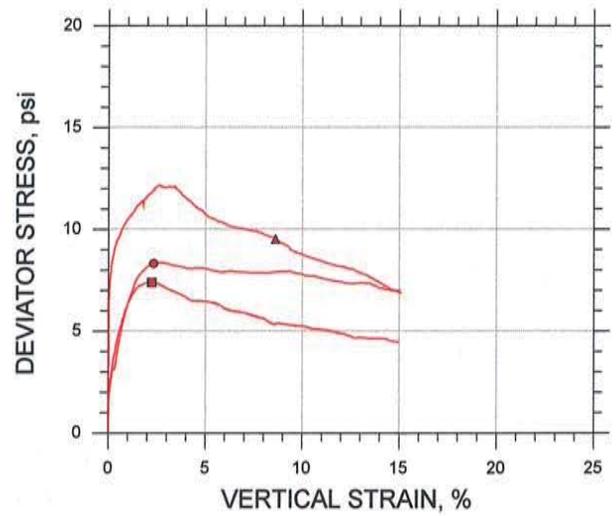
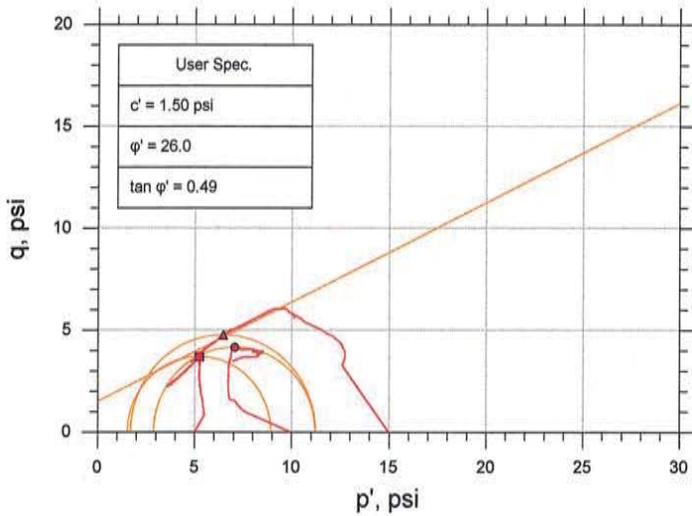


| Symbol | Sample ID | Boring | Depth        | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification     |
|--------|-----------|--------|--------------|-----------------------------|--------------|---------------|------------------|-----------------|-------------------------|
| ◆      | UD-1      | AP-3   | 25.0-27.0 ft | 83                          | 85           | 27            | 58               | 1               | Fat clay with sand (CH) |

Sample Prepared using the WET method  
 3% Retained on #40 Sieve  
 Dry Strength: VERY HIGH  
 Dilatancy: NONE  
 Toughness: MEDIUM

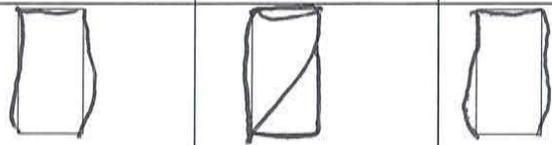
|                                          |                                 |
|------------------------------------------|---------------------------------|
| Client: F&ME Consultants                 |                                 |
| Project Name: US-21 Replacement Bridge   |                                 |
| Project Location: ---                    |                                 |
| Project Number: GTX-305005               |                                 |
| Tested By: md                            | Checked By: mcm                 |
| Boring ID: AP-3                          |                                 |
| Preparation: intact                      |                                 |
| Description: Moist, olive clay with sand |                                 |
| Classification: Fat clay with sand       |                                 |
| Group Symbol: CH                         |                                 |
| Liquid Limit: 85                         | Plastic Limit: 27               |
| Plasticity Index: 58                     | Estimated Specific Gravity: 2.7 |

**CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767**



| Symbol                                           | ■                                                | ●            | ▲            |
|--------------------------------------------------|--------------------------------------------------|--------------|--------------|
| Sample ID                                        | ST-1                                             | ST-1         | ST-1         |
| Depth, ft                                        | 25.0-27.0 ft                                     | 25.0-27.0 ft | 25.0-27.0 ft |
| Test Number                                      | CU-6-1                                           | CU-6-2       | CU-6-3       |
| Initial                                          | Height, in                                       | 4.720        | 4.620        |
|                                                  | Diameter, in                                     | 2.030        | 2.030        |
|                                                  | Moisture Content (from Cuttings), %              | 81.4         | 86.2         |
|                                                  | Dry Density, pcf                                 | 51.4         | 50.4         |
|                                                  | Saturation (Wet Method), %                       | 96.3         | 99.3         |
| Before Shear                                     | Void Ratio                                       | 2.28         | 2.35         |
|                                                  | Moisture Content, %                              | 82.9         | 85.0         |
|                                                  | Dry Density, pcf                                 | 52.0         | 51.1         |
|                                                  | Cross-sectional Area (Method A), in <sup>2</sup> | 3.214        | 3.191        |
|                                                  | Saturation, %                                    | 100.0        | 100.0        |
| Before Shear                                     | Void Ratio                                       | 2.24         | 2.30         |
|                                                  | Back Pressure, psi                               | 152.9        | 160.8        |
| Vertical Effective Consolidation Stress, psi     | 4.946                                            | 9.960        | 14.65        |
| Horizontal Effective Consolidation Stress, psi   | 4.999                                            | 9.962        | 14.97        |
| Vertical Strain after Consolidation, %           | 0.6778                                           | 0.08763      | 3.850        |
| Volumetric Strain after Consolidation, %         | 1.541                                            | 1.531        | 14.69        |
| Time to 50% Consolidation, min                   | 45.56                                            | 16.81        | 297.6        |
| Shear Strength, psi                              | 3.695                                            | 4.164        | 4.763        |
| Strain at Failure, %                             | 2.24                                             | 2.33         | 8.61         |
| Strain Rate, %/min                               | 0.01600                                          | 0.01600      | 0.01600      |
| Deviator Stress at Failure, psi                  | 7.391                                            | 8.329        | 9.526        |
| Effective Minor Principal Stress at Failure, psi | 1.536                                            | 2.888        | 1.698        |
| Effective Major Principal Stress at Failure, psi | 8.927                                            | 11.22        | 11.22        |
| B-Value                                          | 0.95                                             | 0.95         | 0.96         |

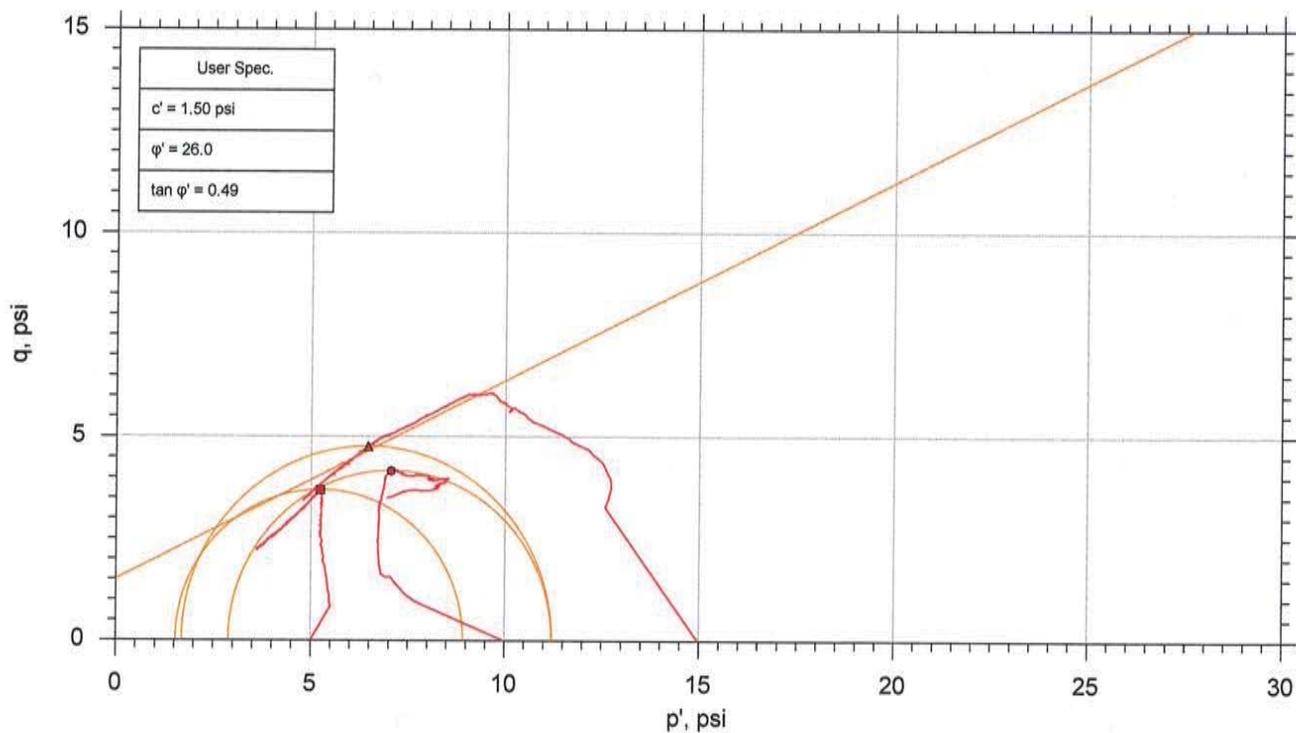
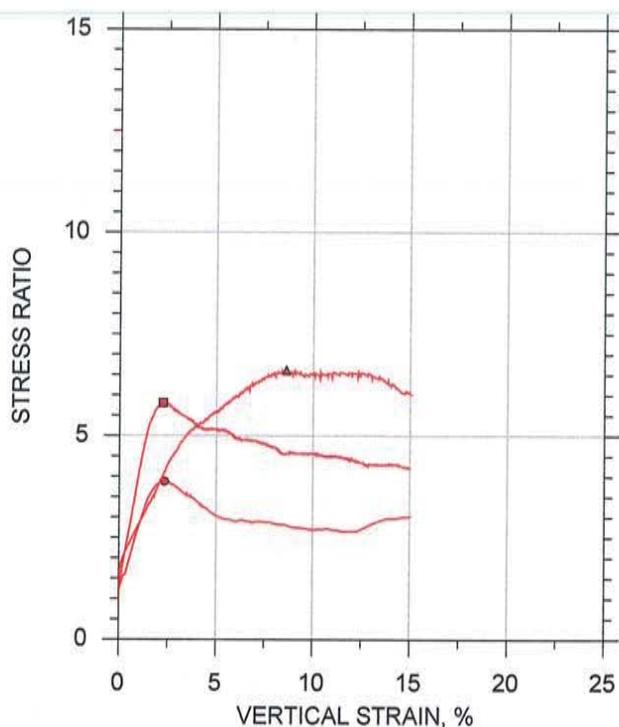
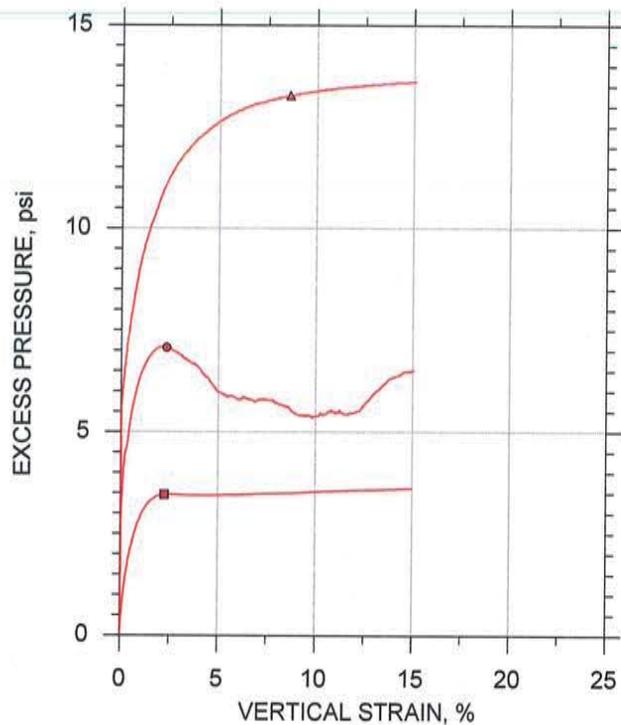
Notes:  
 - Before Shear Saturation set to 100% for phase calculation.  
 - Moisture Content determined by ASTM D2216.  
 - Atterberg Limits determined by ASTM D4318.  
 - Deviator Stress includes membrane correction.  
 - Values for c and  $\phi$  determined from best-fit straight line for the specific 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

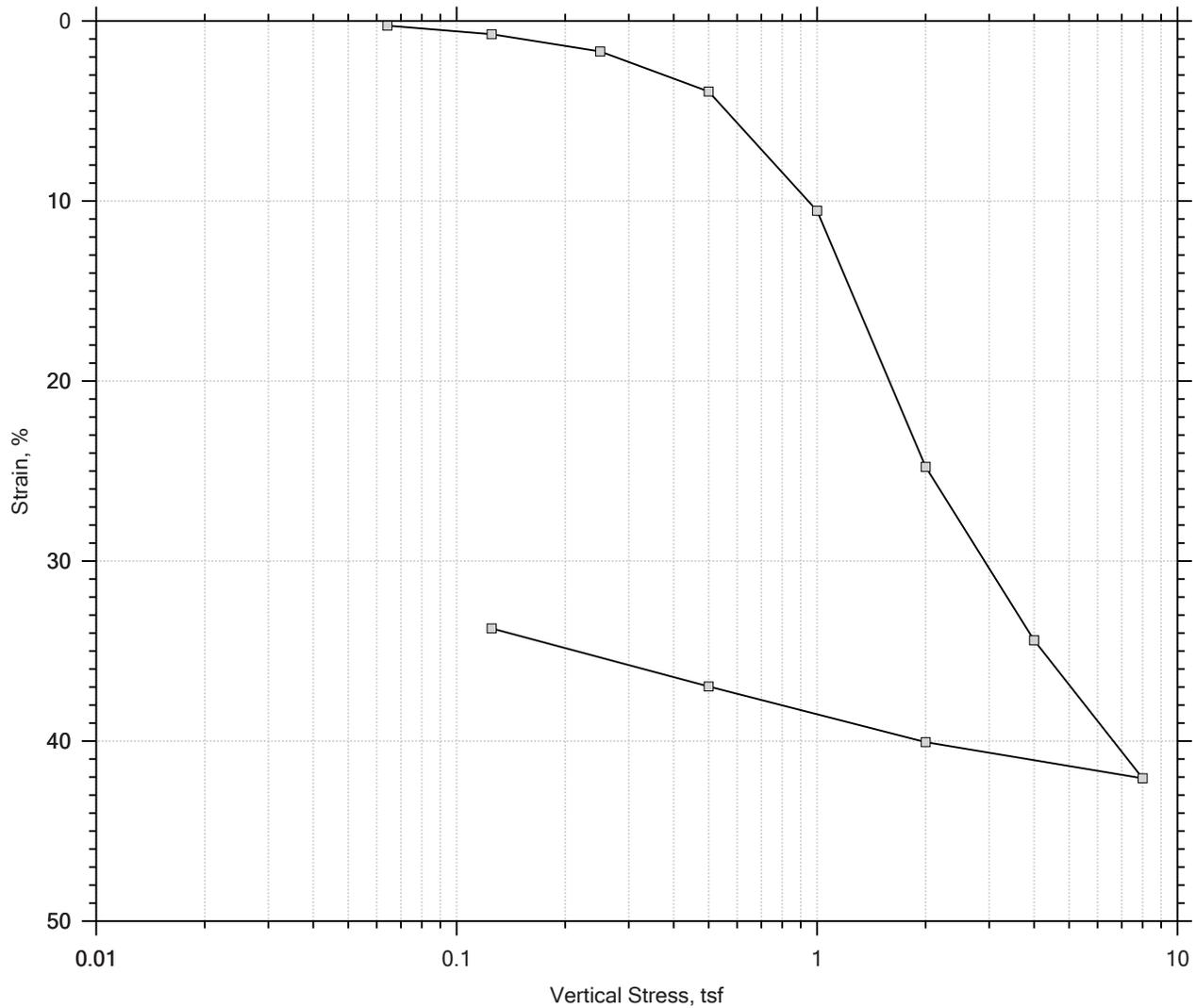


| Sample No. | Test No. | Depth  | Tested By    | Test Date | Checked By | Check Date | Test File |                    |
|------------|----------|--------|--------------|-----------|------------|------------|-----------|--------------------|
| ■          | ST-1     | CU-6-1 | 25.0-27.0 ft | md        | 8/25/16    | mcm        | 9/7/16    | 305005-CU-6-1m.dat |
| ●          | ST-1     | CU-6-2 | 25.0-27.0 ft | md        | 08/26/16   | mcm        | 9/7/16    | 305005-CU-6-2m.dat |
| ▲          | ST-1     | CU-6-3 | 25.0-27.0 ft | md        | 08/25/16   | mcm        | 9/7/16    | 305005-CU-6-3m.dat |

|  |                                          |                     |                         |
|--|------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge        | Location: ---       | Project No.: GTX-305005 |
|  | Boring No.: AP-3                         | Sample Type: intact |                         |
|  | Description: Moist, olive clay with sand |                     |                         |
|  | Remarks: System X                        |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

## Summary Report

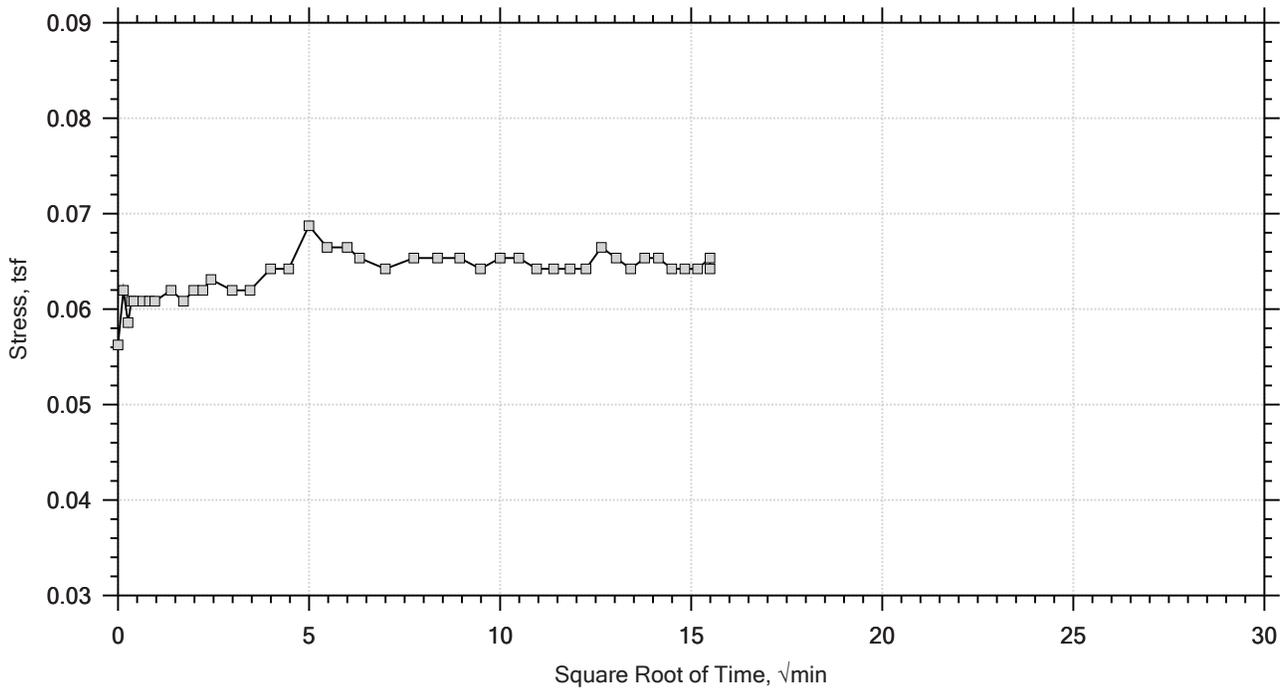
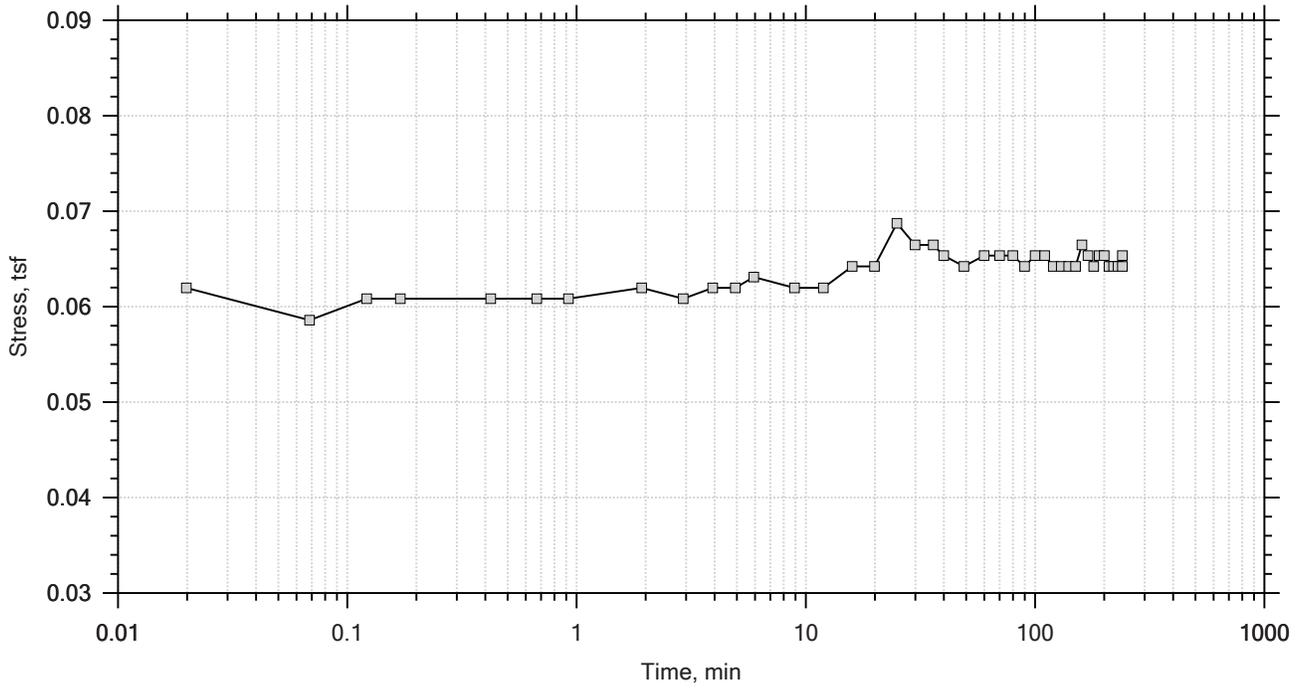


|                                        |              | Before Test          | After Test |        |
|----------------------------------------|--------------|----------------------|------------|--------|
| Current Vertical Effective Stress: --- |              | Water Content, %     | 105.01     | 58.58  |
| Preconsolidation Stress: ---           |              | Dry Unit Weight, pcf | 43.621     | 65.827 |
| Compression Ratio: ---                 |              | Saturation, %        | 98.28      | 100.00 |
| Diameter: 2.5 in                       | Height: 1 in | Void Ratio           | 2.95       | 1.62   |
| LL: 85                                 | PL: 27       | PI: 58               | GS: 2.76   |        |

|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     | Displacement at End of Increment    |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

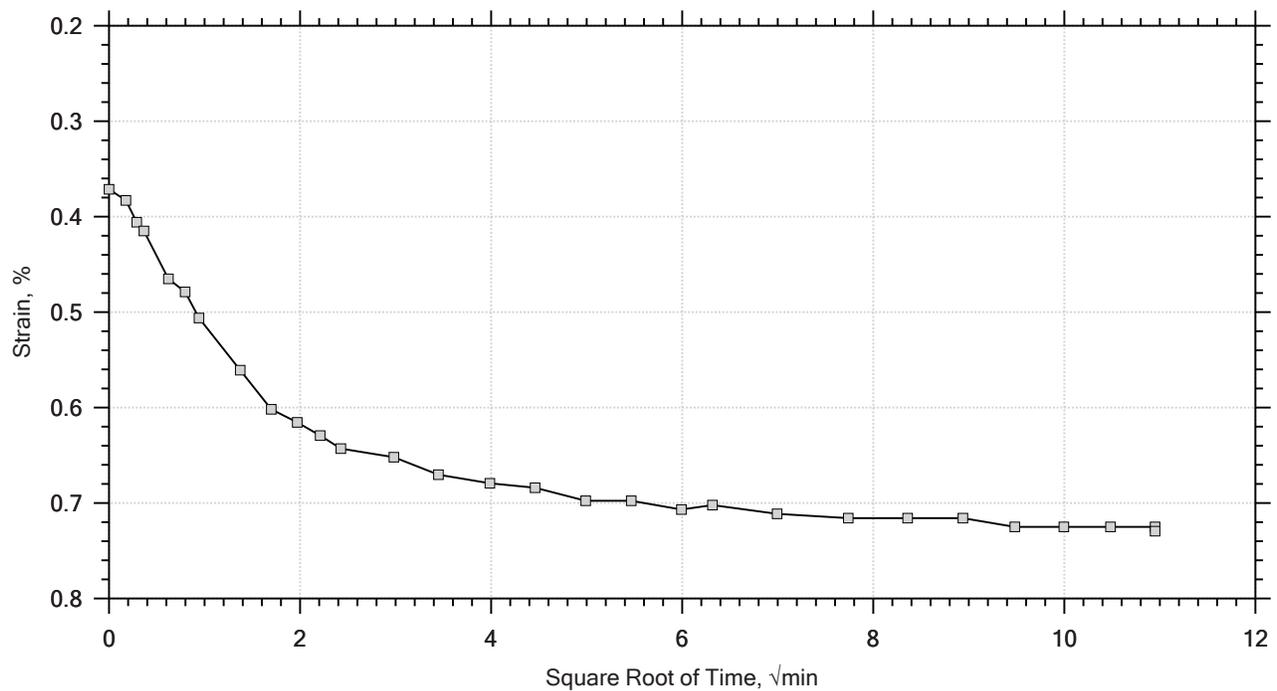
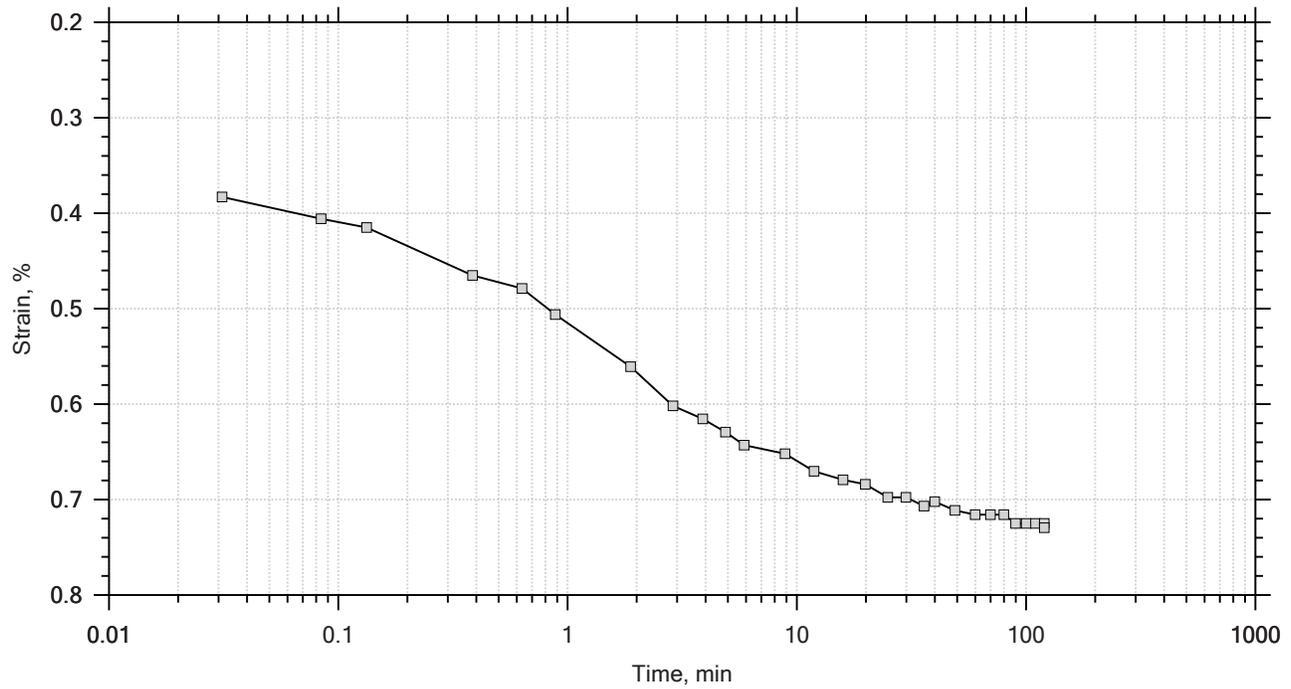
Time Curve 1 of 11  
Constant Volume Step  
Stress: 0.0642 tsf



|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

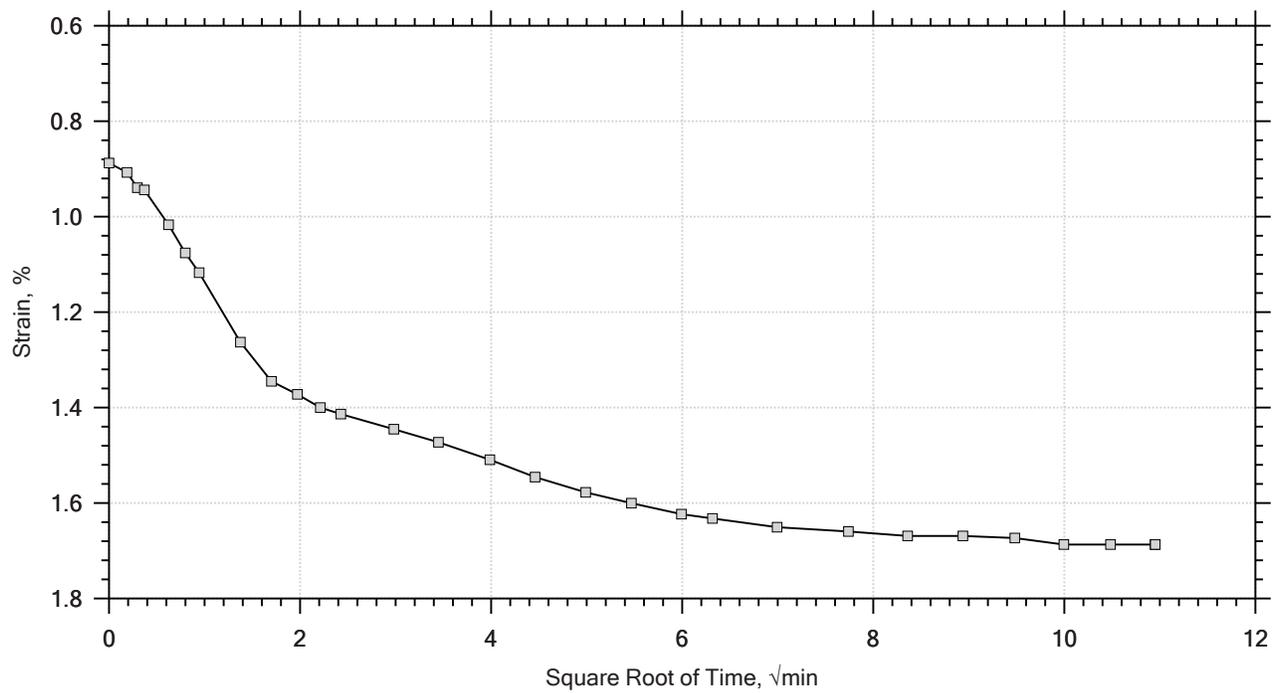
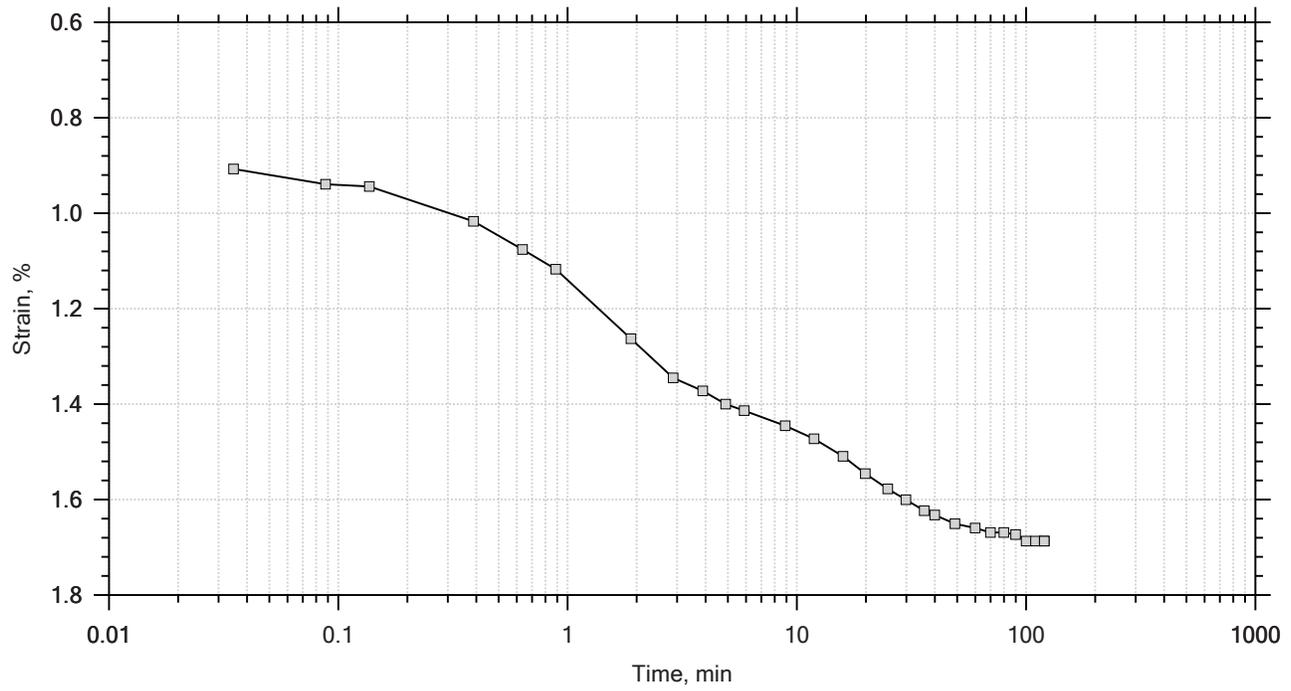
Time Curve 2 of 11  
 Constant Load Step  
 Stress: 0.125 tsf



|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

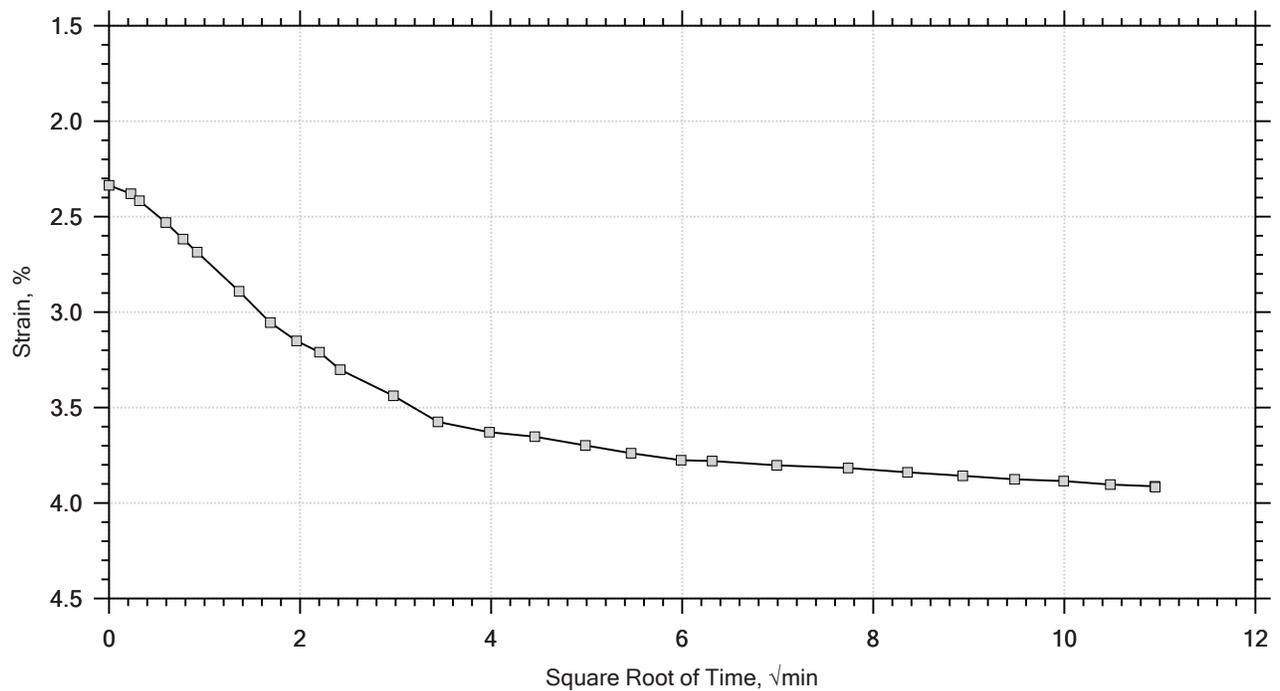
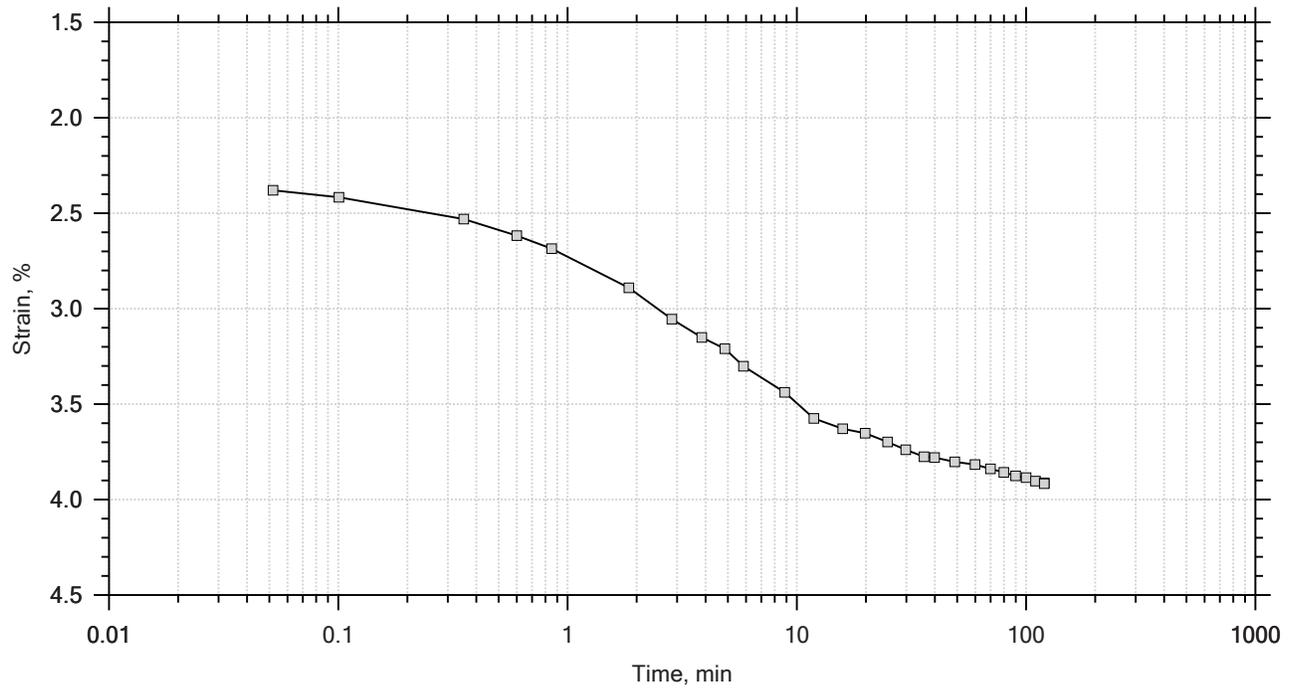
Time Curve 3 of 11  
 Constant Load Step  
 Stress: 0.25 tsf



|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

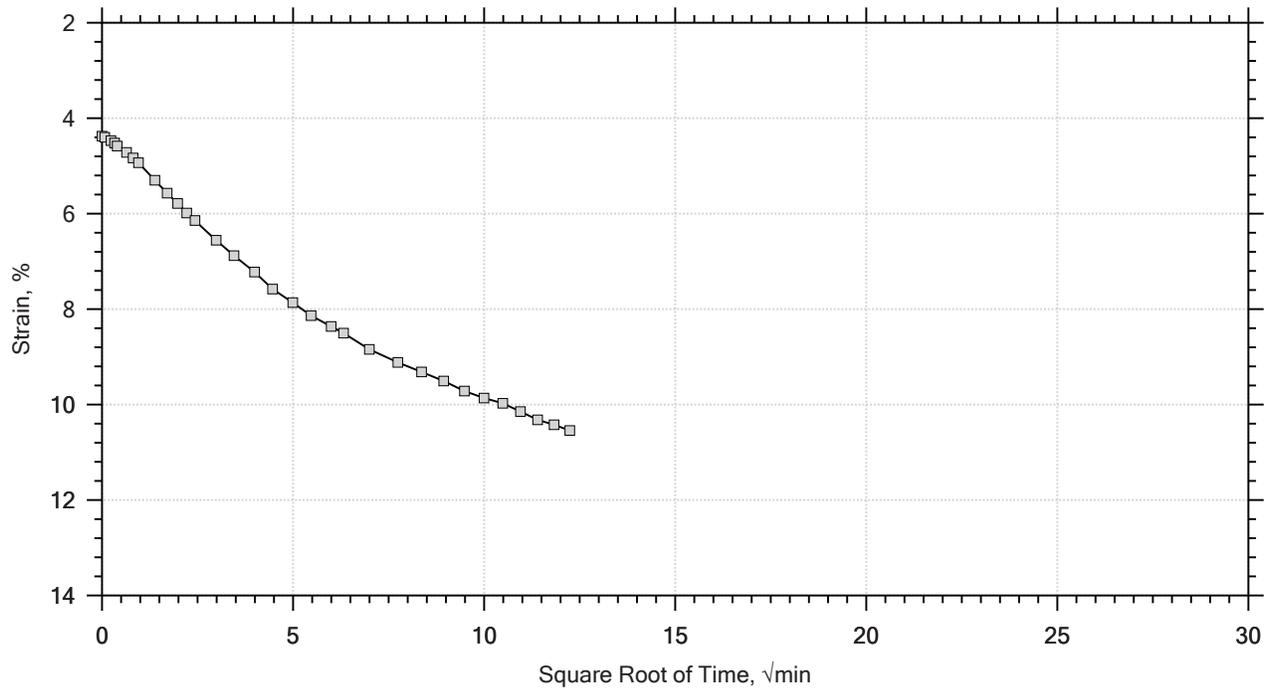
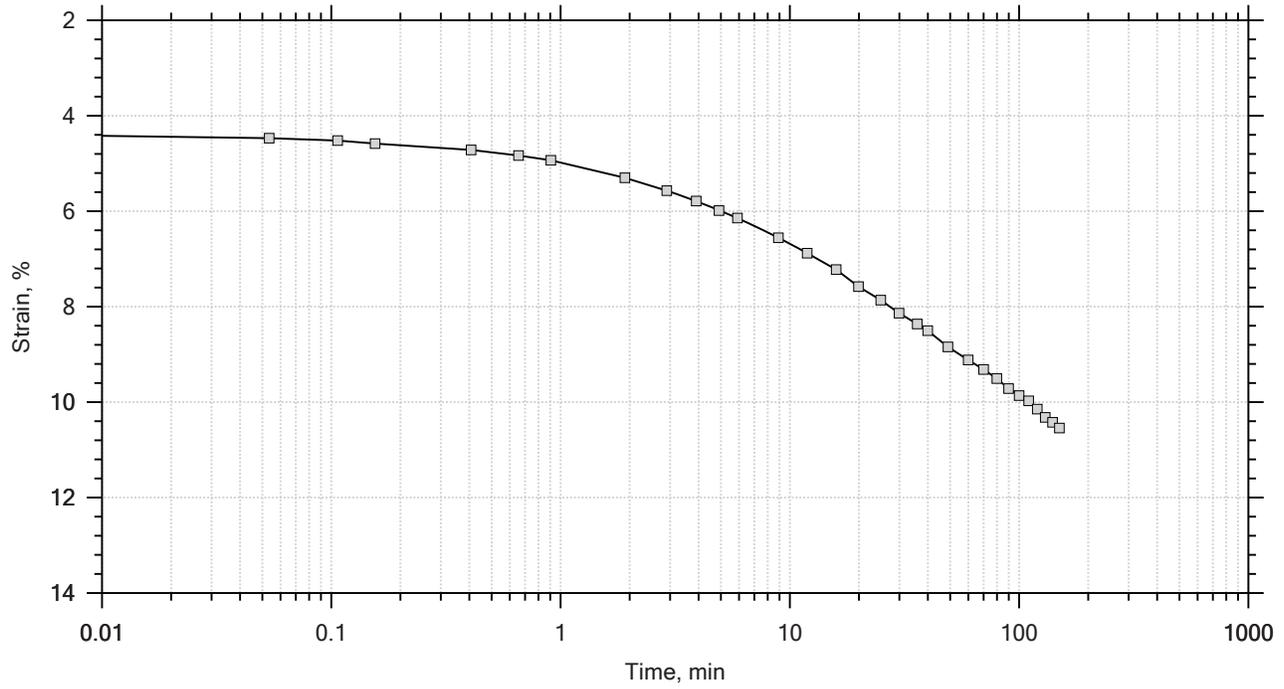
Time Curve 4 of 11  
 Constant Load Step  
 Stress: 0.5 tsf



|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

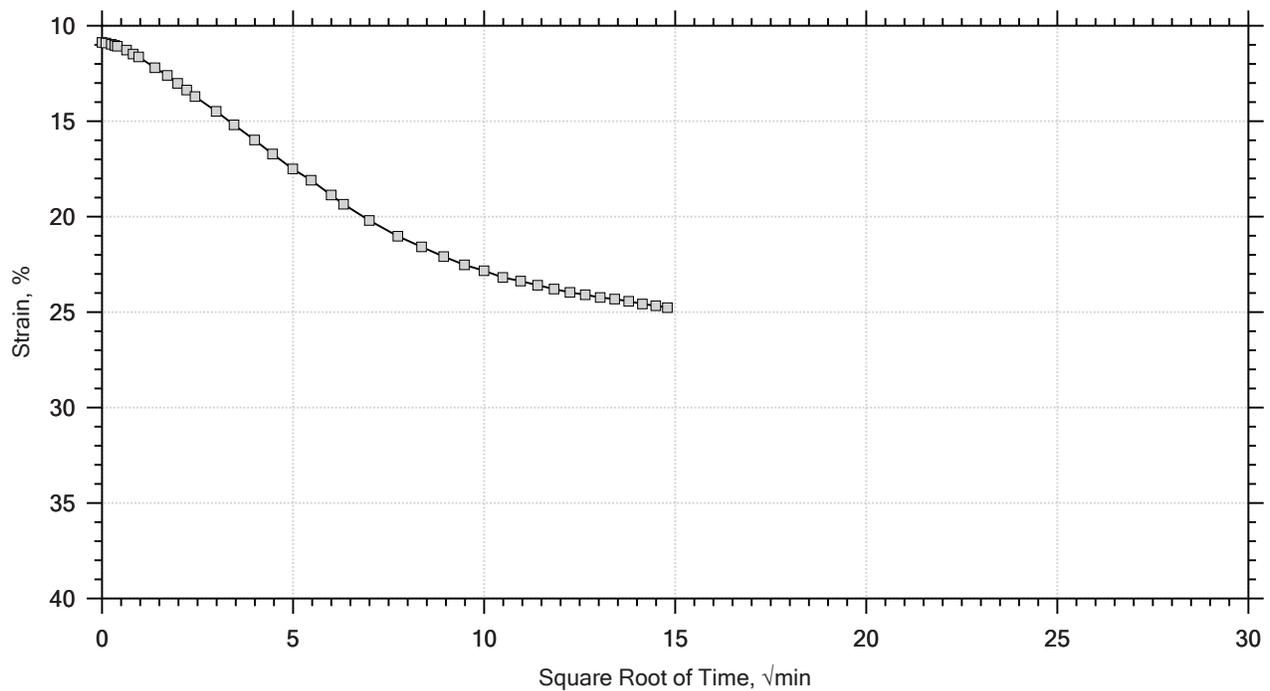
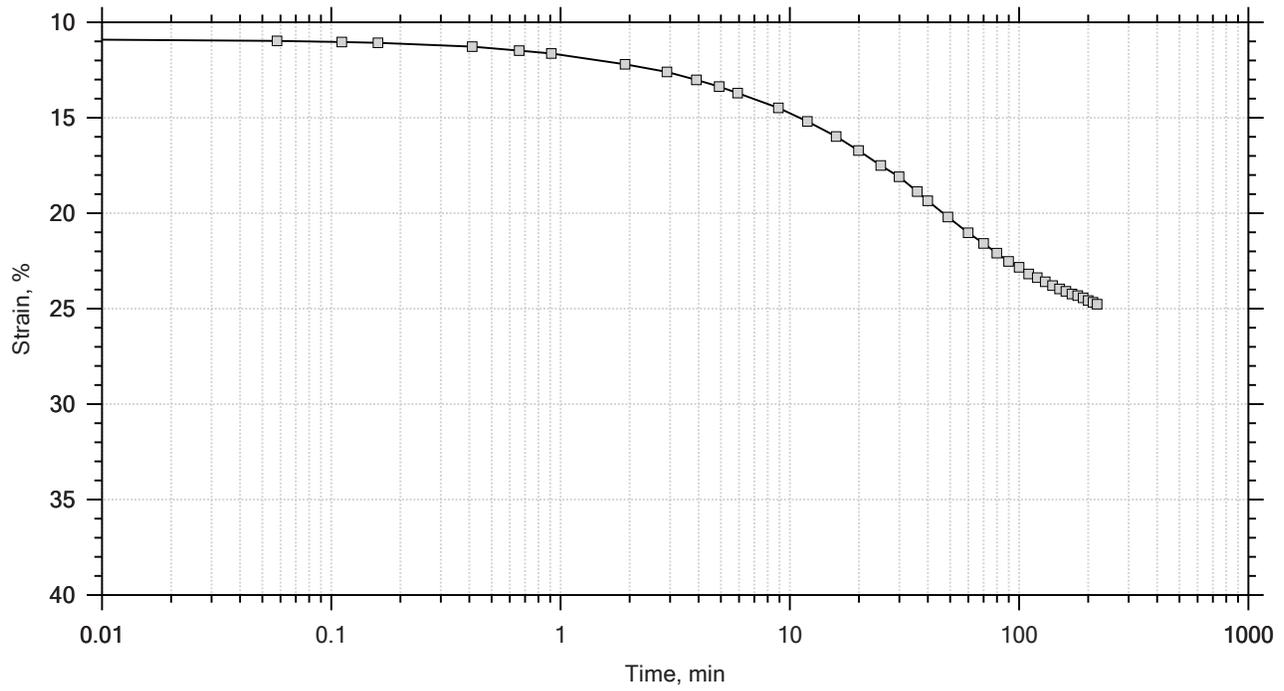
Time Curve 5 of 11  
 Constant Load Step  
 Stress: 1 tsf



|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 11  
 Constant Load Step  
 Stress: 2 tsf

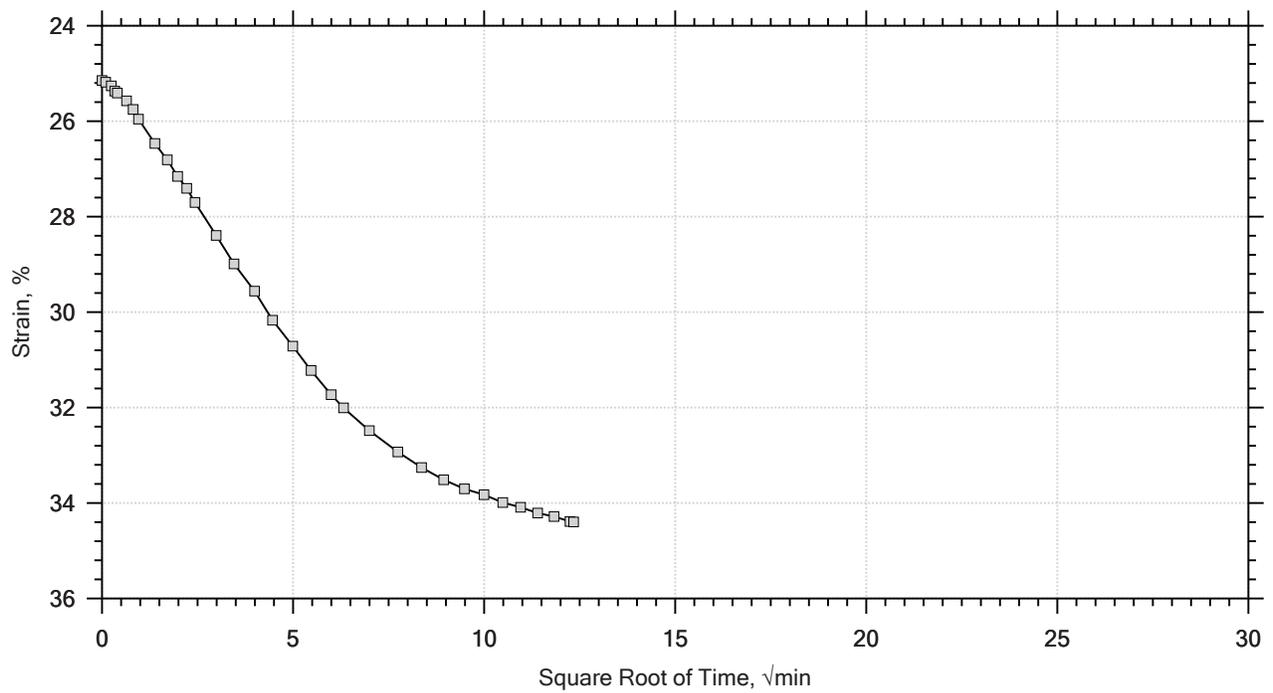
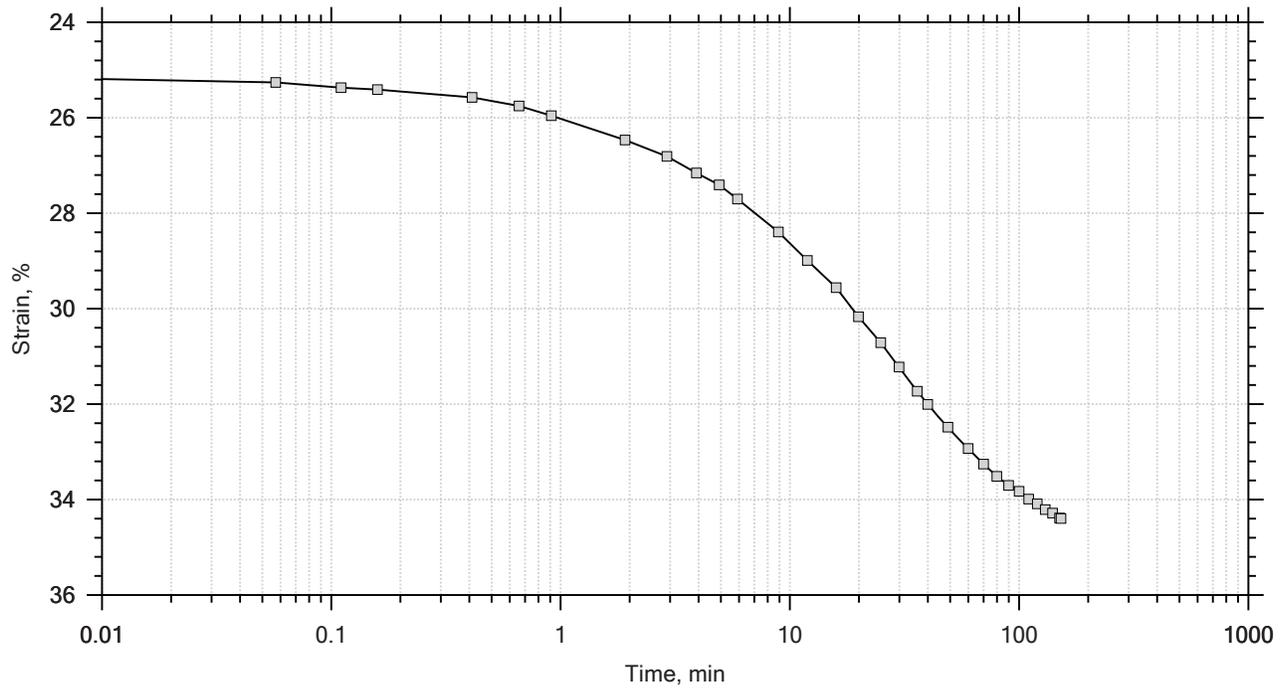


|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |



# One-Dimensional Consolidation by ASTM D2435 - Method B

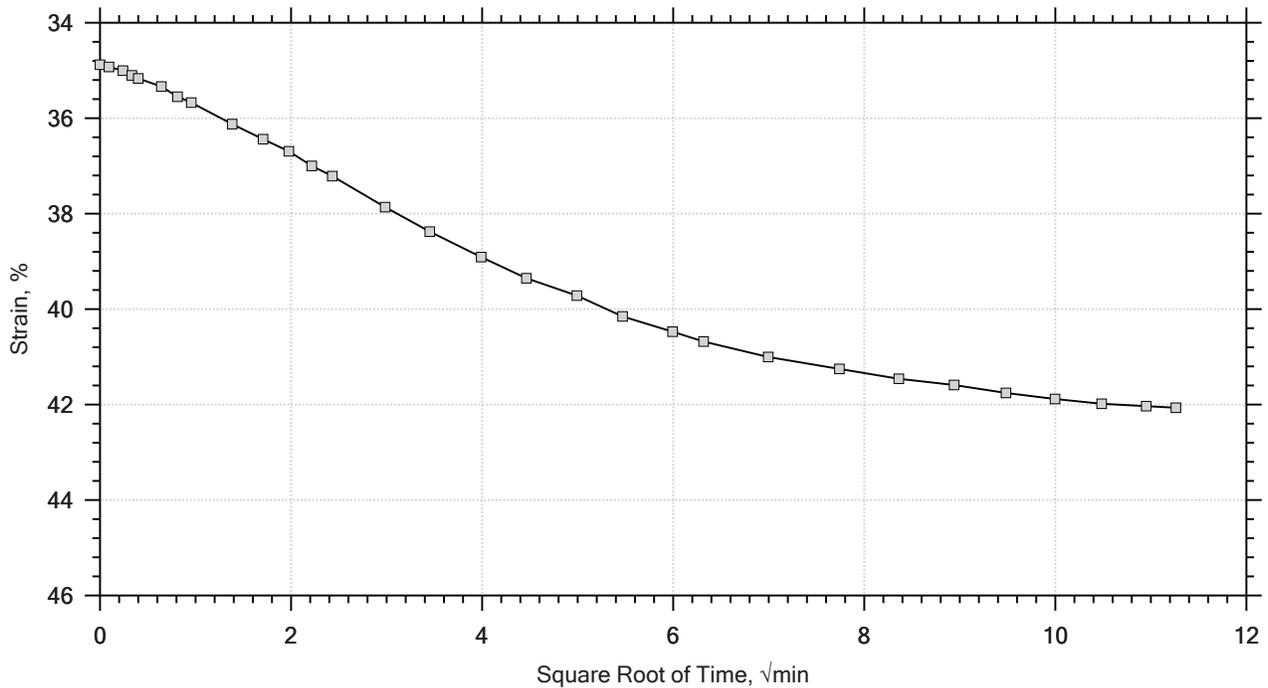
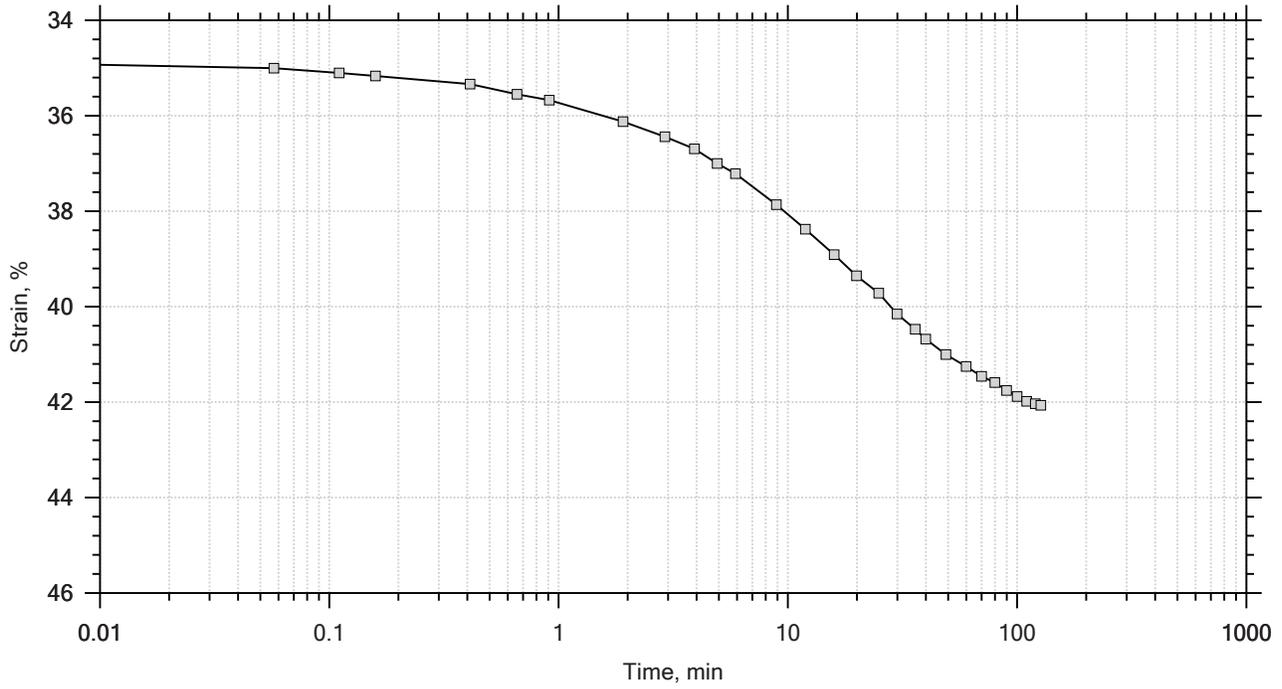
Time Curve 7 of 11  
 Constant Load Step  
 Stress: 4 tsf



|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

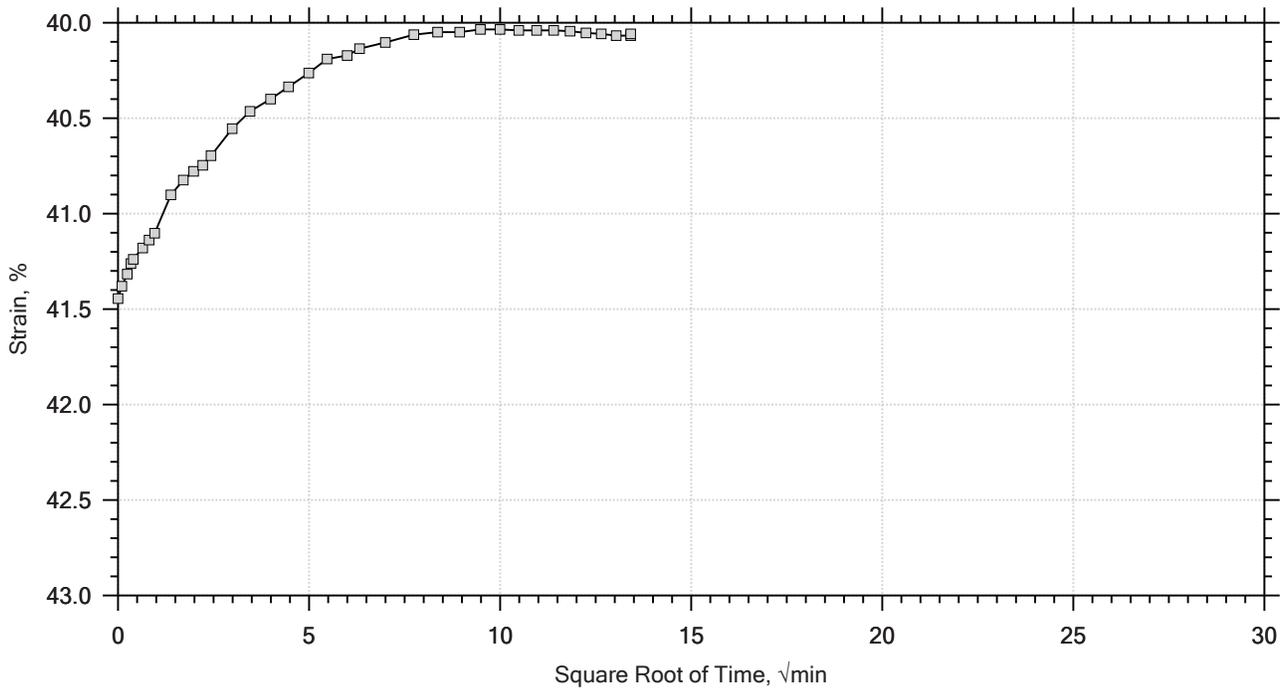
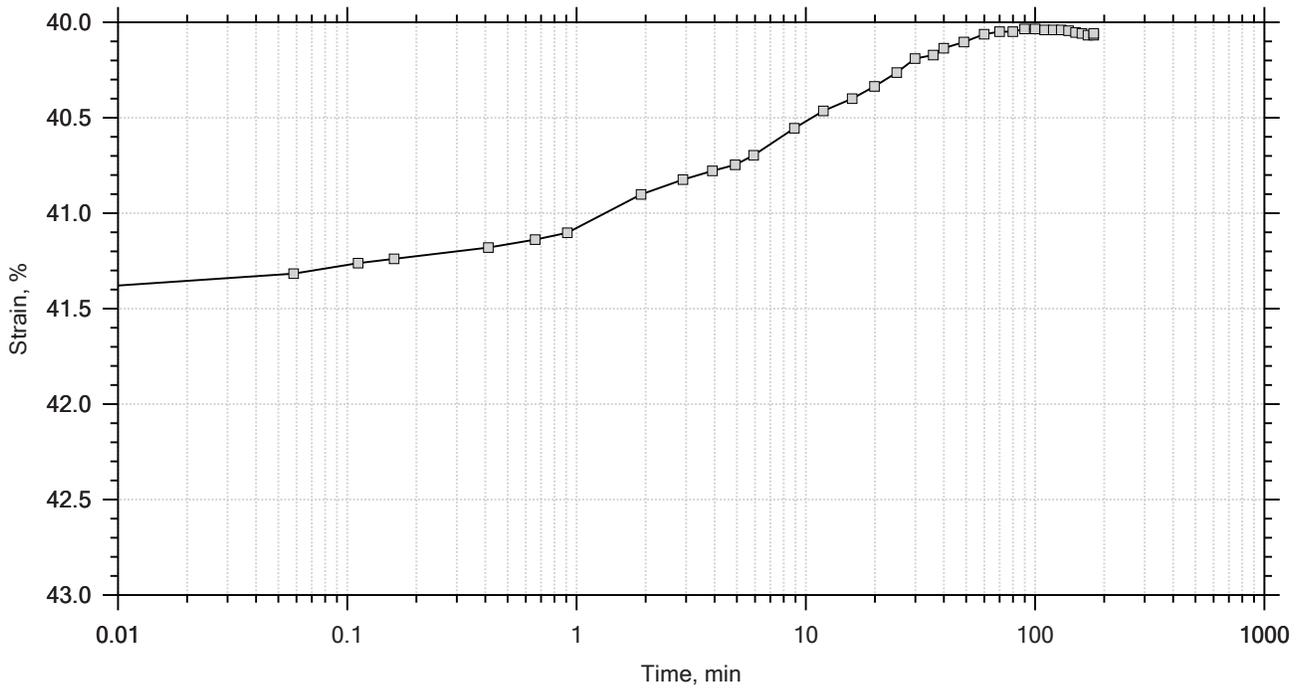
Time Curve 8 of 11  
 Constant Load Step  
 Stress: 8 tsf



|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 11  
 Constant Load Step  
 Stress: 2 tsf



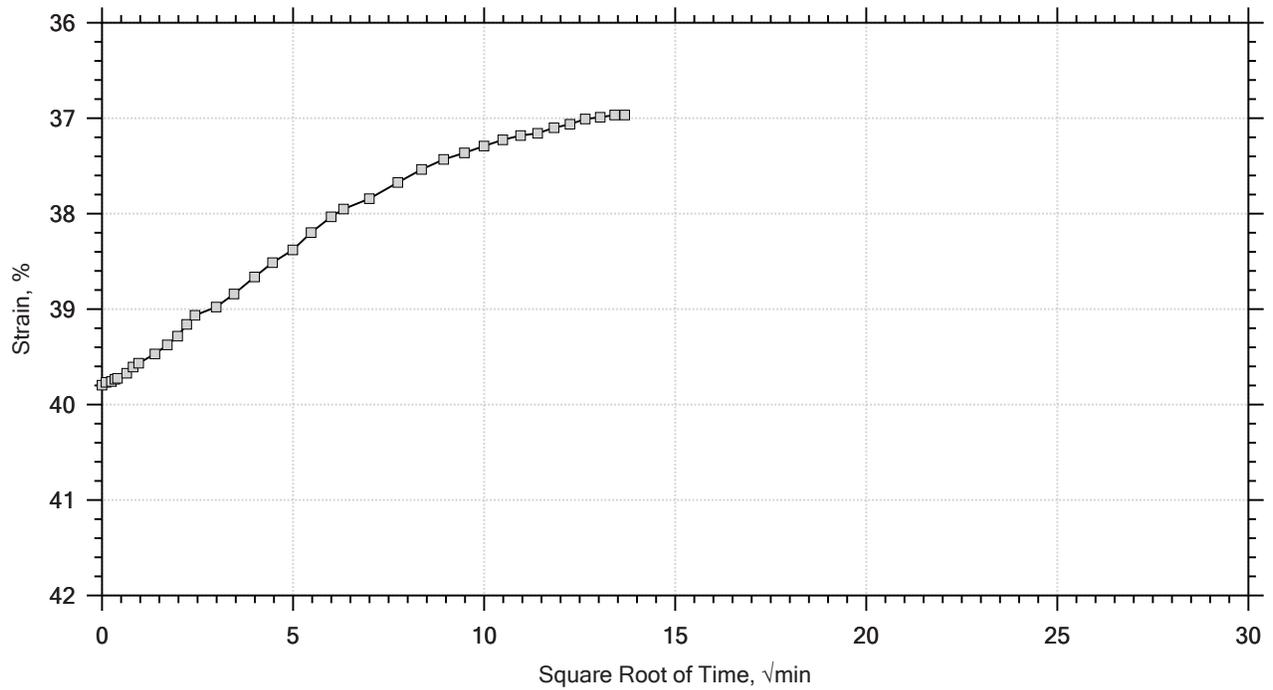
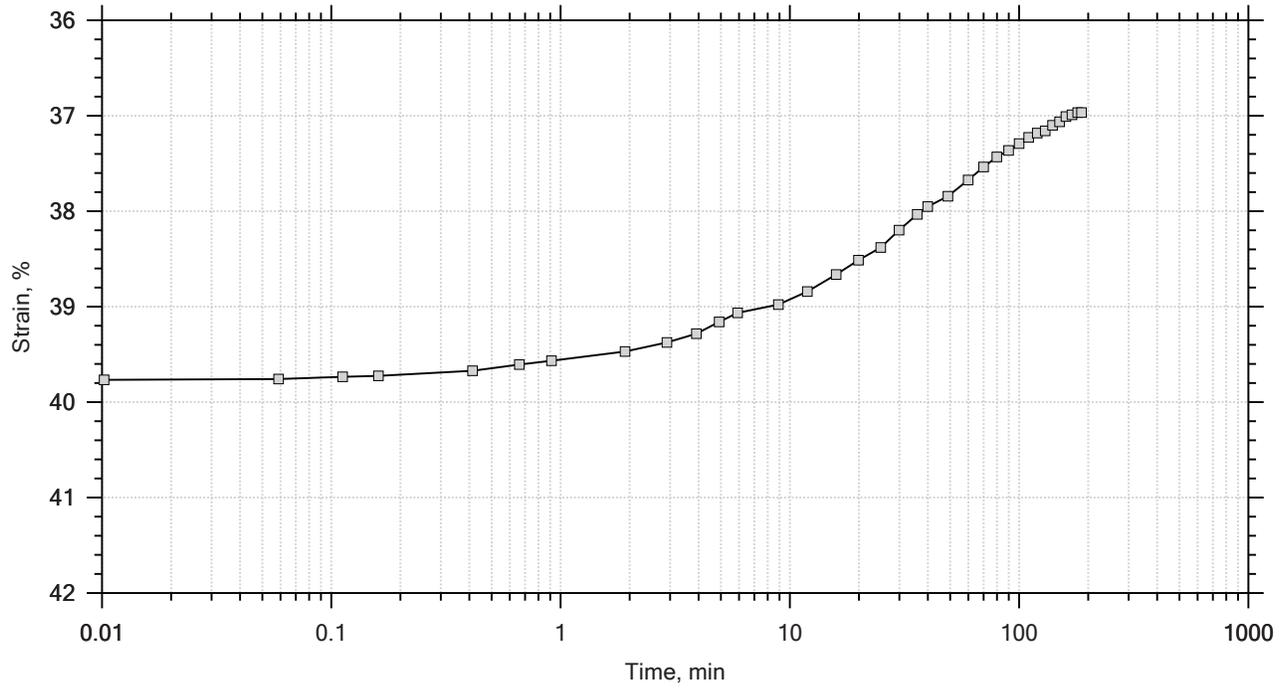
|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 11

Constant Load Step

Stress: 0.5 tsf



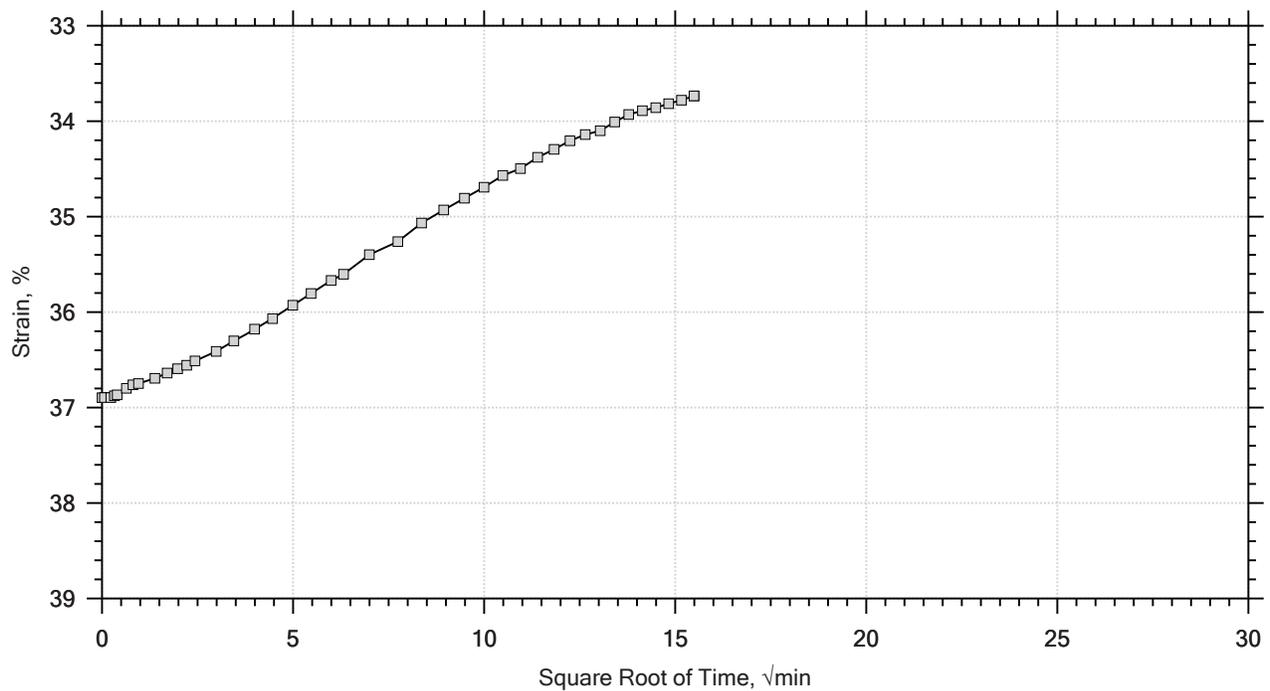
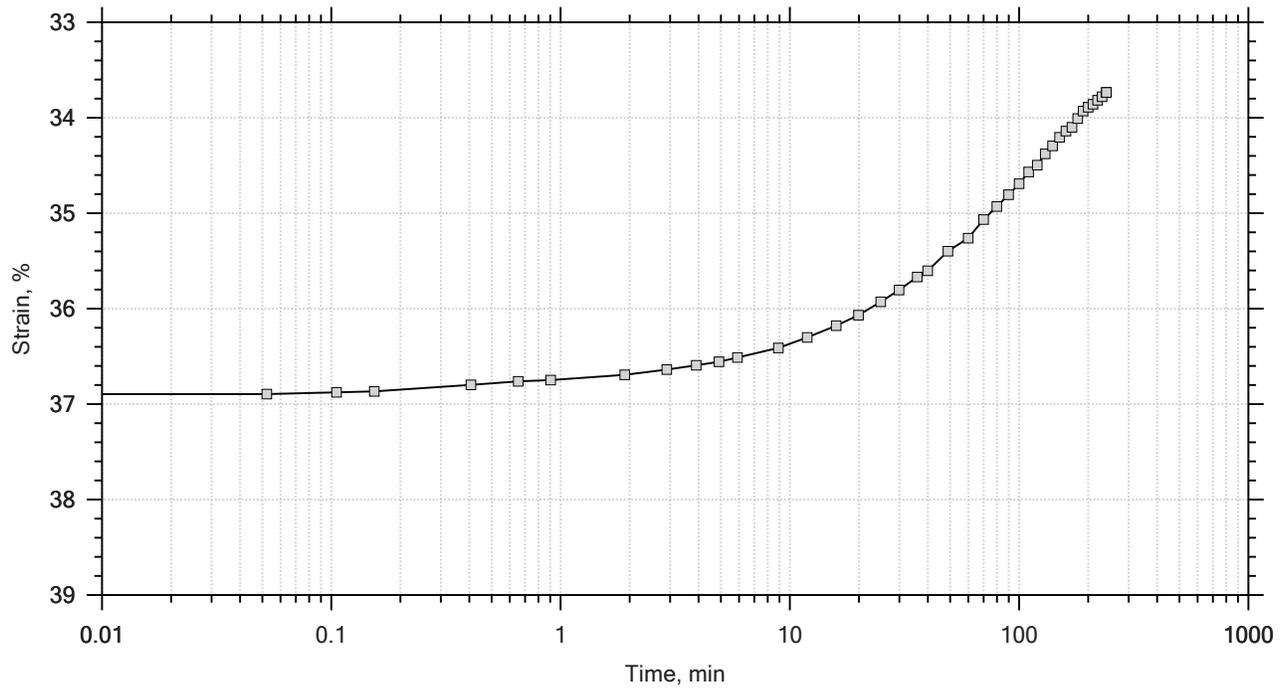
|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 11

Constant Load Step

Stress: 0.125 tsf



|                                                                                     |                                     |                     |                         |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

|                            |                                  |                      |
|----------------------------|----------------------------------|----------------------|
| Specimen Diameter: 2.50 in | Estimated Specific Gravity: 2.76 | Liquid Limit: 85     |
| Initial Height: 1.00 in    | Initial Void Ratio: 2.95         | Plastic Limit: 27    |
| Final Height: 0.66 in      | Final Void Ratio: 1.62           | Plasticity Index: 58 |

|                               | Before Test<br>Trimmings | Before Test<br>Specimen | After Test<br>Specimen | After Test<br>Trimmings |
|-------------------------------|--------------------------|-------------------------|------------------------|-------------------------|
| Container ID                  | C-1757                   | RING                    |                        | C-1676                  |
| Mass Container, gm            | 8.34                     | 108.89                  | 108.89                 | 8.64                    |
| Mass Container + Wet Soil, gm | 169.13                   | 224.12                  | 198.02                 | 97.49                   |
| Mass Container + Dry Soil, gm | 93.83                    | 165.1                   | 165.1                  | 64.67                   |
| Mass Dry Soil, gm             | 85.49                    | 56.207                  | 56.207                 | 56.03                   |
| Water Content, %              | 88.08                    | 105.01                  | 58.58                  | 58.58                   |
| Void Ratio                    | ---                      | 2.95                    | 1.62                   | ---                     |
| Degree of Saturation, %       | ---                      | 98.28                   | 100.00                 | ---                     |
| Dry Unit Weight, pcf          | ---                      | 43.621                  | 65.827                 | ---                     |

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-21 Replacement Bridge   | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                    | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                    | Test Date: 8/26/16  | Depth: 25-27 ft         |
|                                                                                     | Test No.: IP-6                      | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, grey clay       |                     |                         |
|                                                                                     | Remarks: System S, Swell Pressure = |                     |                         |
|                                                                                     |                                     |                     |                         |









|            |                                            |              |            |
|------------|--------------------------------------------|--------------|------------|
| Client:    | F&ME Consultants                           |              |            |
| Project:   | US-21 Replacement Bridge over Harbor River |              |            |
| Location:  | ---                                        | Project No:  | GTX-305005 |
| Boring ID: | ---                                        | Sample Type: | ---        |
| Sample ID: | ---                                        | Test Date:   | 08/30/16   |
| Depth :    | ---                                        | Test Id:     | 387124     |
|            |                                            | Tested By:   | jbr        |
|            |                                            | Checked By:  | mcm        |

## Moisture Content of Soil and Rock - ASTM D2216

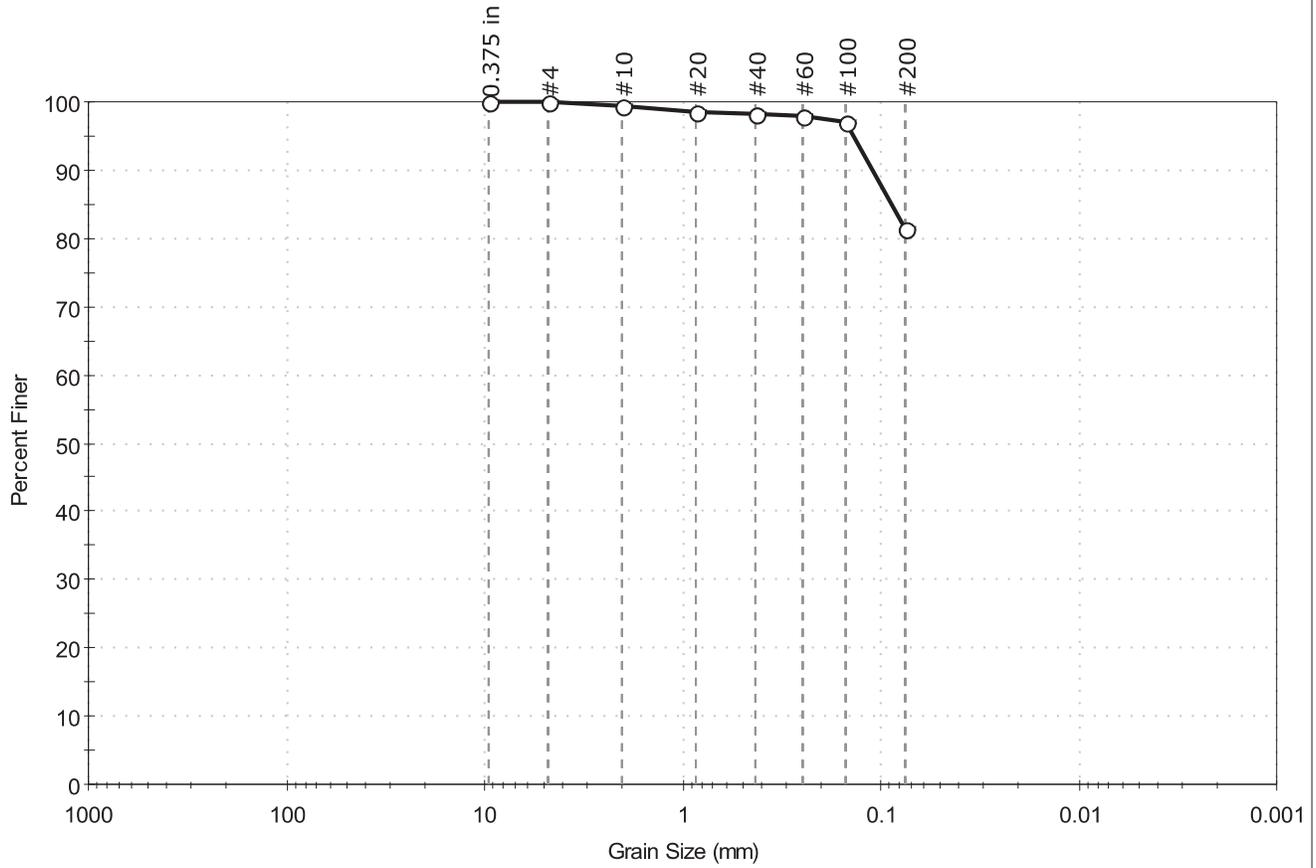
| Boring ID | Sample ID | Depth        | Description                 | Moisture Content, % |
|-----------|-----------|--------------|-----------------------------|---------------------|
| AP-3      | UD-2      | 27.0-29.0 ft | Moist, olive clay with sand | 78.8                |

Notes: Temperature of Drying : 110° Celsius



|                          |                                                     |                        |
|--------------------------|-----------------------------------------------------|------------------------|
| Client: F&ME Consultants | Project: US-21 Replacement Bridge over Harbor River | Project No: GTX-305005 |
| Location: ---            | Boring ID: AP-3                                     | Sample Type: tube      |
| Sample ID: UD-2          | Test Date: 08/23/16                                 | Tested By: jbr         |
| Depth: 27.0-29.0 ft      | Test Id: 387106                                     | Checked By: mcm        |
| Test Comment: ---        | Visual Description: Moist, olive clay with sand     | Sample Comment: ---    |

## Particle Size Analysis - ASTM D422



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 0.1      | 18.5   | 81.4               |

| 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           | 98            |               |          |
| #60        | 0.25           | 98            |               |          |
| #100       | 0.15           | 97            |               |          |
| #200       | 0.075          | 81            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.0878 mm | 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  |

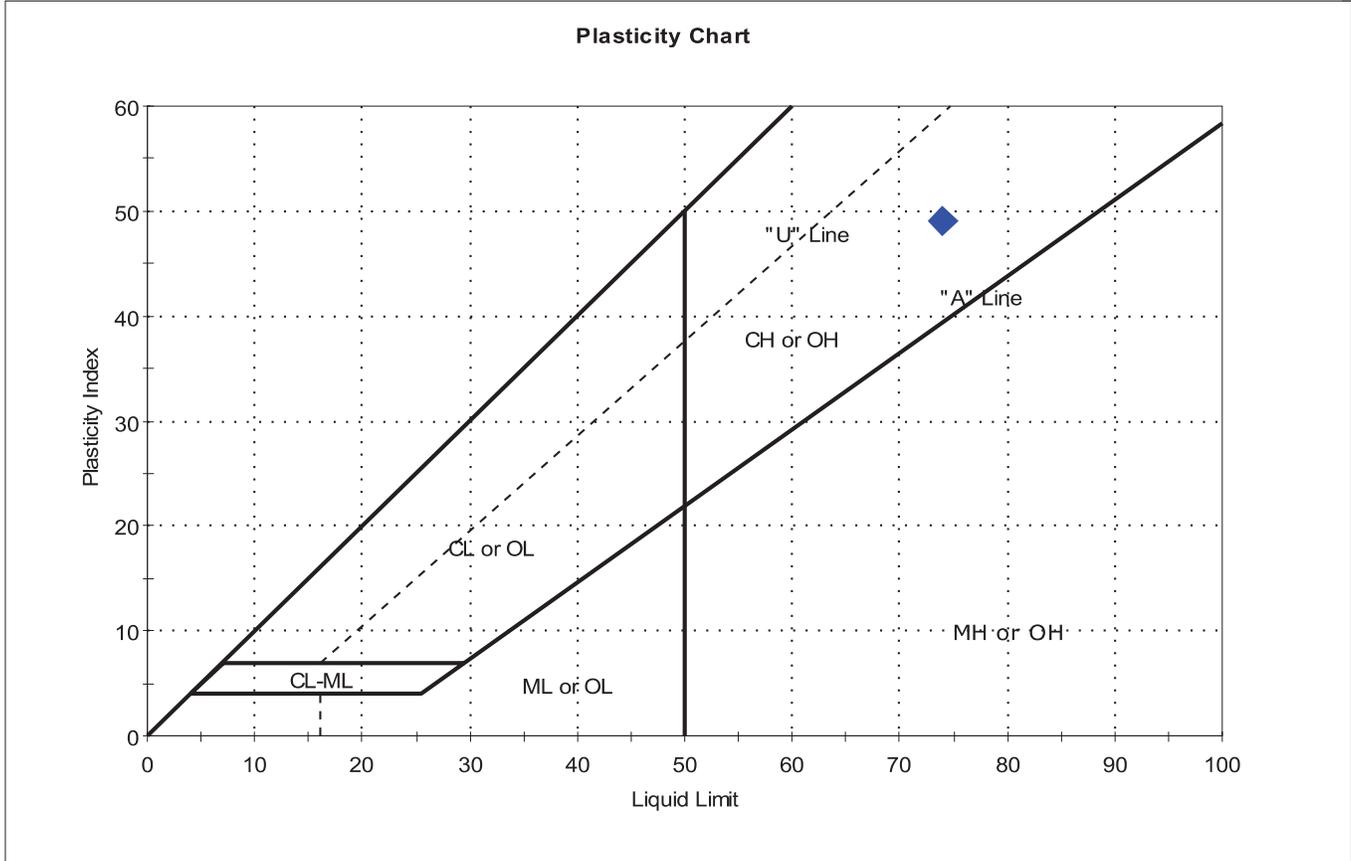
| <u>Classification</u> |                           |
|-----------------------|---------------------------|
| <u>ASTM</u>           | Fat clay with sand (CH)   |
| <u>AASHTO</u>         | Clayey Soils (A-7-6 (43)) |

| <u>Sample/Test Description</u> |       |
|--------------------------------|-------|
| Sand/Gravel Particle Shape     | : --- |
| Sand/Gravel Hardness           | : --- |



|                     |                                            |              |             |             |        |
|---------------------|--------------------------------------------|--------------|-------------|-------------|--------|
| Client:             | F&ME Consultants                           |              | Project No: | GTX-305005  |        |
| Project:            | US-21 Replacement Bridge over Harbor River |              |             |             |        |
| Location:           | ---                                        |              | Tested By:  | GA          |        |
| Boring ID:          | AP-3                                       | Sample Type: | tube        | Checked By: | mcm    |
| Sample ID:          | UD-2                                       | Test Date:   | 08/31/16    | Test Id:    | 387114 |
| Depth :             | 27.0-29.0 ft                               |              |             |             |        |
| Test Comment:       | ---                                        |              |             |             |        |
| Visual Description: | Moist, olive clay with sand                |              |             |             |        |
| Sample Comment:     | ---                                        |              |             |             |        |

## Atterberg Limits - ASTM D4318



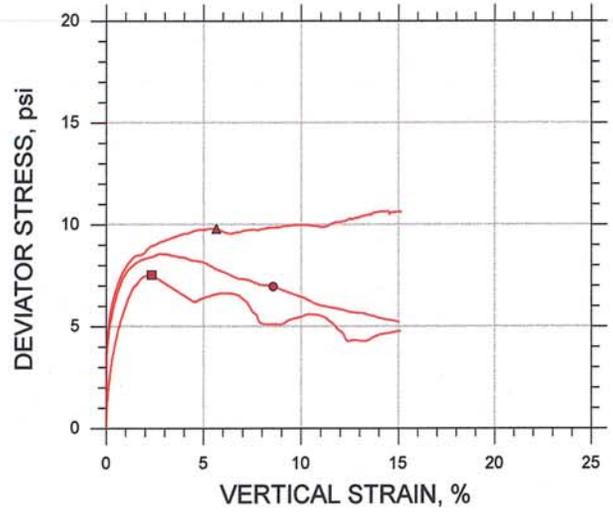
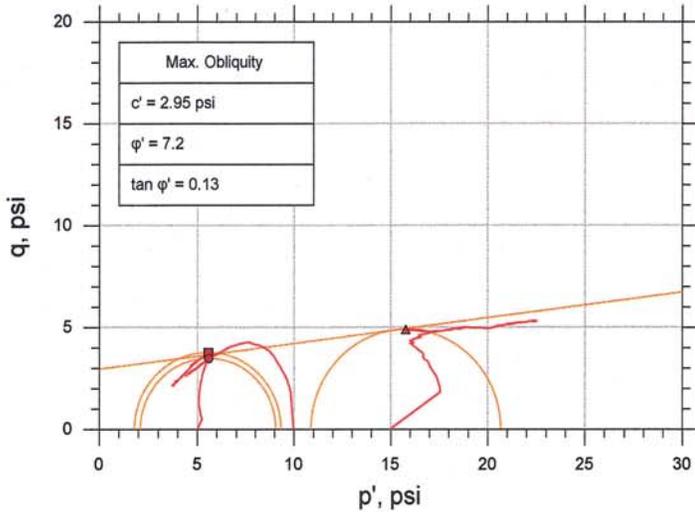
| Symbol | Sample ID | Boring | Depth        | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification     |
|--------|-----------|--------|--------------|-----------------------------|--------------|---------------|------------------|-----------------|-------------------------|
| ◆      | UD-2      | AP-3   | 27.0-29.0 ft | 79                          | 74           | 25            | 49               | 1.1             | Fat clay with sand (CH) |

Sample Prepared using the WET method  
 2% Retained on #40 Sieve  
 Dry Strength: VERY HIGH  
 Dilatancy: NONE  
 Toughness: MEDIUM



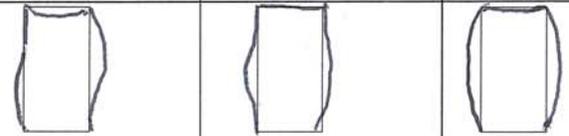
|                                          |                                 |
|------------------------------------------|---------------------------------|
| Client: F&ME Consultants                 |                                 |
| Project Name: US-21 Replacement Bridge   |                                 |
| Project Location: ---                    |                                 |
| Project Number: GTX-305005               |                                 |
| Tested By: md                            | Checked By: mcm                 |
| Boring ID: AP-3                          |                                 |
| Preparation: intact                      |                                 |
| Description: Moist, olive clay with sand |                                 |
| Classification: Fat clay with sand       |                                 |
| Group Symbol: CH                         |                                 |
| Liquid Limit: 74                         | Plastic Limit: 25               |
| Plasticity Index: 49                     | Estimated Specific Gravity: 2.7 |

**CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767**



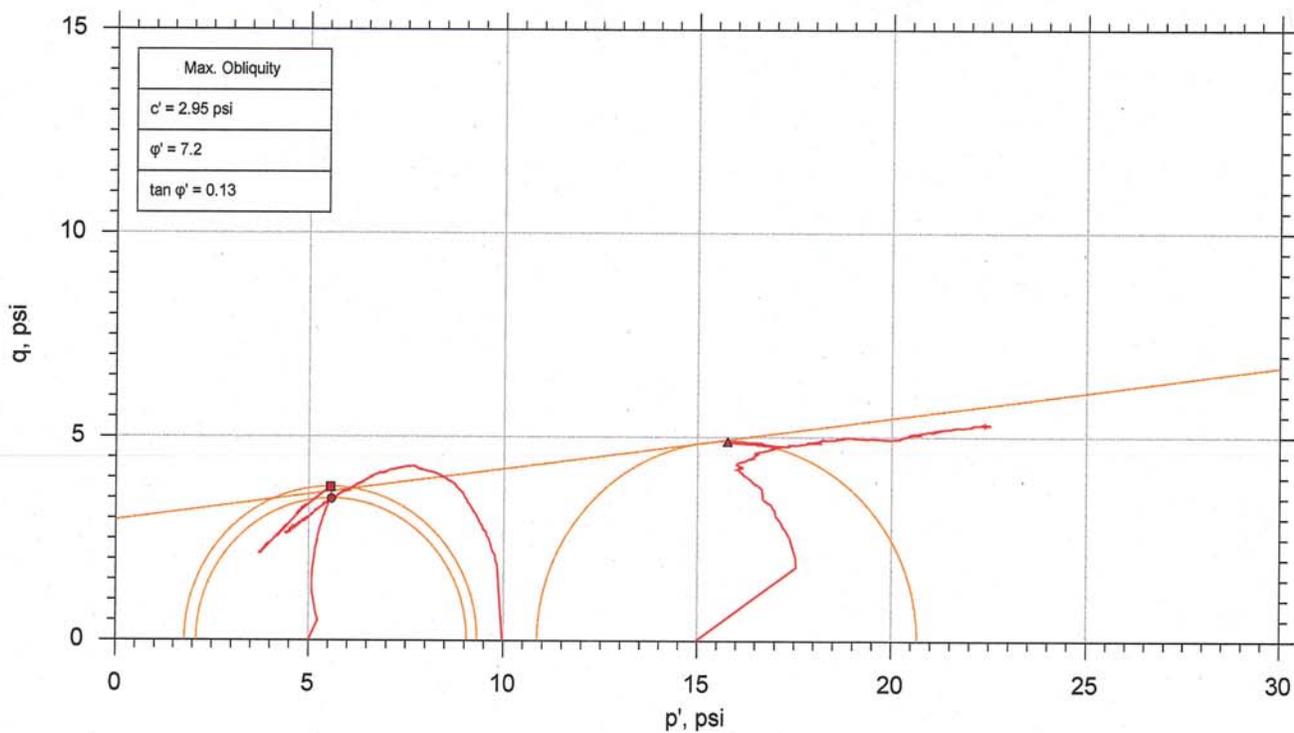
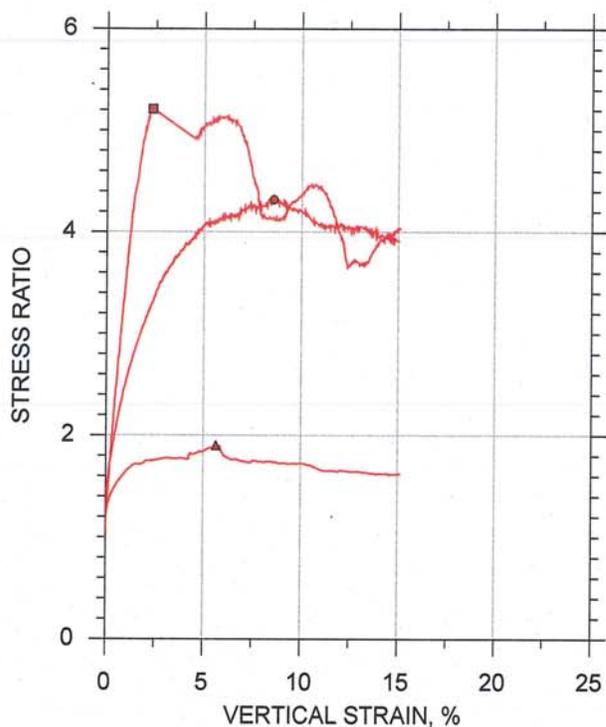
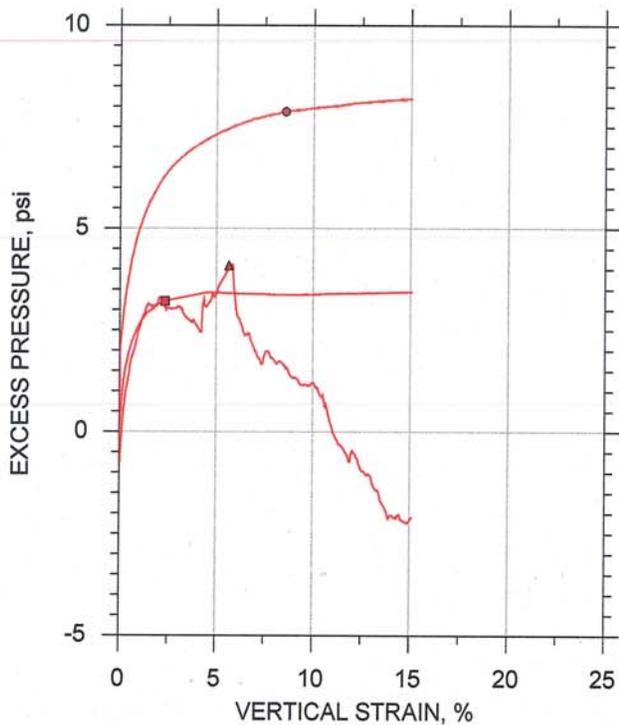
| Symbol                                           | ■            | ●            | ▲            |
|--------------------------------------------------|--------------|--------------|--------------|
| Sample ID                                        | ST-2         | ST-2         | ST-2         |
| Depth, ft                                        | 27.0-29.0 ft | 27.0-29.0 ft | 27.0-29.0 ft |
| Test Number                                      | CU-1-1       | CU-1-2       | CU-1-3A      |
| Height, in                                       | 4.550        | 4.750        | 4.410        |
| Diameter, in                                     | 2.030        | 2.030        | 2.040        |
| Moisture Content (from Cuttings), %              | 59.7         | 78.5         | 94.1         |
| Dry Density, pcf                                 | 62.0         | 51.8         | 47.3         |
| Saturation (Wet Method), %                       | 93.8         | 94.1         | 99.3         |
| Void Ratio                                       | 1.72         | 2.25         | 2.56         |
| Moisture Content, %                              | 62.7         | 74.6         | 85.0         |
| Dry Density, pcf                                 | 62.6         | 55.9         | 51.2         |
| Cross-sectional Area (Method A), in <sup>2</sup> | 3.208        | 3.048        | 3.185        |
| Saturation, %                                    | 100.0        | 100.0        | 100.0        |
| Void Ratio                                       | 1.69         | 2.02         | 2.29         |
| Back Pressure, psi                               | 149.0        | 152.8        | 162.9        |
| Vertical Effective Consolidation Stress, psi     | 4.995        | 9.855        | 14.56        |
| Horizontal Effective Consolidation Stress, psi   | 5.004        | 9.975        | 14.97        |
| Vertical Strain after Consolidation, %           | 0.1308       | 1.490        | 5.016        |
| Volumetric Strain after Consolidation, %         | 1.243        | 7.152        | 7.479        |
| Time to 50% Consolidation, min                   | 9.610        | 121.0        | 30.25        |
| Shear Strength, psi                              | 3.769        | 3.482        | 4.897        |
| Strain at Failure, %                             | 2.33         | 8.55         | 5.65         |
| Strain Rate, %/min                               | 0.01600      | 0.01600      | 0.01600      |
| Deviator Stress at Failure, psi                  | 7.539        | 6.965        | 9.794        |
| Effective Minor Principal Stress at Failure, psi | 1.790        | 2.097        | 10.87        |
| Effective Major Principal Stress at Failure, psi | 9.329        | 9.062        | 20.67        |
| B-Value                                          | 0.96         | 0.95         | 0.96         |

**Notes:**  
 - Before Shear Saturation set to 100% for phase calculation.  
 - Moisture Content determined by ASTM D2216.  
 - Atterberg Limits determined by ASTM D4318.  
 - Deviator Stress includes membrane correction.  
 - Values for c and  $\phi$  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

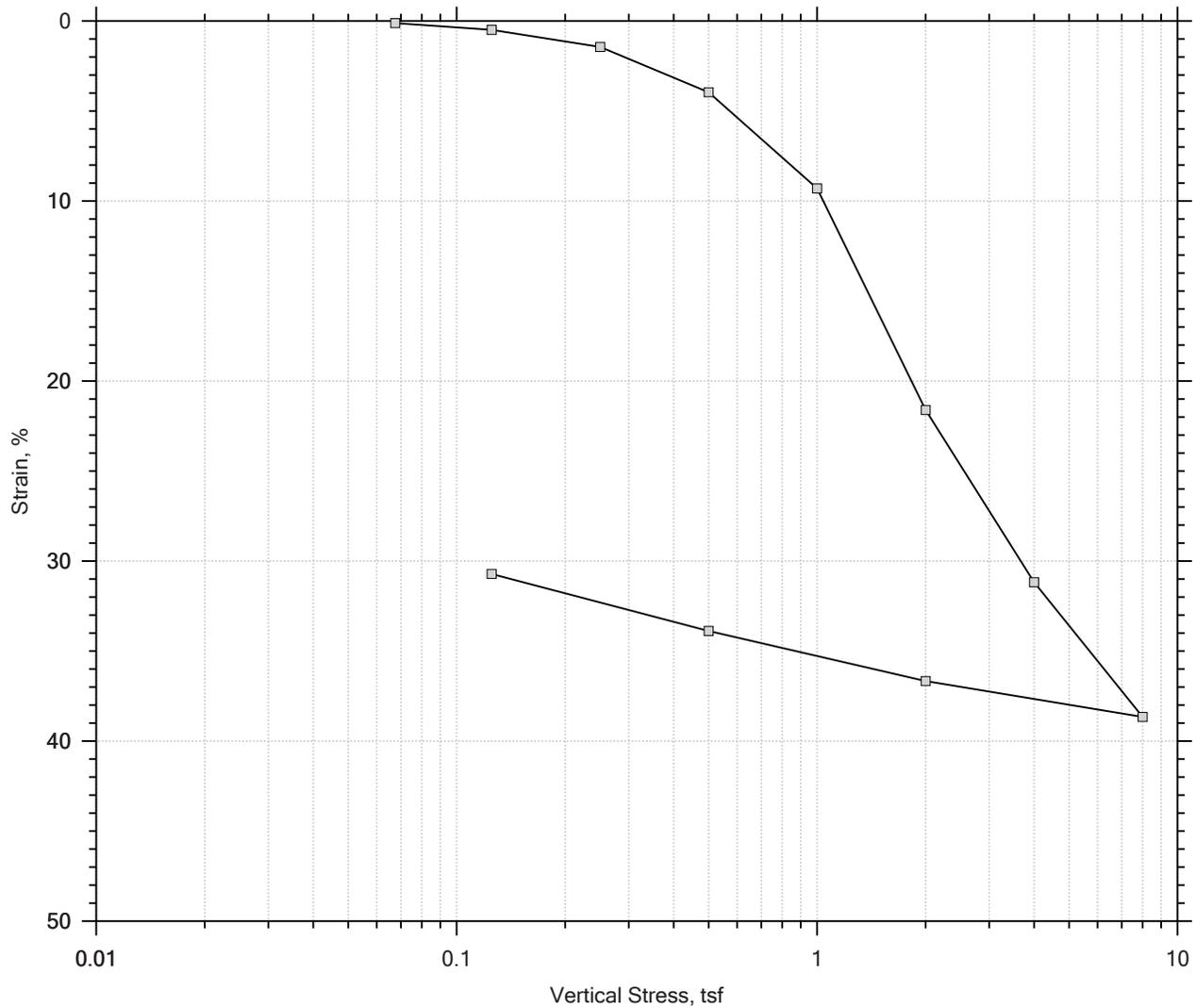


| Sample No. | Test No. | Depth   | Tested By | Test Date | Checked By | Check Date | Test File           |
|------------|----------|---------|-----------|-----------|------------|------------|---------------------|
| ■          | ST-2     | CU-1-1  | md        | 8/16/16   | mcm        | 9/8/16     | 305005-CU-1-1m.dat  |
| ●          | ST-2     | CU-1-2  | md        | 8/16/16   | mcm        | 9/8/16     | 305005-CU-1-2m.dat  |
| ▲          | ST-2     | CU-1-3A | md        | 8/22/16   | mcm        | 9/8/16     | 305005-CU-1-3Am.dat |

|                                                                                     |                                          |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge        | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                         | Sample Type: intact |                         |
|                                                                                     | Description: Moist, olive clay with sand |                     |                         |
|                                                                                     | Remarks: System X                        |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

## Summary Report

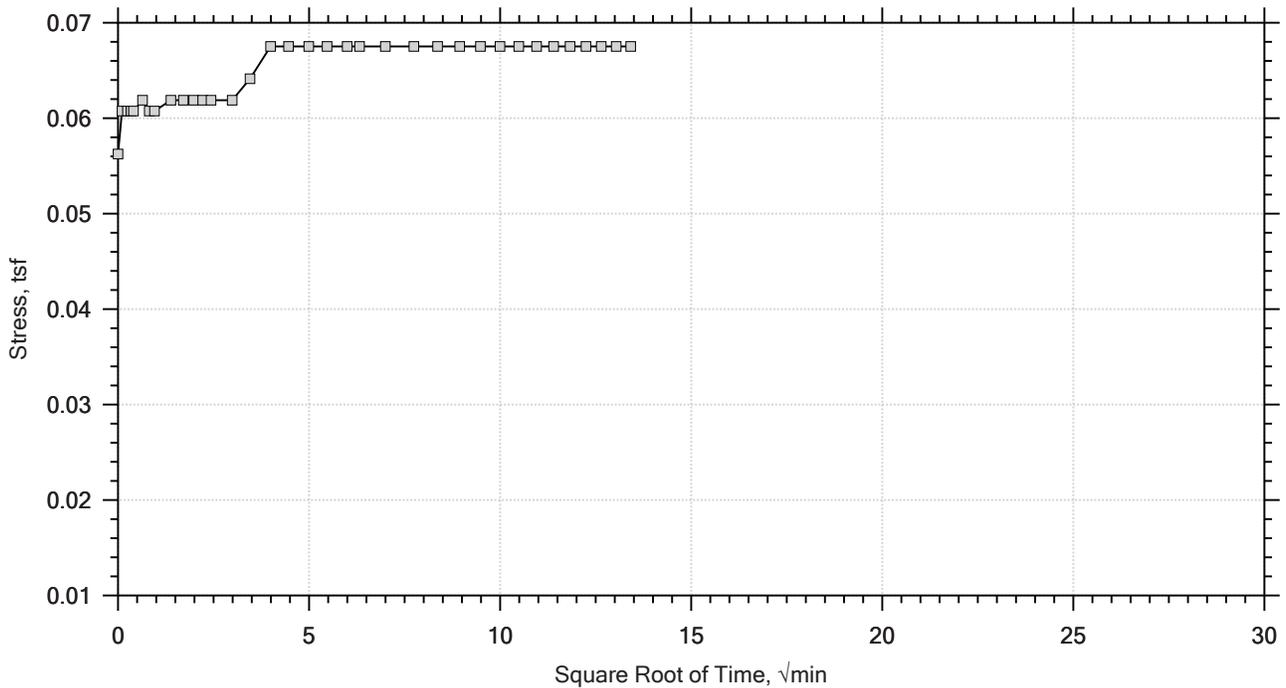
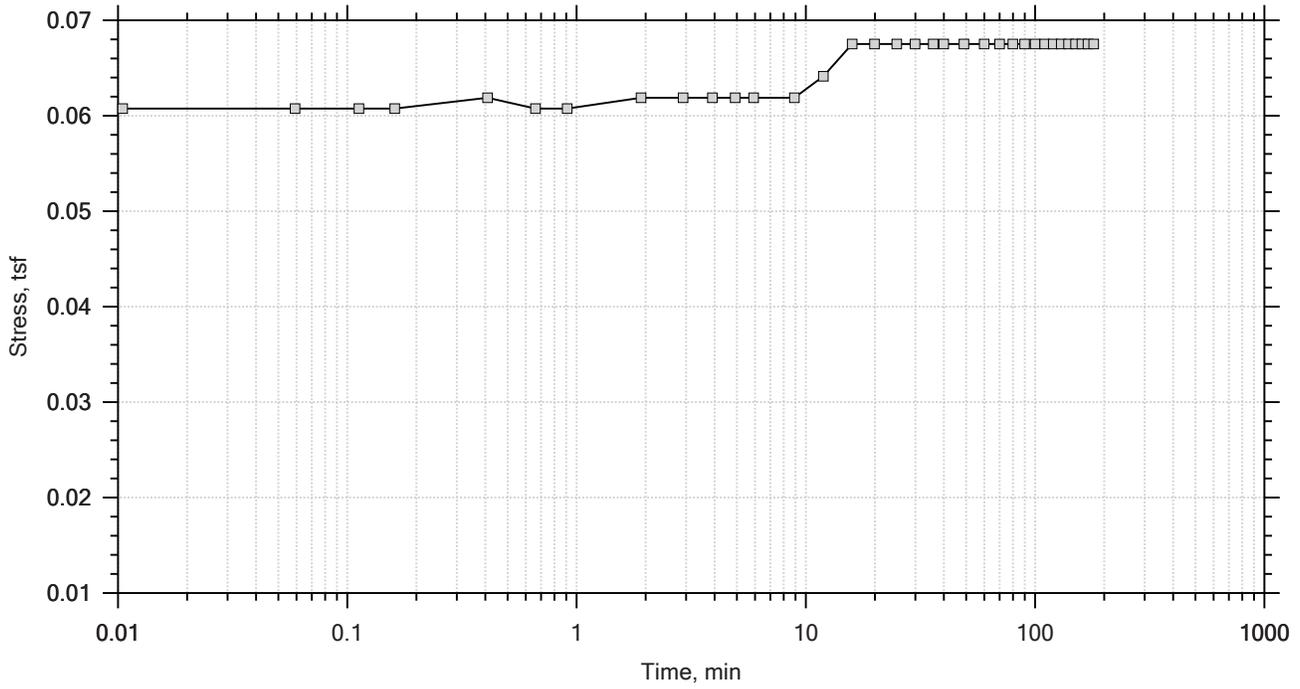


|                                        |         |              |          | Before Test          | After Test |        |
|----------------------------------------|---------|--------------|----------|----------------------|------------|--------|
| Current Vertical Effective Stress: --- |         |              |          | Water Content, %     | 83.73      | 52.10  |
| Preconsolidation Stress: ---           |         |              |          | Dry Unit Weight, pcf | 51.8       | 70.476 |
| Compression Ratio: ---                 |         |              |          | Saturation, %        | 99.63      | 100.00 |
| Diameter: 2.5 in                       |         | Height: 1 in |          | Void Ratio           | 2.30       | 1.43   |
| LL: ---                                | PL: --- | PI: ---      | GS: 2.74 |                      |            |        |

|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
| Displacement at End of Increment                                                    |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

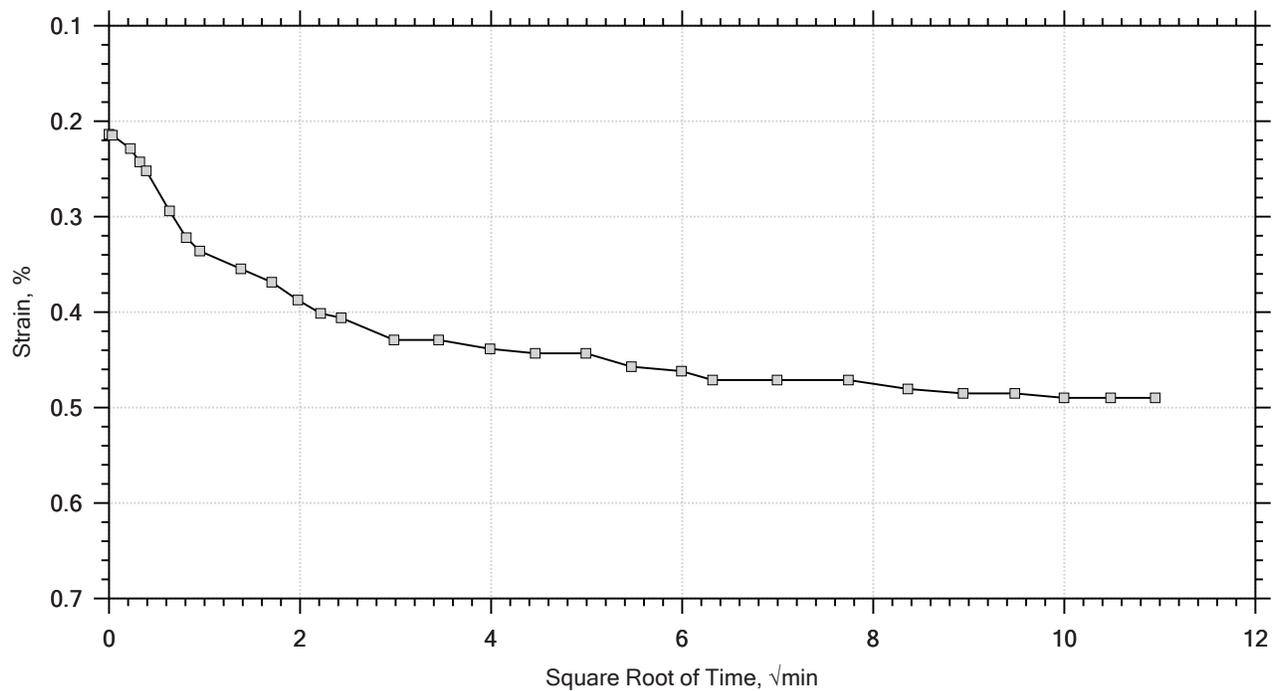
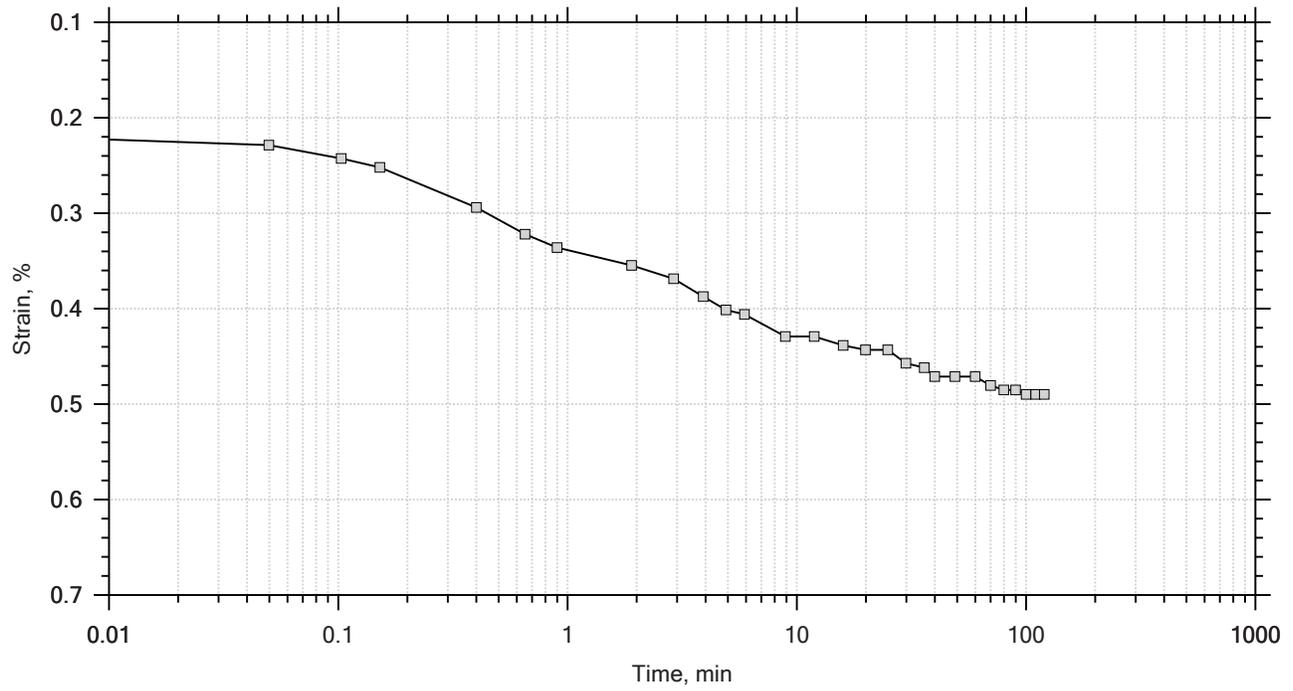
Time Curve 1 of 11  
 Constant Volume Step  
 Stress: 0.0675 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 11  
 Constant Load Step  
 Stress: 0.125 tsf

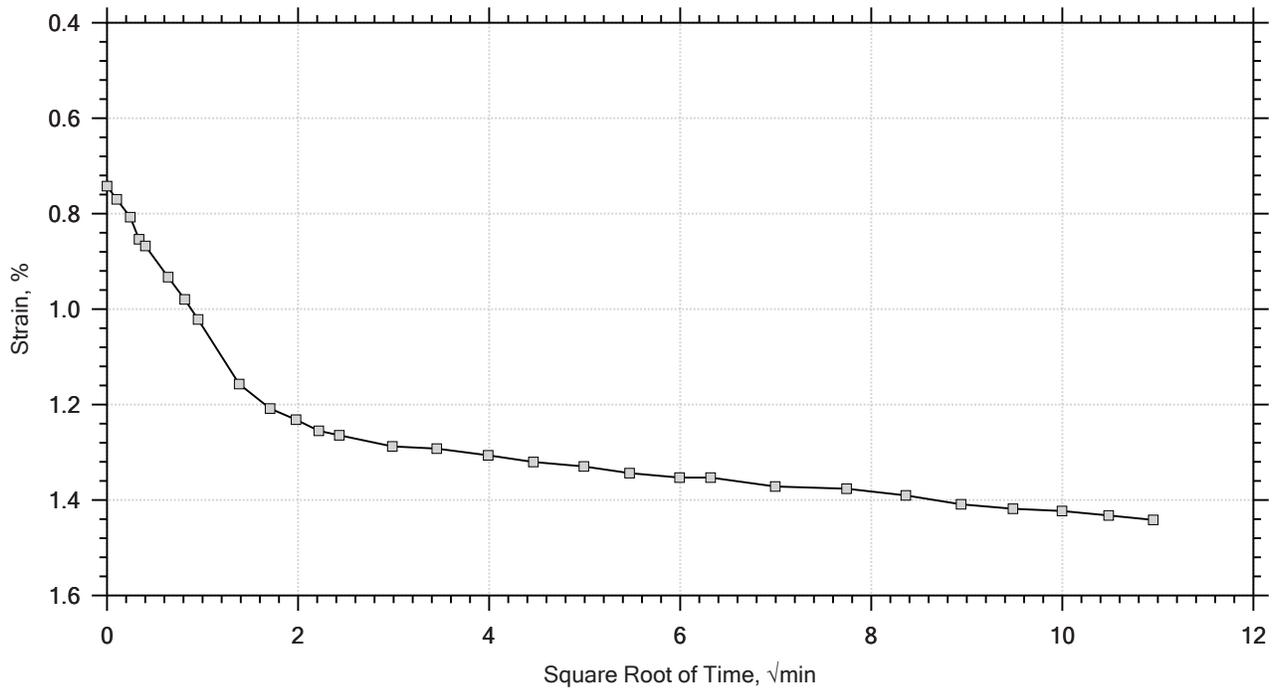
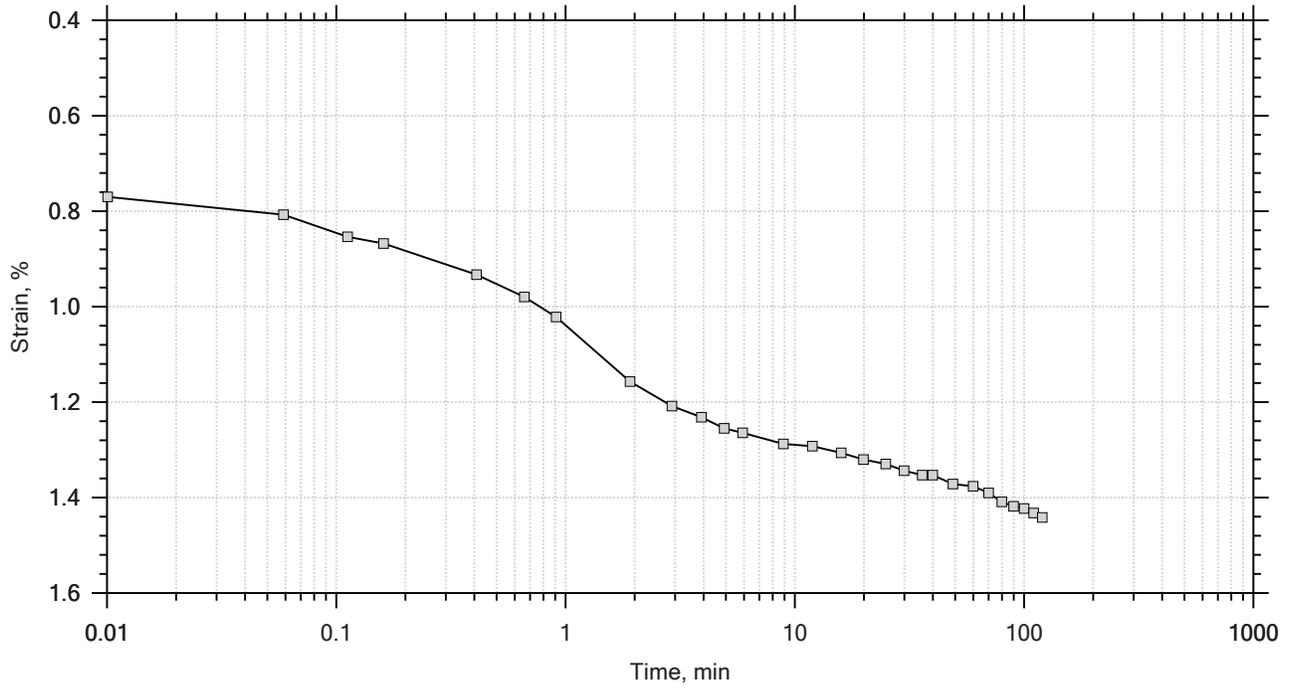


|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |



# One-Dimensional Consolidation by ASTM D2435 - Method B

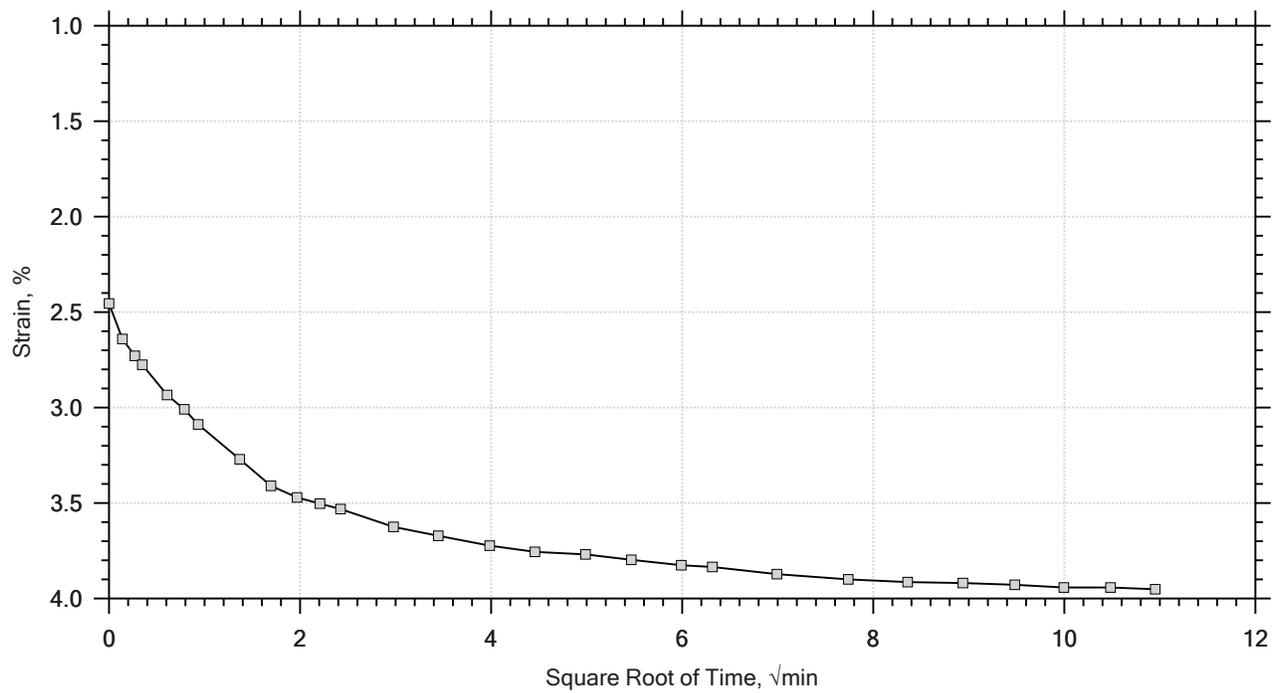
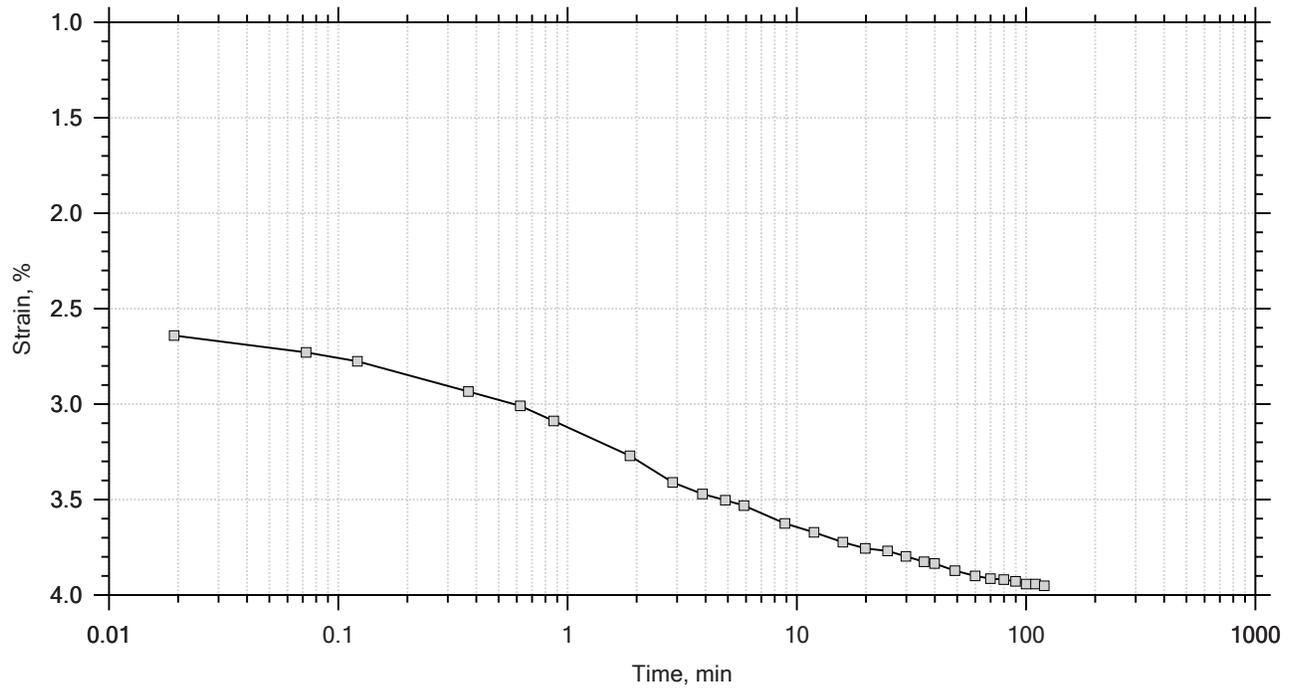
Time Curve 3 of 11  
 Constant Load Step  
 Stress: 0.25 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

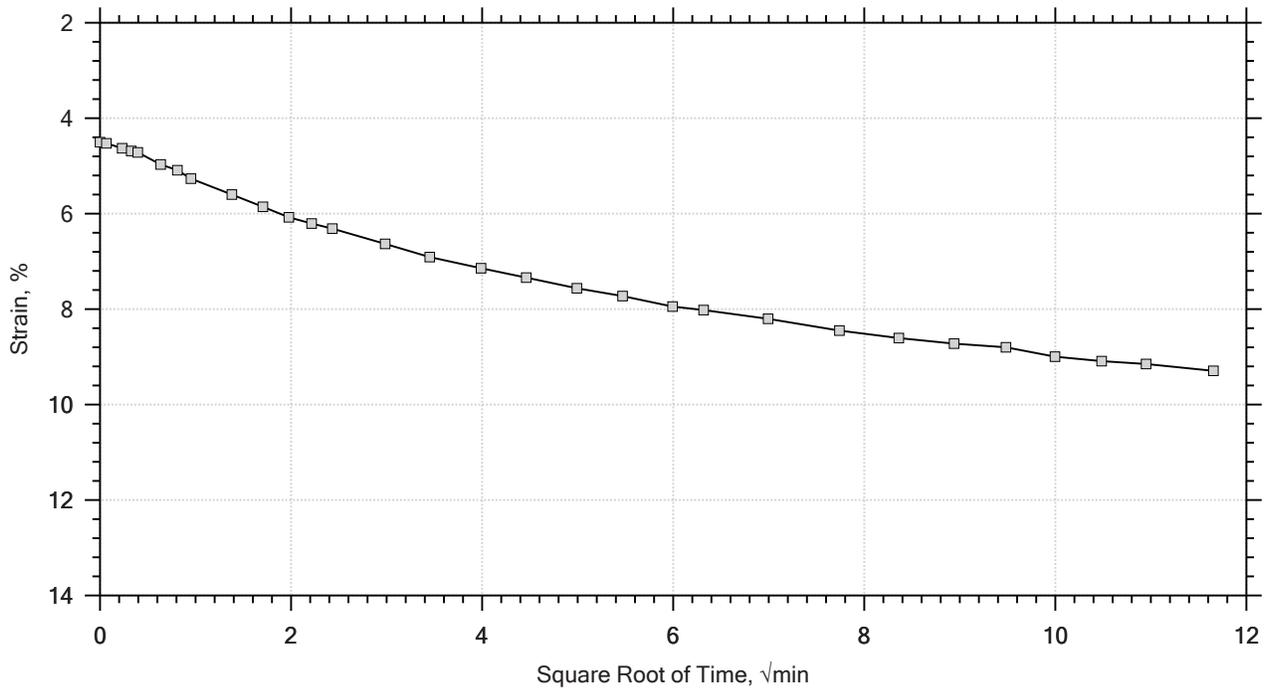
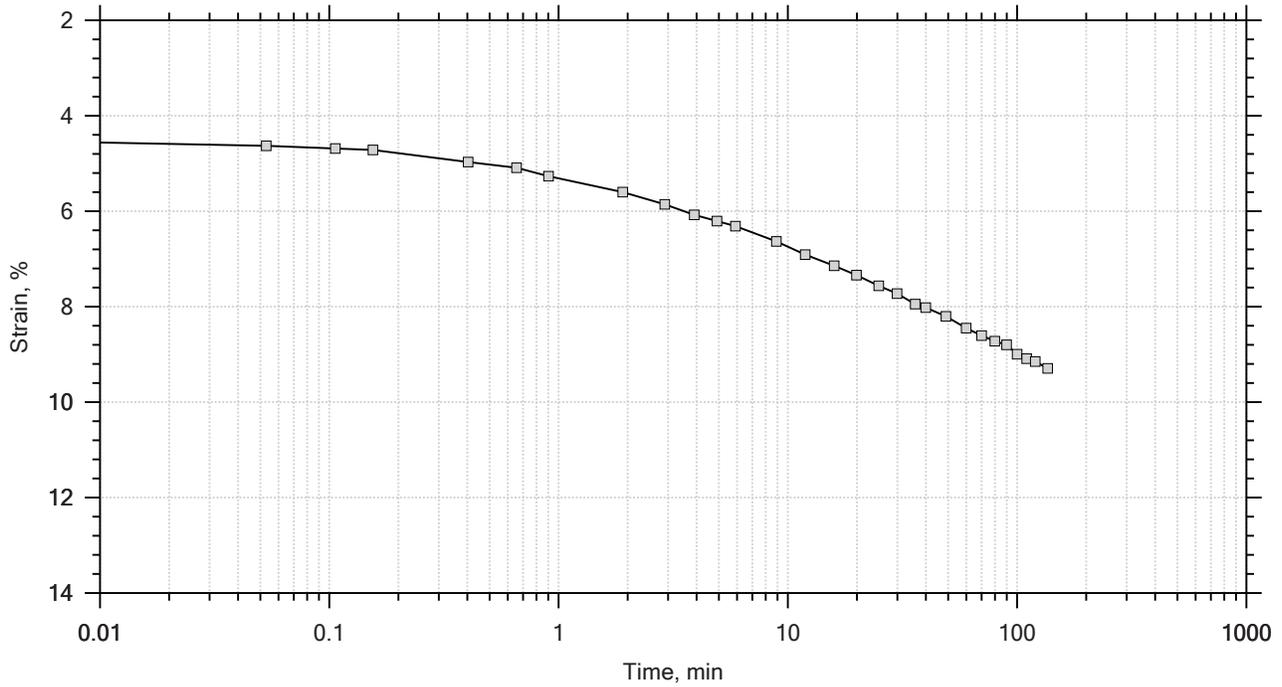
Time Curve 4 of 11  
 Constant Load Step  
 Stress: 0.5 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

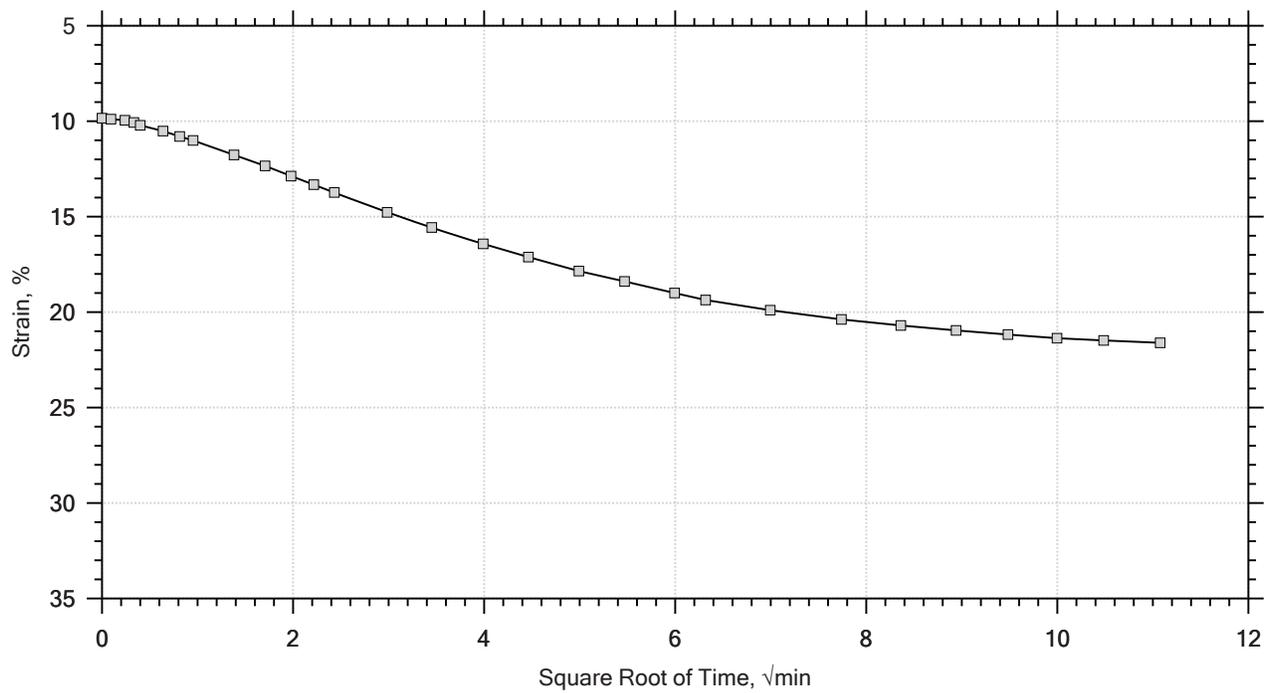
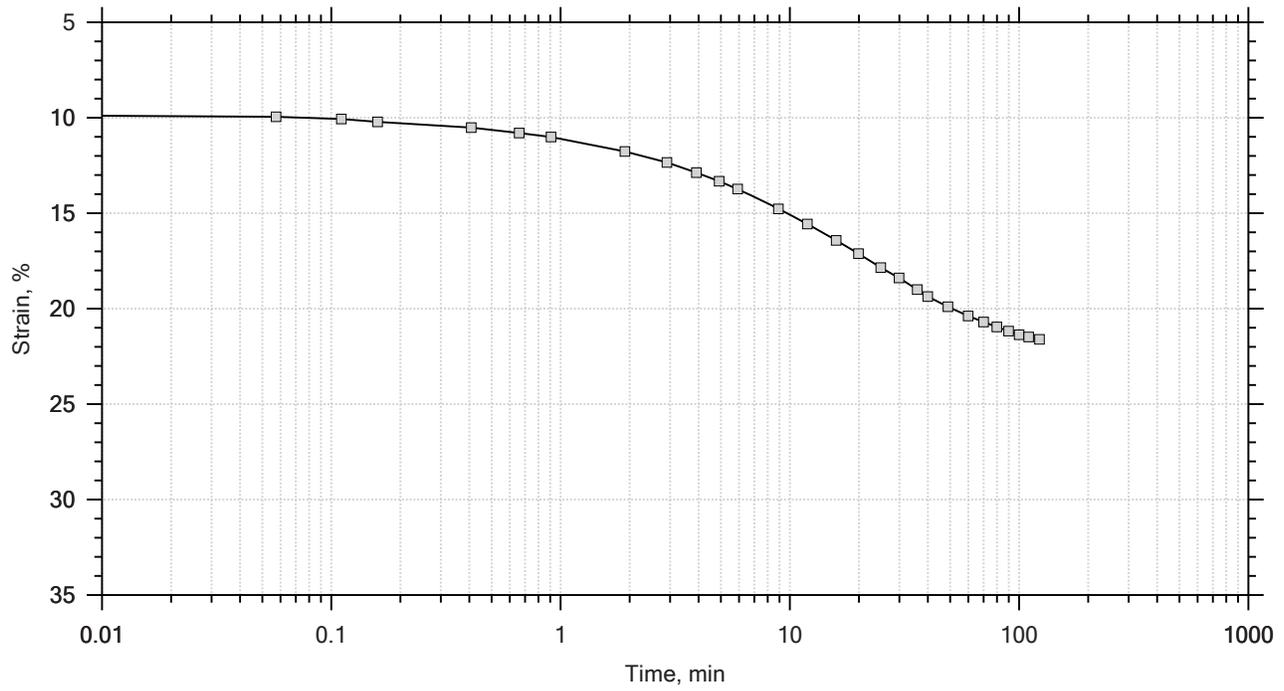
Time Curve 5 of 11  
 Constant Load Step  
 Stress: 1 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

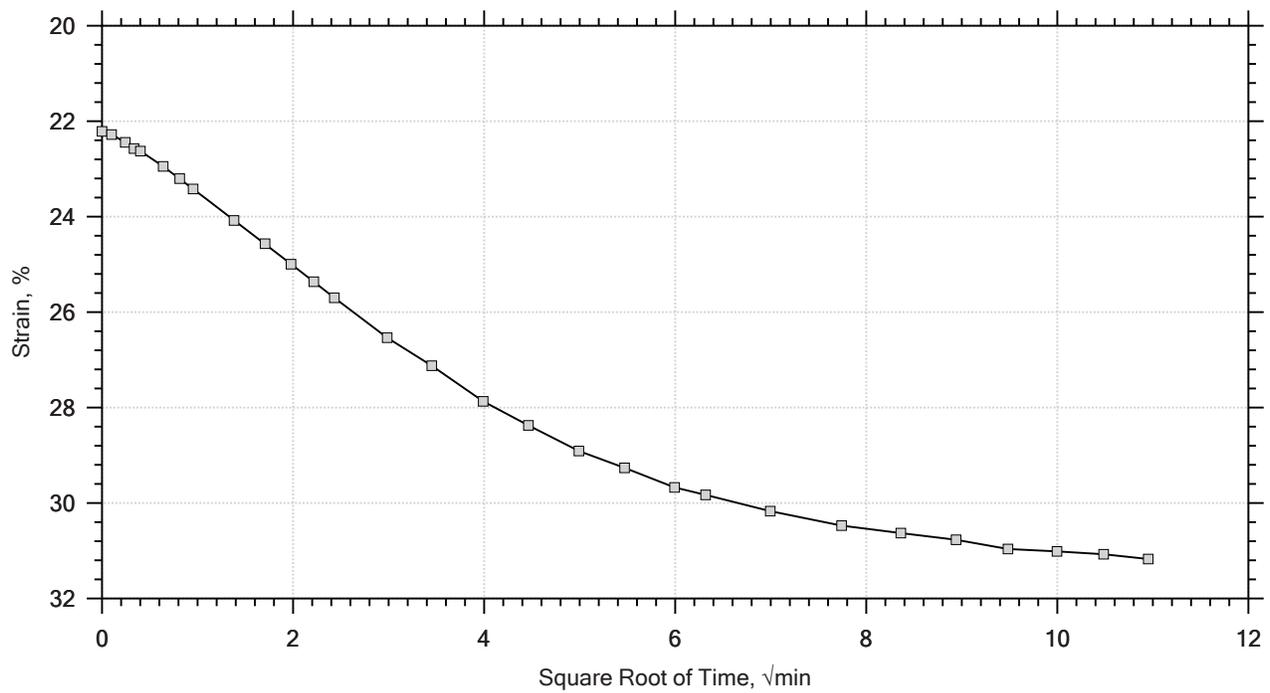
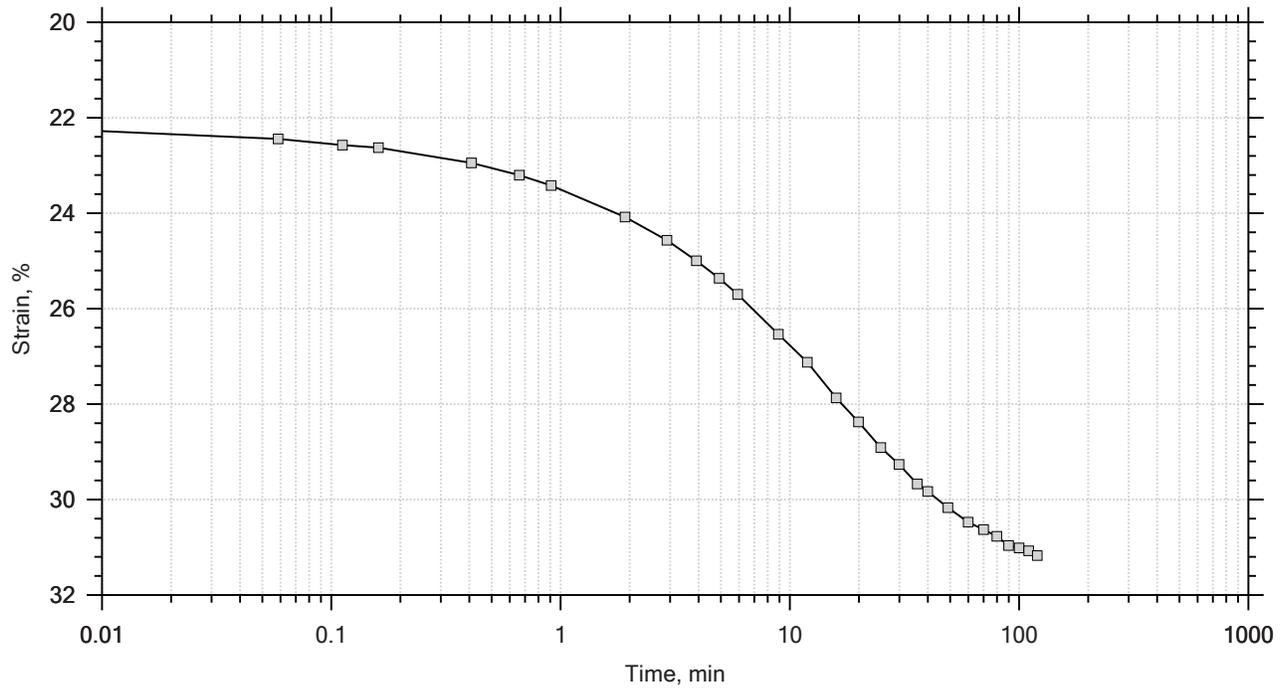
Time Curve 6 of 11  
 Constant Load Step  
 Stress: 2 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

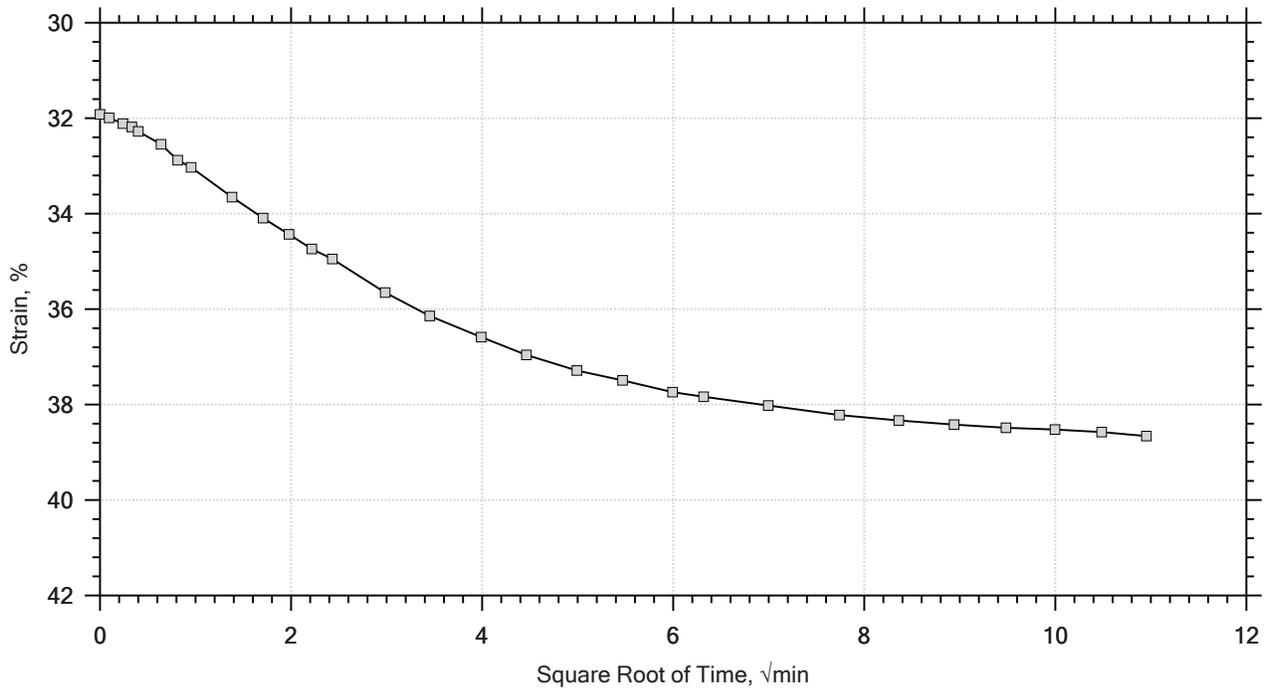
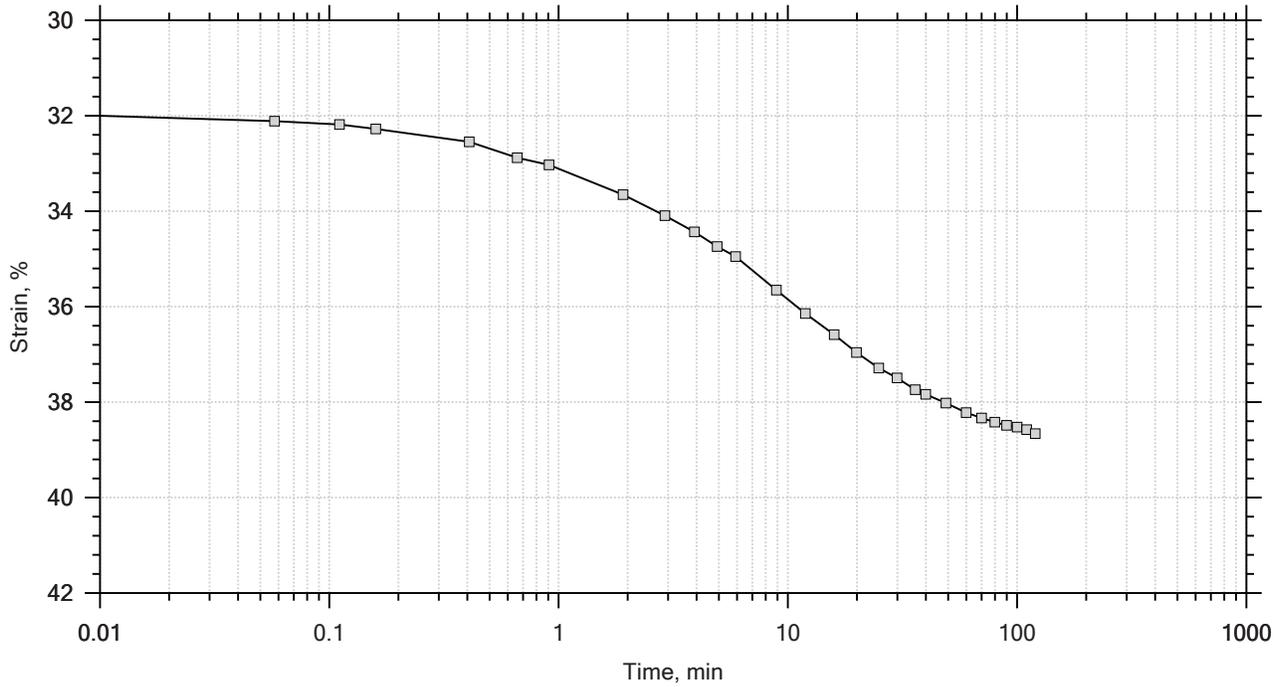
Time Curve 7 of 11  
 Constant Load Step  
 Stress: 4 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

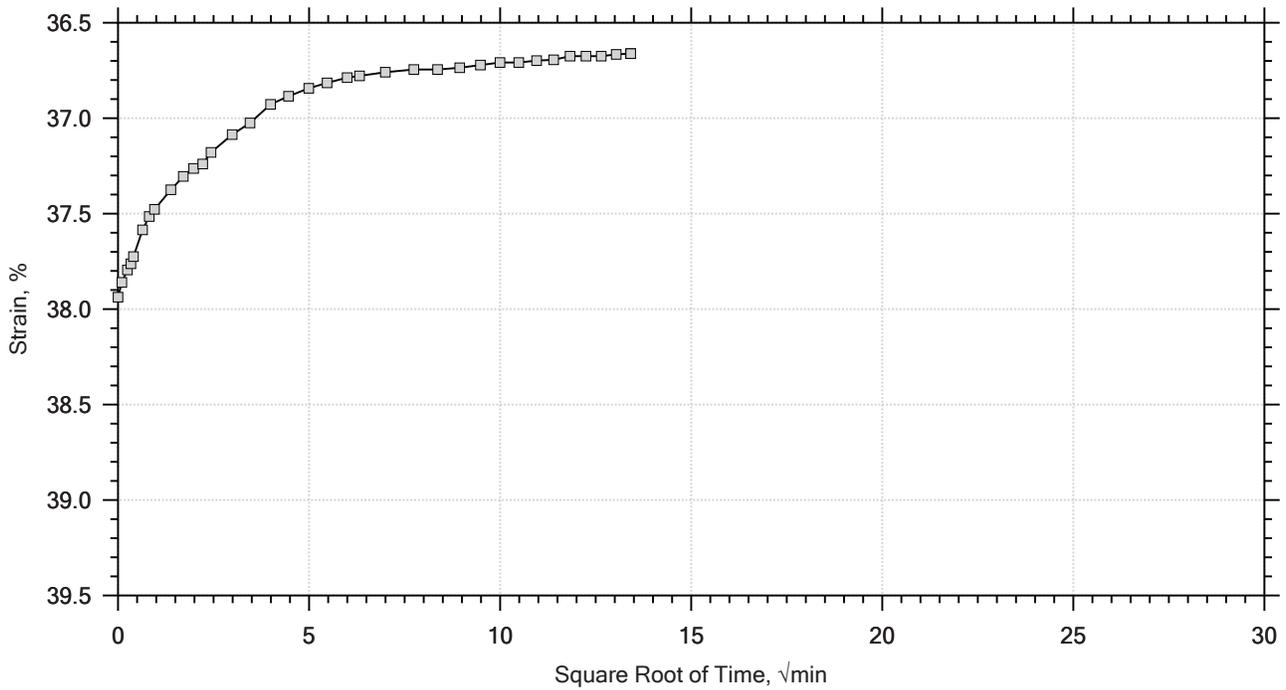
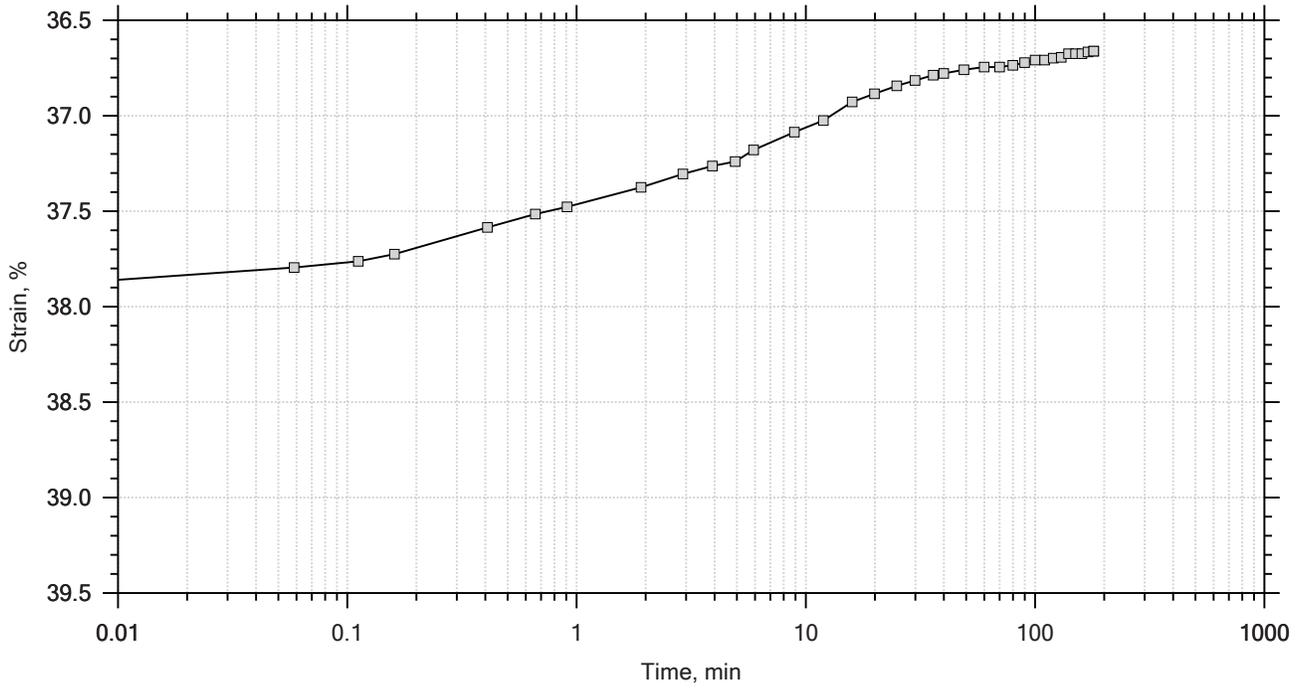
Time Curve 8 of 11  
 Constant Load Step  
 Stress: 8 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 11  
 Constant Load Step  
 Stress: 2 tsf



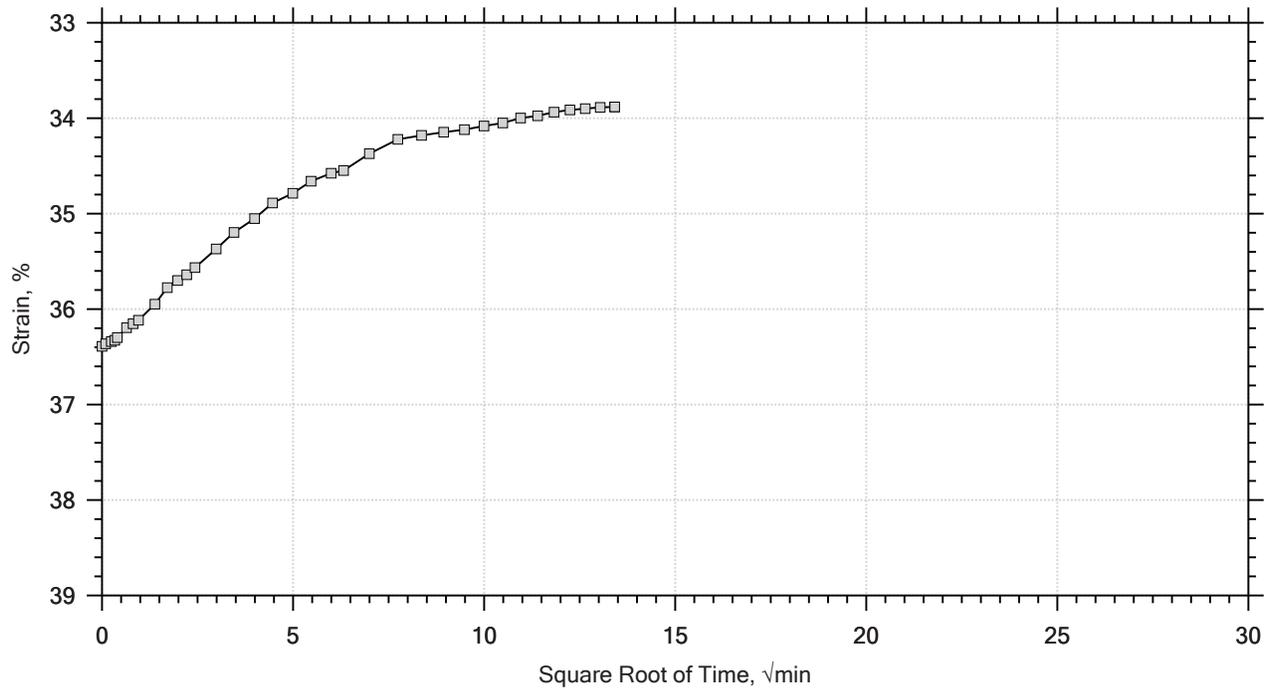
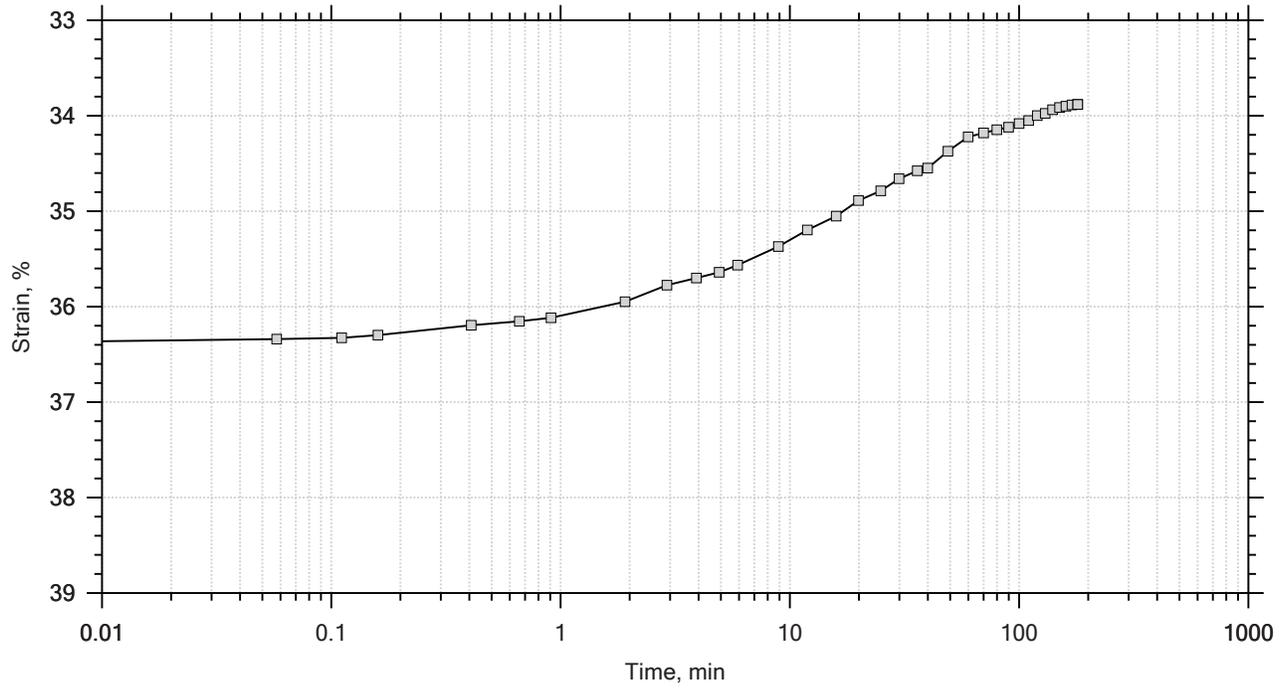
|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 11

Constant Load Step

Stress: 0.5 tsf

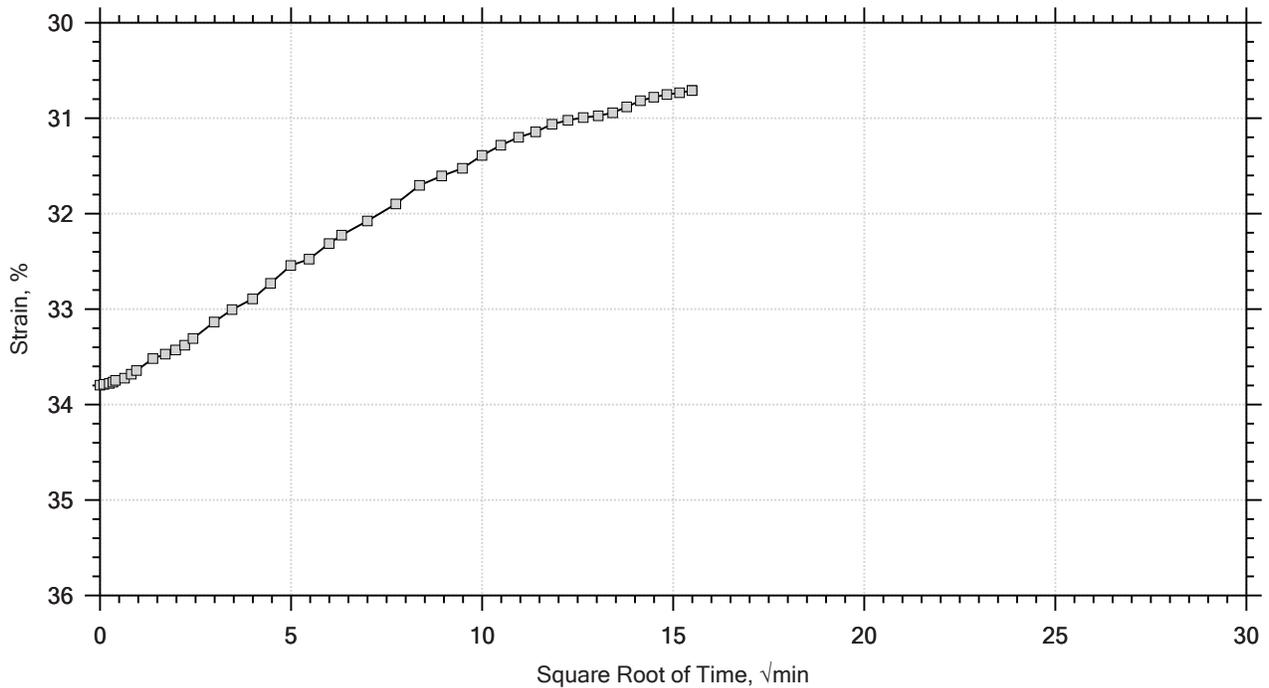
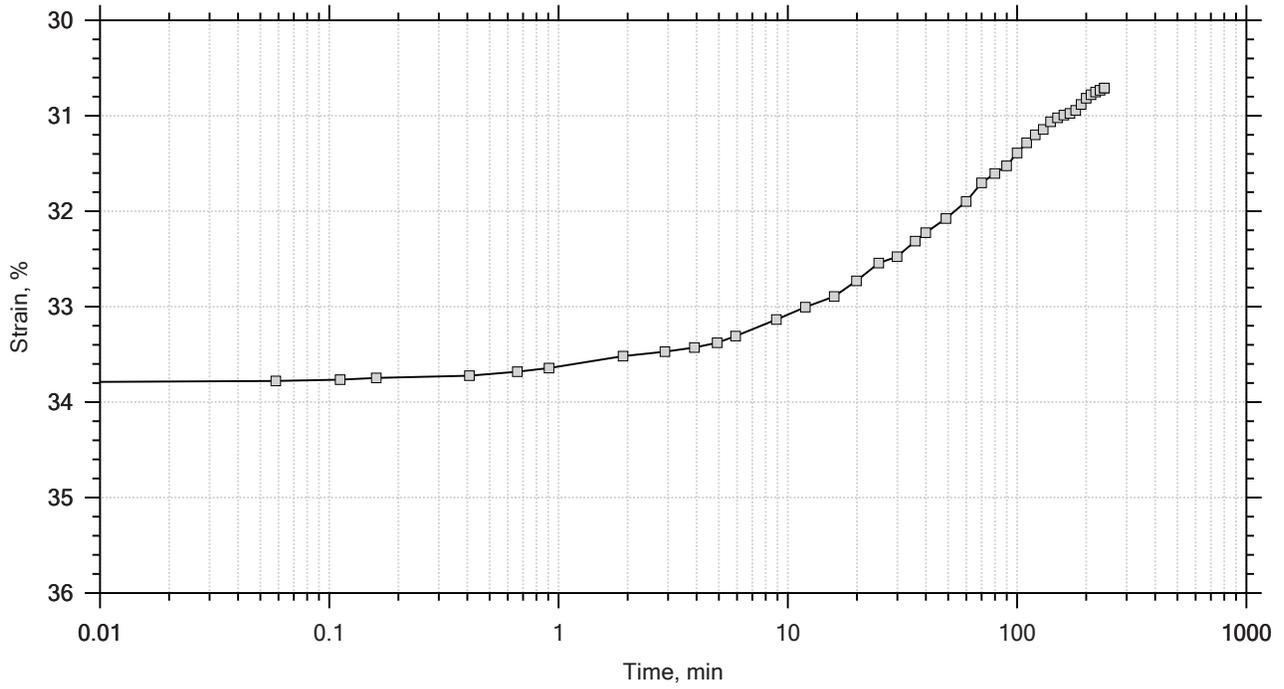


|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |



# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 11  
 Constant Load Step  
 Stress: 0.125 tsf



|                                                                                     |                                                |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

|                            |                                  |                       |
|----------------------------|----------------------------------|-----------------------|
| Specimen Diameter: 2.50 in | Estimated Specific Gravity: 2.74 | Liquid Limit: ---     |
| Initial Height: 1.00 in    | Initial Void Ratio: 2.30         | Plastic Limit: ---    |
| Final Height: 0.73 in      | Final Void Ratio: 1.43           | Plasticity Index: --- |

|                               | Before Test<br>Trimmings | Before Test<br>Specimen | After Test<br>Specimen | After Test<br>Trimmings |
|-------------------------------|--------------------------|-------------------------|------------------------|-------------------------|
| Container ID                  |                          | RING                    |                        | B-990                   |
| Mass Container, gm            | 0                        | 109.41                  | 109.41                 | 7.92                    |
| Mass Container + Wet Soil, gm | 122.63                   | 232.04                  | 210.93                 | 107.44                  |
| Mass Container + Dry Soil, gm | 65.43                    | 176.15                  | 176.15                 | 73.35                   |
| Mass Dry Soil, gm             | 65.43                    | 66.745                  | 66.745                 | 65.43                   |
| Water Content, %              | 87.42                    | 83.73                   | 52.10                  | 52.10                   |
| Void Ratio                    | ---                      | 2.30                    | 1.43                   | ---                     |
| Degree of Saturation, %       | ---                      | 99.63                   | 100.00                 | ---                     |
| Dry Unit Weight, pcf          | ---                      | 51.8                    | 70.476                 | ---                     |

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-21 Replacement Bridge              | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-3                               | Tested By: md       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-2                               | Test Date: 8/19/16  | Depth: 27.0-29.0 ft     |
|                                                                                     | Test No.: IP-1                                 | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, olive clay with sand       |                     |                         |
|                                                                                     | Remarks: System W, Swell Pressure = 0.0675 tsf |                     |                         |
|                                                                                     |                                                |                     |                         |







|            |                                            |              |            |             |     |
|------------|--------------------------------------------|--------------|------------|-------------|-----|
| Client:    | F&ME Consultants                           | Project No:  | GTX-305005 |             |     |
| Project:   | US-21 Replacement Bridge over Harbor River |              |            |             |     |
| Location:  | ---                                        |              |            |             |     |
| Boring ID: | ---                                        | Sample Type: | ---        | Tested By:  | GA  |
| Sample ID: | ---                                        | Test Date:   | 10/31/16   | Checked By: | mcm |
| Depth :    | ---                                        | Test Id:     | 397035     |             |     |

## Moisture Content of Soil and Rock - ASTM D2216

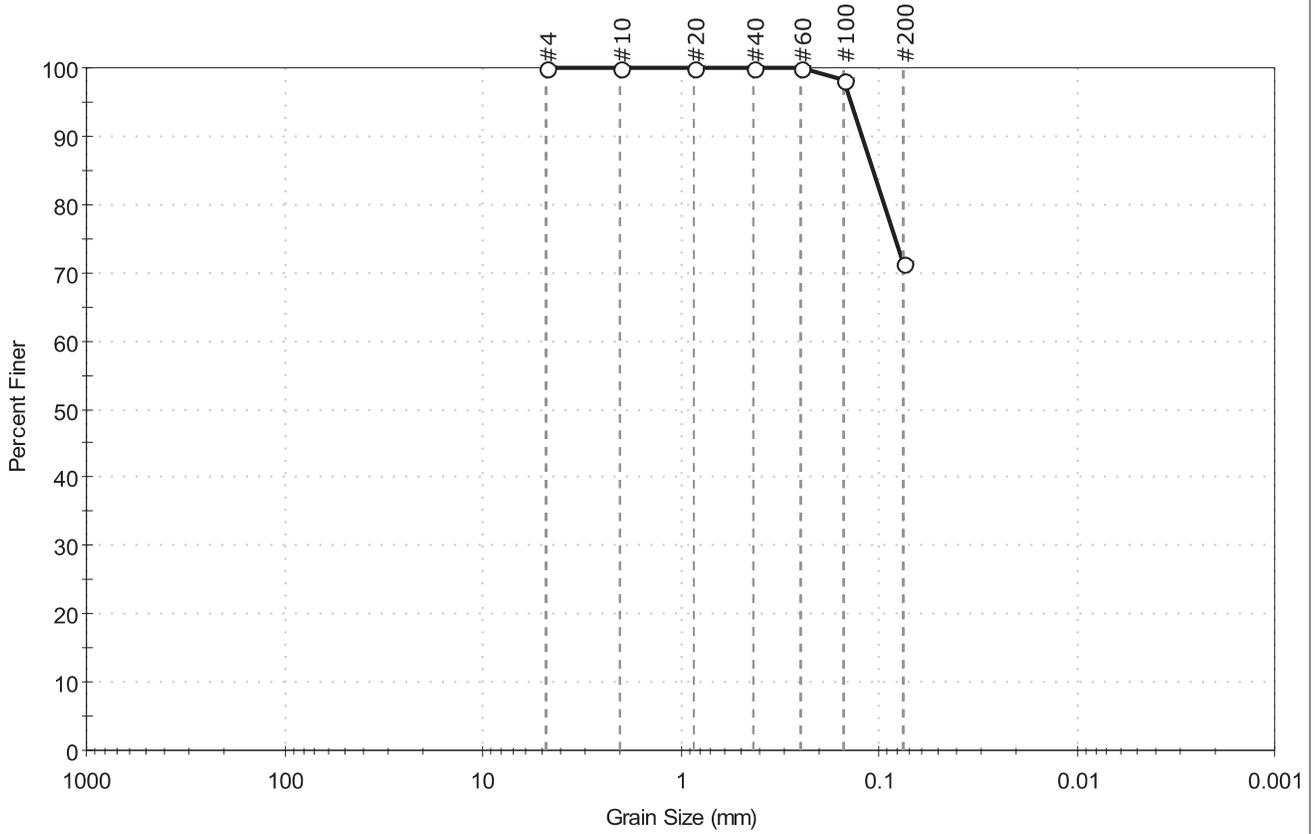
| Boring ID | Sample ID | Depth        | Description                                   | Moisture Content, % |
|-----------|-----------|--------------|-----------------------------------------------|---------------------|
| AP-4      | UD-1      | 38.0-40.0 ft | Moist, very dark greenish gray clay with sand | 69.0                |

Notes: Temperature of Drying : 110° Celsius



|                          |                                                                   |                        |
|--------------------------|-------------------------------------------------------------------|------------------------|
| Client: F&ME Consultants | Project: US-21 Replacement Bridge over Harbor River               | Project No: GTX-305005 |
| Location: ---            | Boring ID: AP-4                                                   | Sample Type: tube      |
| Tested By: GA            | Sample ID: UD-1                                                   | Test Date: 10/31/16    |
| Checked By: mcm          | Depth: 38.0-40.0 ft                                               | Test Id: 397033        |
| Test Comment: ---        | Visual Description: Moist, very dark greenish gray clay with sand | Sample Comment: ---    |

## Particle Size Analysis - ASTM D422



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 0.0      | 28.7   | 71.3               |

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

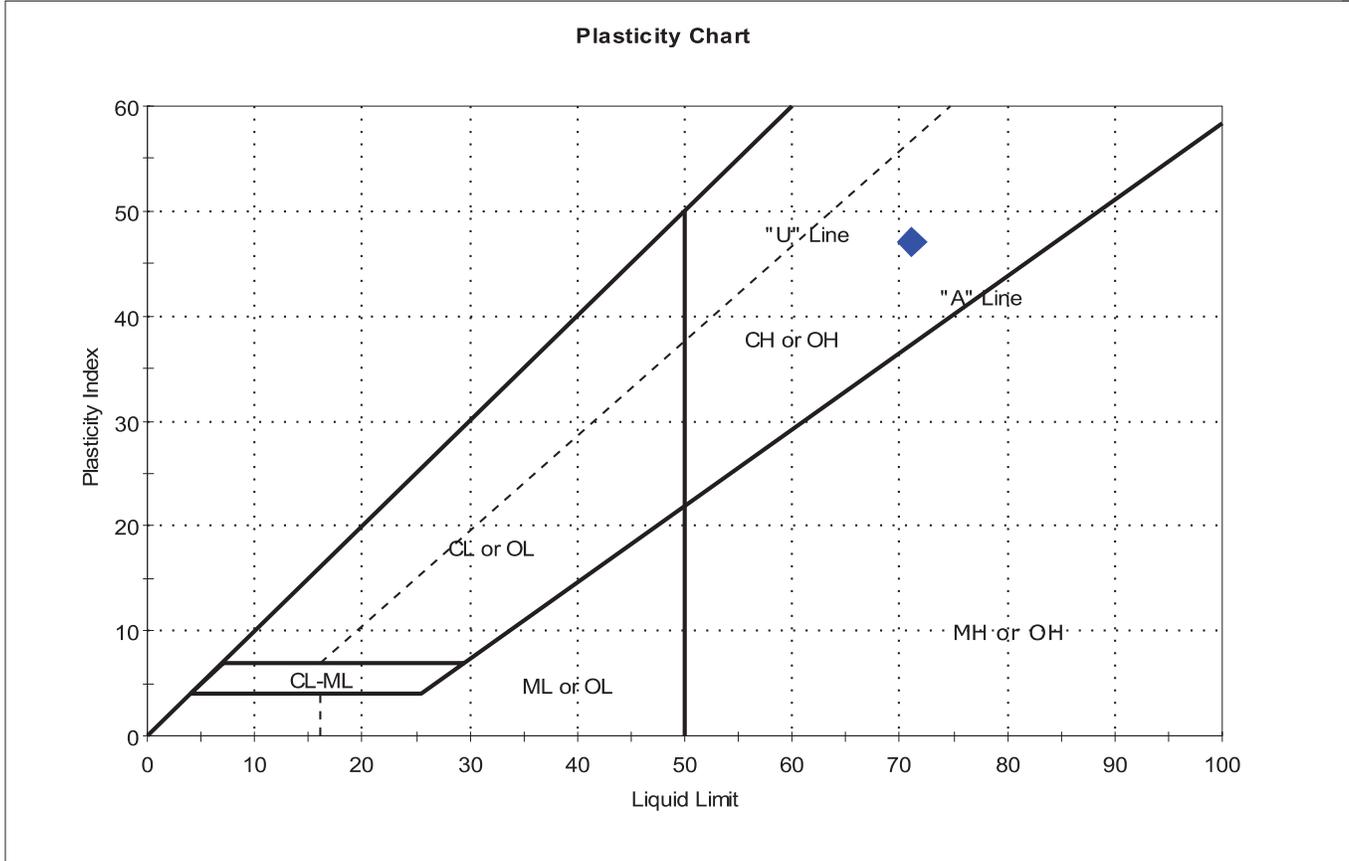
| <b>Coefficients</b>         |                       |
|-----------------------------|-----------------------|
| D <sub>85</sub> = 0.1068 mm | D <sub>30</sub> = N/A |
| D <sub>60</sub> = N/A       | D <sub>15</sub> = N/A |
| D <sub>50</sub> = N/A       | D <sub>10</sub> = N/A |
| C <sub>u</sub> = N/A        | C <sub>c</sub> = N/A  |

| <b>Classification</b> |                           |
|-----------------------|---------------------------|
| <b>ASTM</b>           | Fat clay with sand (CH)   |
| <b>AASHTO</b>         | Clayey Soils (A-7-6 (34)) |

| <b>Sample/Test Description</b> |       |
|--------------------------------|-------|
| Sand/Gravel Particle Shape     | : --- |
| Sand/Gravel Hardness           | : --- |

|                     |                                               |              |            |
|---------------------|-----------------------------------------------|--------------|------------|
| Client:             | F&ME Consultants                              | Project No:  | GTX-305005 |
| Project:            | US-21 Replacement Bridge over Harbor River    | Tested By:   | GA         |
| Location:           | ---                                           | Checked By:  | mcm        |
| Boring ID:          | AP-4                                          | Sample Type: | tube       |
| Sample ID:          | UD-1                                          | Test Date:   | 10/31/16   |
| Depth :             | 38.0-40.0 ft                                  | Test Id:     | 397034     |
| Test Comment:       | ---                                           |              |            |
| Visual Description: | Moist, very dark greenish gray clay with sand |              |            |
| Sample Comment:     | ---                                           |              |            |

## Atterberg Limits - ASTM D4318



| Symbol | Sample ID | Boring | Depth        | Natural Moisture Content, % | Liquid Limit | Plastic Limit | Plasticity Index | Liquidity Index | Soil Classification     |
|--------|-----------|--------|--------------|-----------------------------|--------------|---------------|------------------|-----------------|-------------------------|
| ◆      | UD-1      | AP-4   | 38.0-40.0 ft | 69                          | 71           | 24            | 47               | 1               | Fat clay with sand (CH) |

Sample Prepared using the WET method  
 0% Retained on #40 Sieve  
 Dry Strength: HIGH  
 Dilatancy: SLOW  
 Toughness: LOW

**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1281 **DATE SAMPLE RECEIVED:** 8/8/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** MB **DATE OF TESTING:** 8/19/2016  
**DATE OF WEIGHING:** 8/22/2016

|                          |            |            |  |  |  |
|--------------------------|------------|------------|--|--|--|
| <b>BORING NO.</b>        | AP-4/UD-2  | AP-4/UD-3  |  |  |  |
| <b>SAMPLE NO.</b>        | 16-1281E   | 16-1281H   |  |  |  |
| <b>SAMPLE DEPTH</b>      | 40.0-42.0' | 70.0-72.0' |  |  |  |
| <b>WATER CONTENT, W%</b> | 33.8       | 58.8       |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |



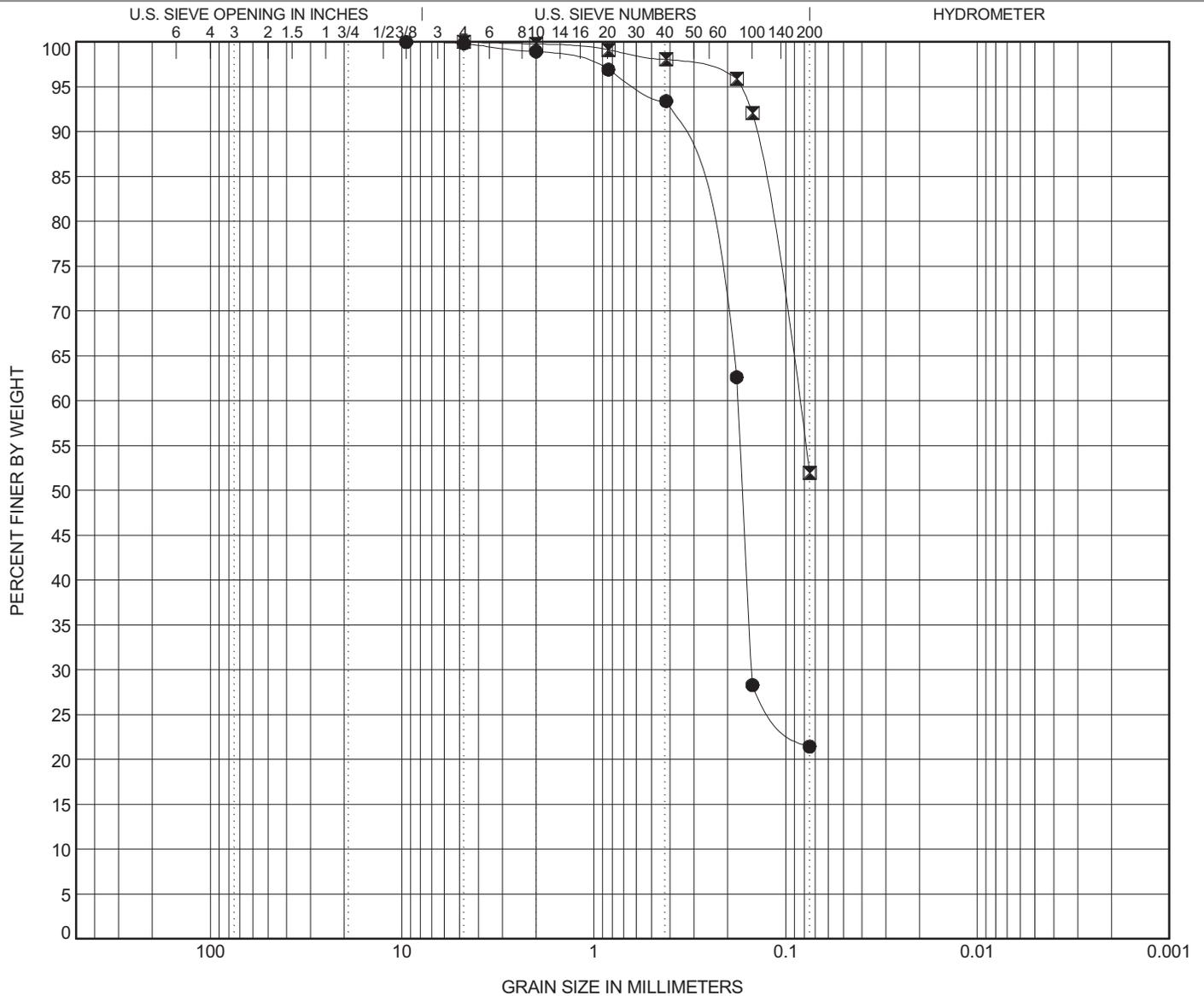


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

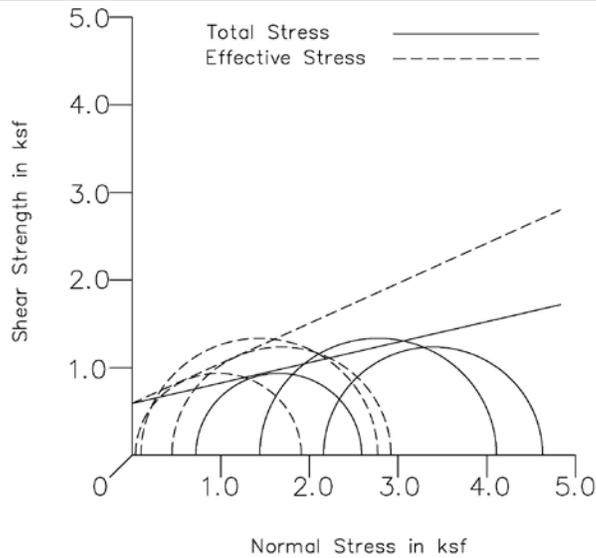
| BOREHOLE | DEPTH | Classification         |       |       |     |         | LL    | PL    | PI    | Cc | Cu |
|----------|-------|------------------------|-------|-------|-----|---------|-------|-------|-------|----|----|
| ● AP-4   | 42.0  | Silty SAND (SM) A-2-4  |       |       |     |         | NP    | NP    | NP    |    |    |
| ⊠ AP-4   | 72.0  | Sandy SILT (ML) A-4(0) |       |       |     |         | NP    | NP    | NP    |    |    |
| BOREHOLE | DEPTH | D100                   | D95   | D50   | D10 | %Gravel | %Sand | %Silt | %Clay |    |    |
| ● AP-4   | 42.0  | 9.52                   | 0.574 | 0.168 |     | 0.2     | 78.4  | 21.5  |       |    |    |
| ⊠ AP-4   | 72.0  | 4.76                   | 0.172 |       |     | 0.0     | 48.0  | 52.0  |       |    |    |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/18/16

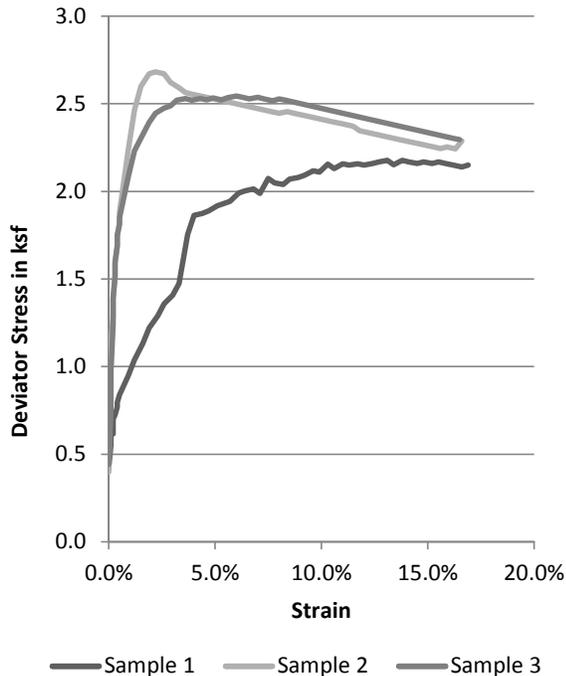


# TRIAXIAL SHEAR TEST REPORT

## ASTM D4767 / AASHTO T297



### Stress-Strain Curves



|                              |                         | Sample |        |        |
|------------------------------|-------------------------|--------|--------|--------|
|                              |                         | 1      | 2      | 3      |
| Initial                      | Water Content, %        | 33.8%  | 33.8%  | 33.8%  |
|                              | Void Ratio              | 1.13   | 1.40   | 0.88   |
|                              | Diameter, in.           | 2.84   | 2.84   | 2.85   |
|                              | Height, in.             | 5.74   | 5.84   | 5.87   |
|                              | Volume, in <sup>3</sup> | 36.47  | 36.94  | 37.35  |
| Final                        | Water Content, %        | 59.5%  | 53.8%  | 33.8%  |
|                              | Void Ratio              | 1.56   | 1.40   | 0.90   |
|                              | Diameter, in.           | 2.84   | 2.84   | 2.85   |
|                              | Height, in.             | 5.66   | 5.72   | 5.79   |
|                              | Volume, in <sup>3</sup> | 35.95  | 36.19  | 36.84  |
|                              | Saturation, %           | 100.0% | 100.0% | 100.0% |
| Dry Density, PCF             |                         | 64.9   | 69.1   | 87.0   |
| Cell Pressure (ksf)          |                         | 5.76   | 6.48   | 7.20   |
| Sample Pressure (ksf)        |                         | 5.04   | 5.04   | 5.04   |
| Stress at Failure (ksf)      |                         | 1.87   | 2.67   | 2.47   |
| Strain at Failure, %         |                         | 4.4%   | 1.9%   | 2.6%   |
| $\sigma_1$ at Failure (ksf)  |                         | 2.59   | 4.11   | 4.63   |
| $\sigma_3$ at Failure (ksf)  |                         | 0.72   | 1.44   | 2.16   |
| $\sigma'_1$ at Failure (ksf) |                         | 1.91   | 2.77   | 2.92   |
| $\sigma'_3$ at Failure (ksf) |                         | 0.04   | 0.10   | 0.45   |

Project Name US 21 Bridge Replacement over Harbor River

Project Number G5396 Date 9/1/2016

SCDOT Project ID P026862

Location/Sample AP-4/UD-2 / Sample #16-1281A

Depth/Elevation 40.0' - 42.0'

Type of Test : Consolidated Undrained

Sample Type : Undisturbed - Shelby Tube

Description: Dark Grey Silty Fine to Medium SAND (SM), A-2-4

PI= NP % Fines= 21.5

C= 0.59 ksf C'= 0.59 ksf

$\phi$ = 13°  $\phi'$ = 24°

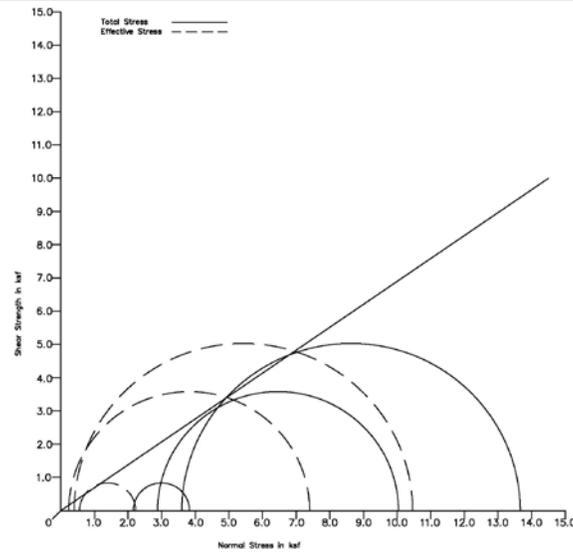


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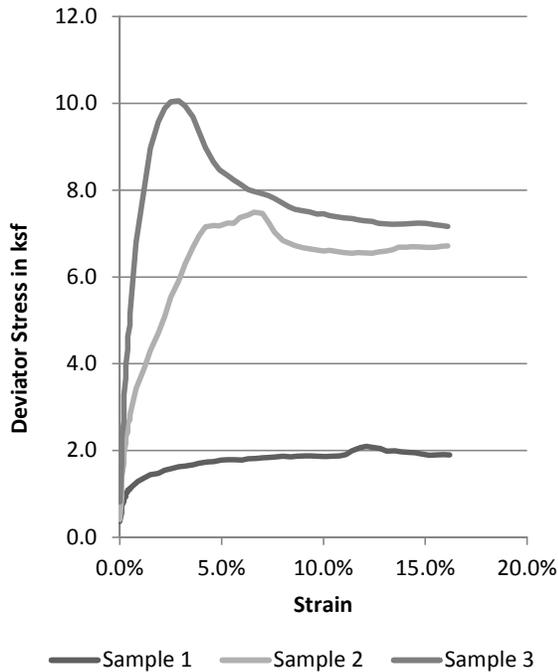
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# TRIAXIAL SHEAR TEST REPORT

## ASTM D4767 / AASHTO T297



### Stress-Strain Curves



|                              |                         | Sample |        |        |
|------------------------------|-------------------------|--------|--------|--------|
|                              |                         | 1      | 2      | 3      |
| Initial                      | Water Content, %        | 58.8%  | 58.8%  | 58.8%  |
|                              | Void Ratio              | 1.75   | 1.49   | 1.51   |
|                              | Diameter, in.           | 2.87   | 2.87   | 2.86   |
|                              | Height, in.             | 5.86   | 5.90   | 5.90   |
|                              | Volume, in <sup>3</sup> | 37.81  | 38.26  | 37.79  |
| Final                        | Water Content, %        | 57.0%  | 52.0%  | 56.6%  |
|                              | Void Ratio              | 1.61   | 1.36   | 1.45   |
|                              | Diameter, in.           | 2.87   | 2.87   | 2.86   |
|                              | Height, in.             | 5.47   | 5.79   | 5.82   |
|                              | Volume, in <sup>3</sup> | 35.31  | 37.56  | 37.31  |
|                              | Saturation, %           | 93.9%  | 100.0% | 100.0% |
| Dry Density, PCF             |                         | 63.5   | 70.3   | 67.7   |
| Cell Pressure (ksf)          |                         | 7.20   | 7.92   | 8.64   |
| Sample Pressure (ksf)        |                         | 5.04   | 5.04   | 5.04   |
| Stress at Failure (ksf)      |                         | 1.67   | 7.16   | 10.06  |
| Strain at Failure, %         |                         | 3.6%   | 4.2%   | 2.9%   |
| $\sigma_1$ at Failure (ksf)  |                         | 3.83   | 10.04  | 13.66  |
| $\sigma_3$ at Failure (ksf)  |                         | 2.16   | 2.88   | 3.60   |
| $\sigma'_1$ at Failure (ksf) |                         | 2.23   | 7.40   | 10.46  |
| $\sigma'_3$ at Failure (ksf) |                         | 0.56   | 0.24   | 0.40   |

Project Name US 21 Bridge Replacement over Harbor River

Project Number G5396 Date 9/8/2016  
 SCDOT Project ID P026862

Location/Sample AP-4/UD-3 / Sample #16-1281B  
 Depth/Elevation 70.0' - 72.0'

Type of Test : Consolidated Undrained  
 Sample Type : Undisturbed - Shelby Tube  
 Description: Dark Grey Fine Sandy SILT (ML), A  
 4(0)  
 PI= NP                      % Fines= 52.0  
 C= 0                              C'= --  
 $\phi$ = 34°                               $\phi'$ = --

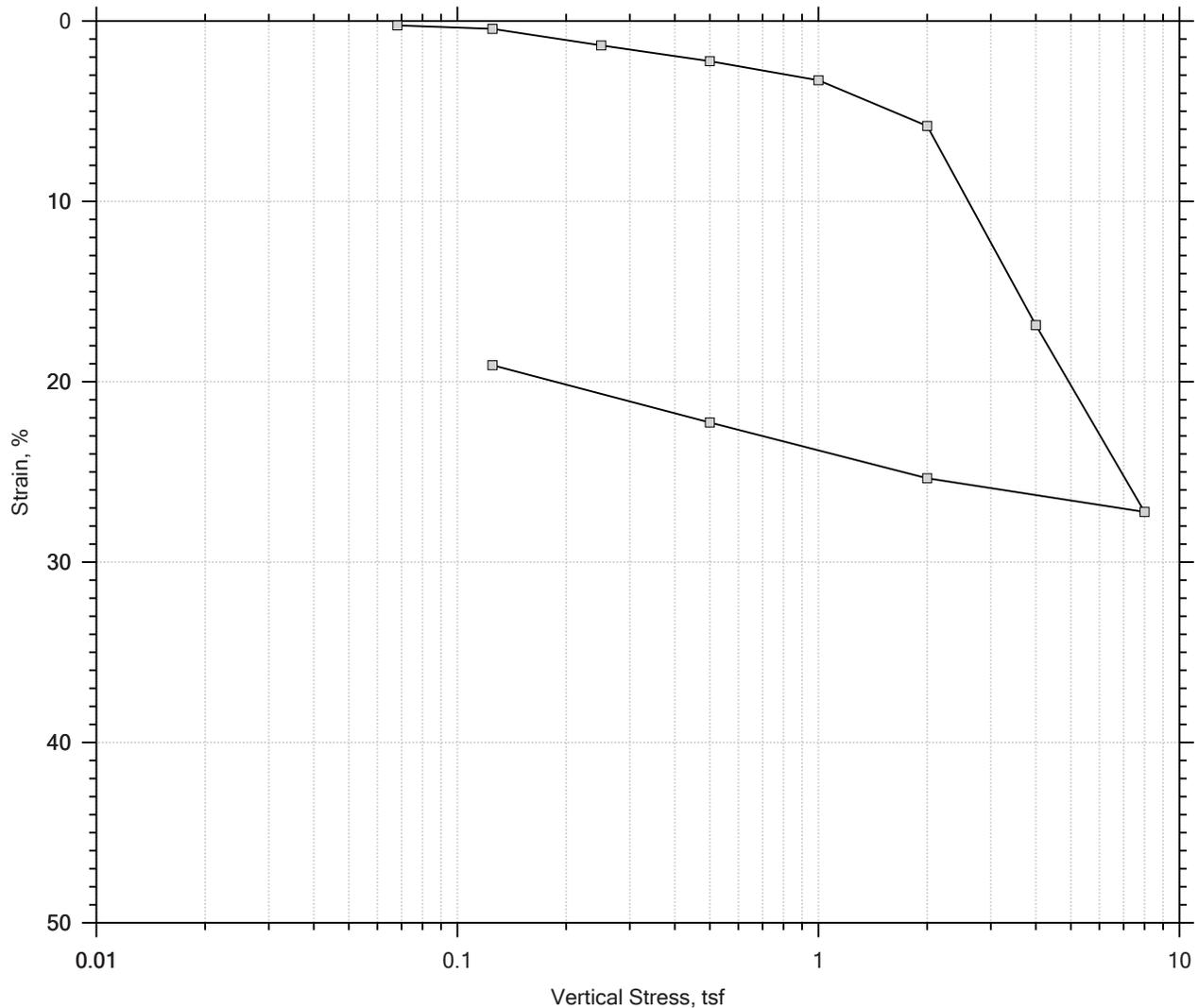


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# One-Dimensional Consolidation by ASTM D2435 - Method B

## Summary Report

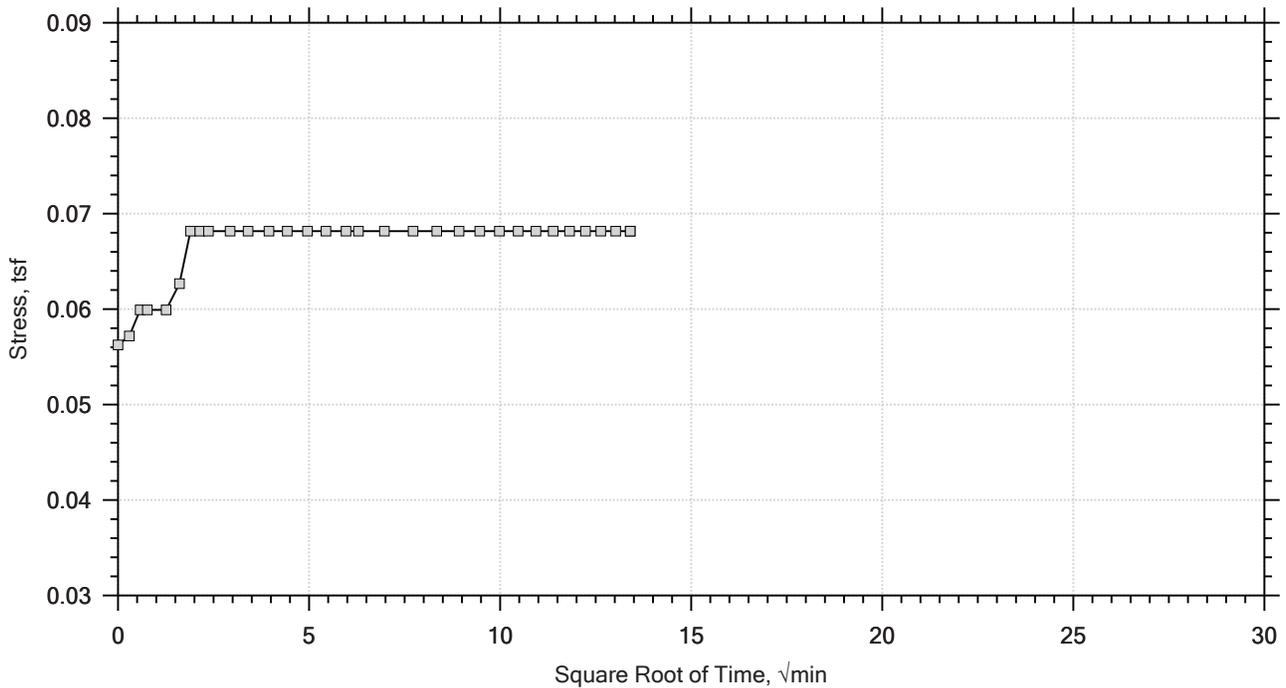
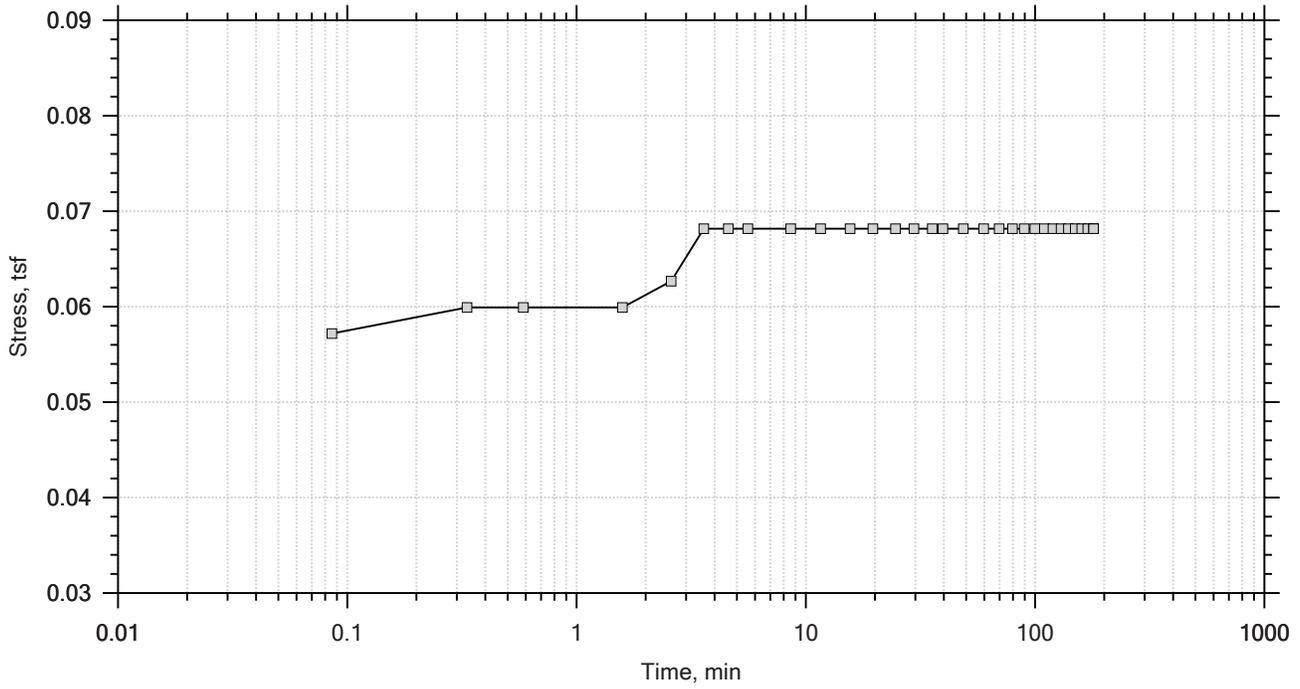


|                                        |         |              |          | Before Test          | After Test |        |
|----------------------------------------|---------|--------------|----------|----------------------|------------|--------|
| Current Vertical Effective Stress: --- |         |              |          | Water Content, %     | 76.63      | 57.24  |
| Preconsolidation Stress: ---           |         |              |          | Dry Unit Weight, pcf | 53.798     | 66.486 |
| Compression Ratio: ---                 |         |              |          | Saturation, %        | 96.53      | 100.00 |
| Diameter: 2.5 in                       |         | Height: 1 in |          | Void Ratio           | 2.17       | 1.56   |
| LL: ---                                | PL: --- | PI: ---      | GS: 2.73 |                      |            |        |

|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     | Displacement at End of Increment                           |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

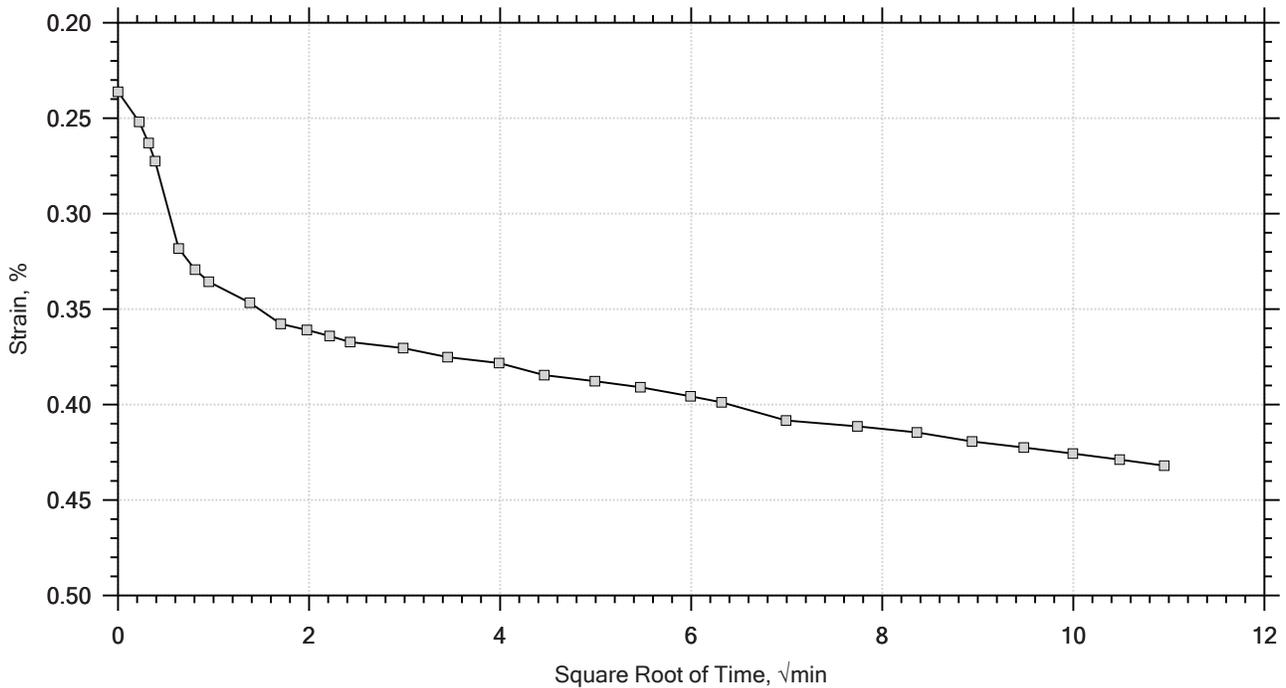
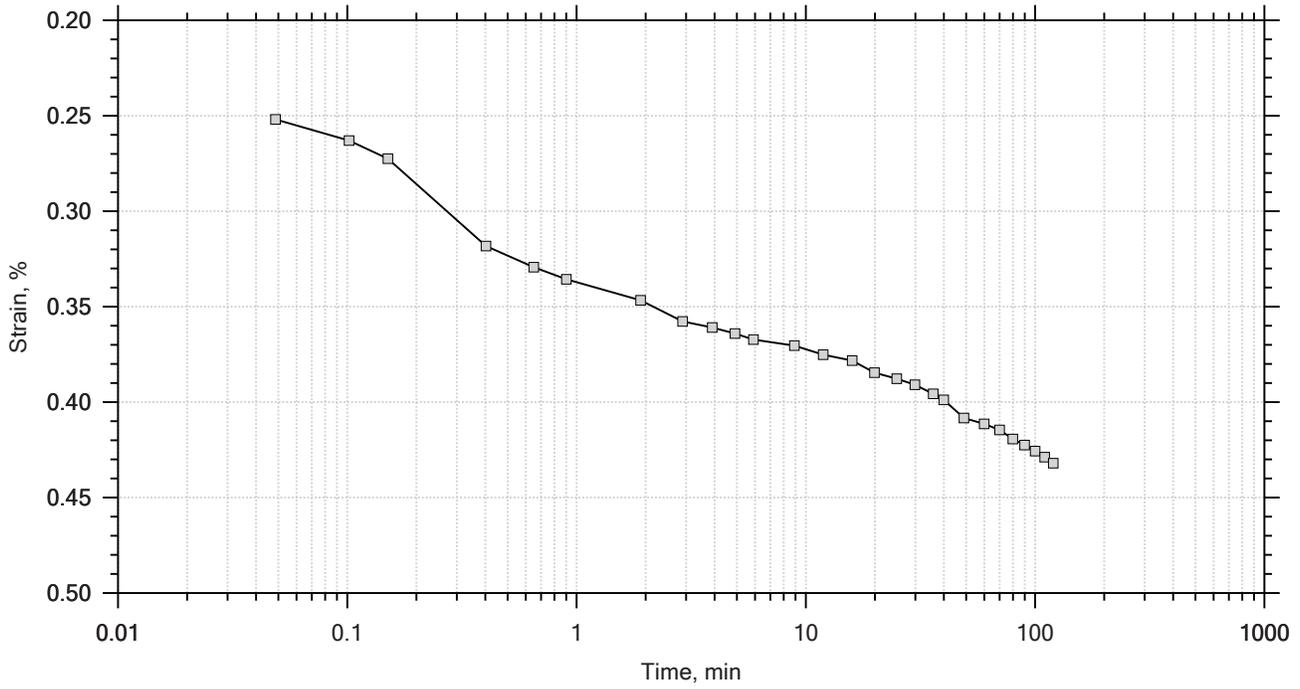
Time Curve 1 of 11  
 Constant Volume Step  
 Stress: 0.0682 tsf



|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

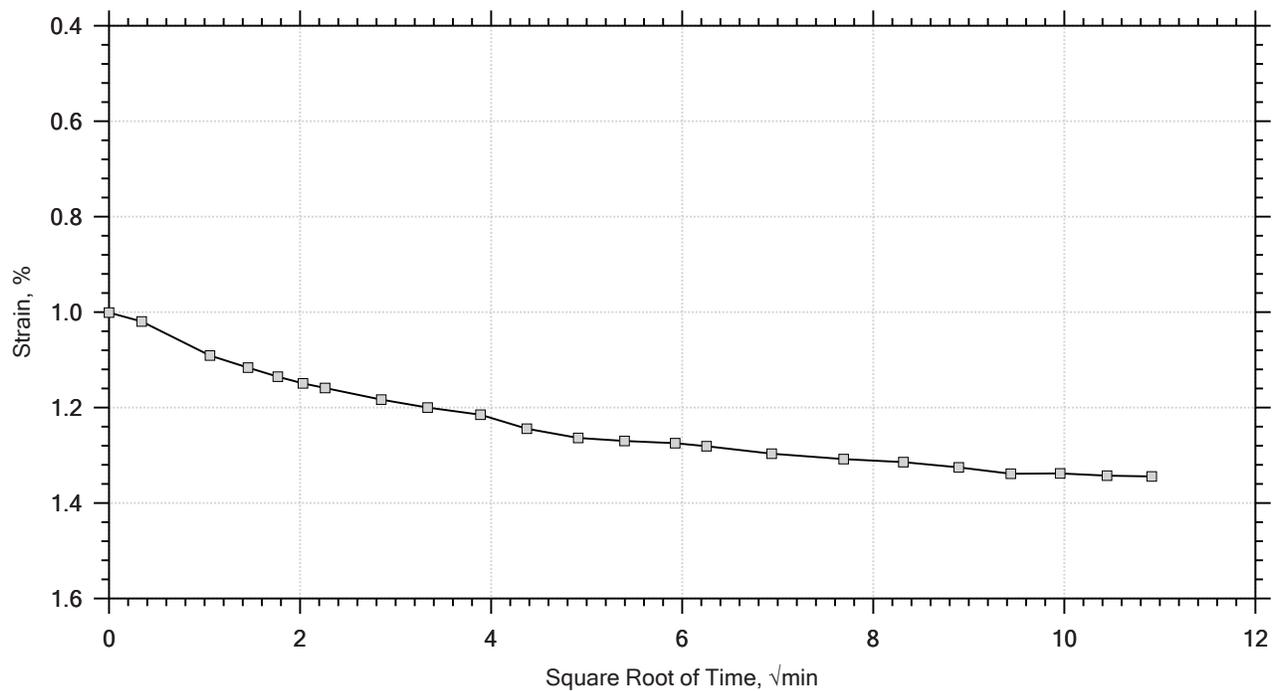
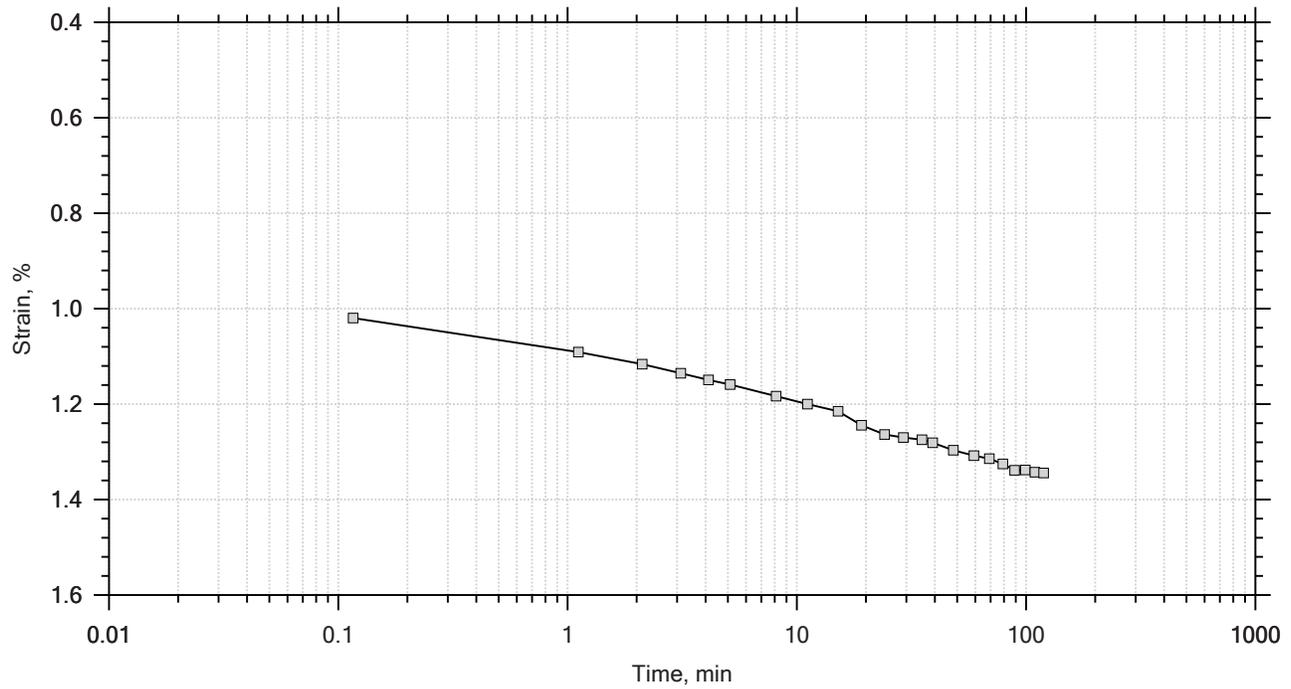
Time Curve 2 of 11  
 Constant Load Step  
 Stress: 0.125 tsf



|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 11  
 Constant Load Step  
 Stress: 0.25 tsf

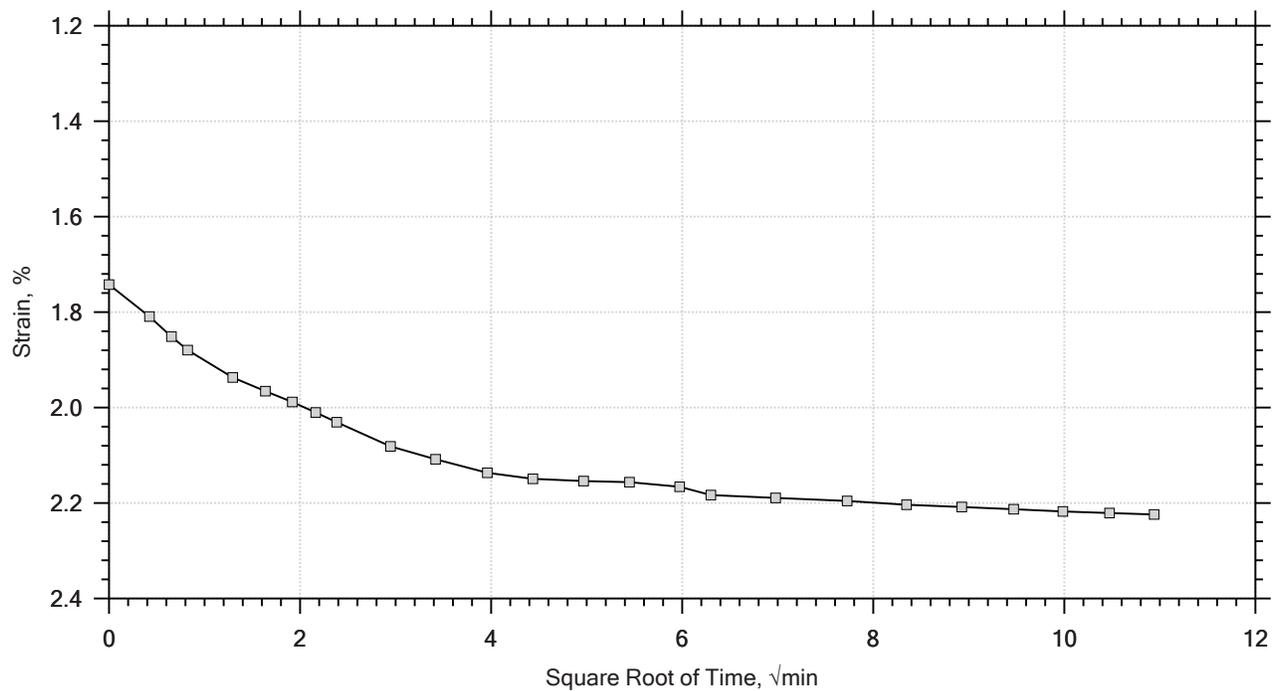
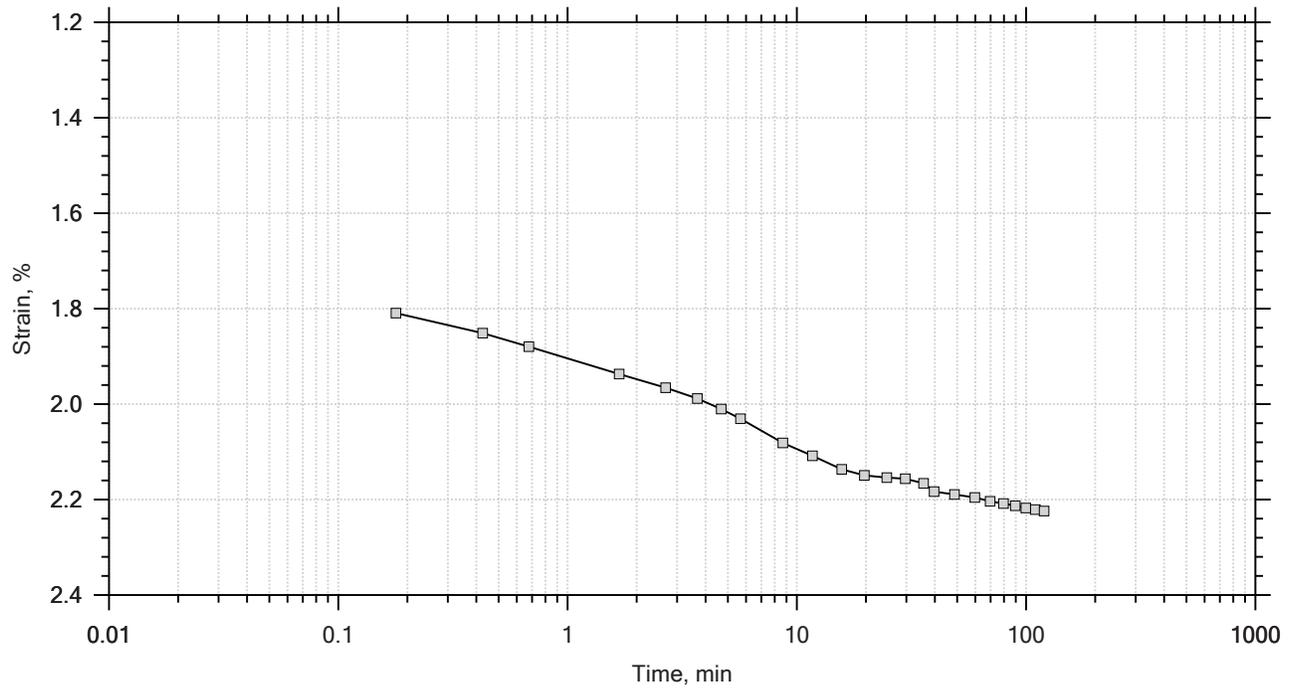


|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |



# One-Dimensional Consolidation by ASTM D2435 - Method B

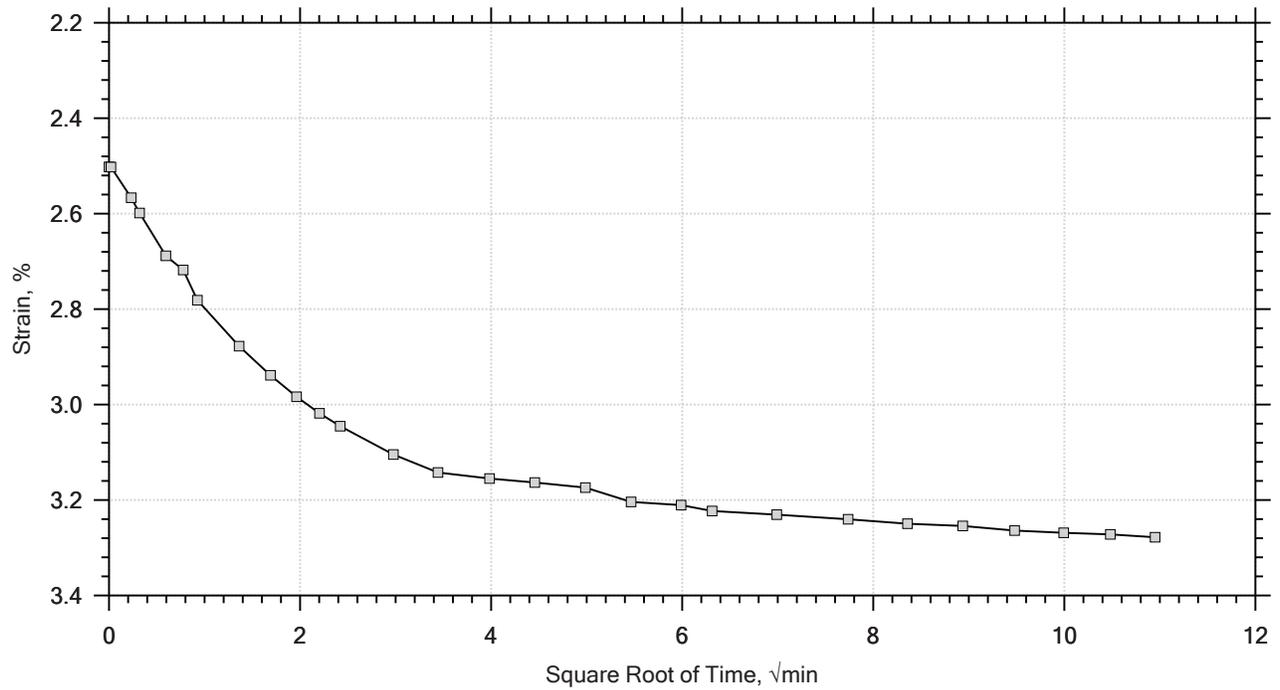
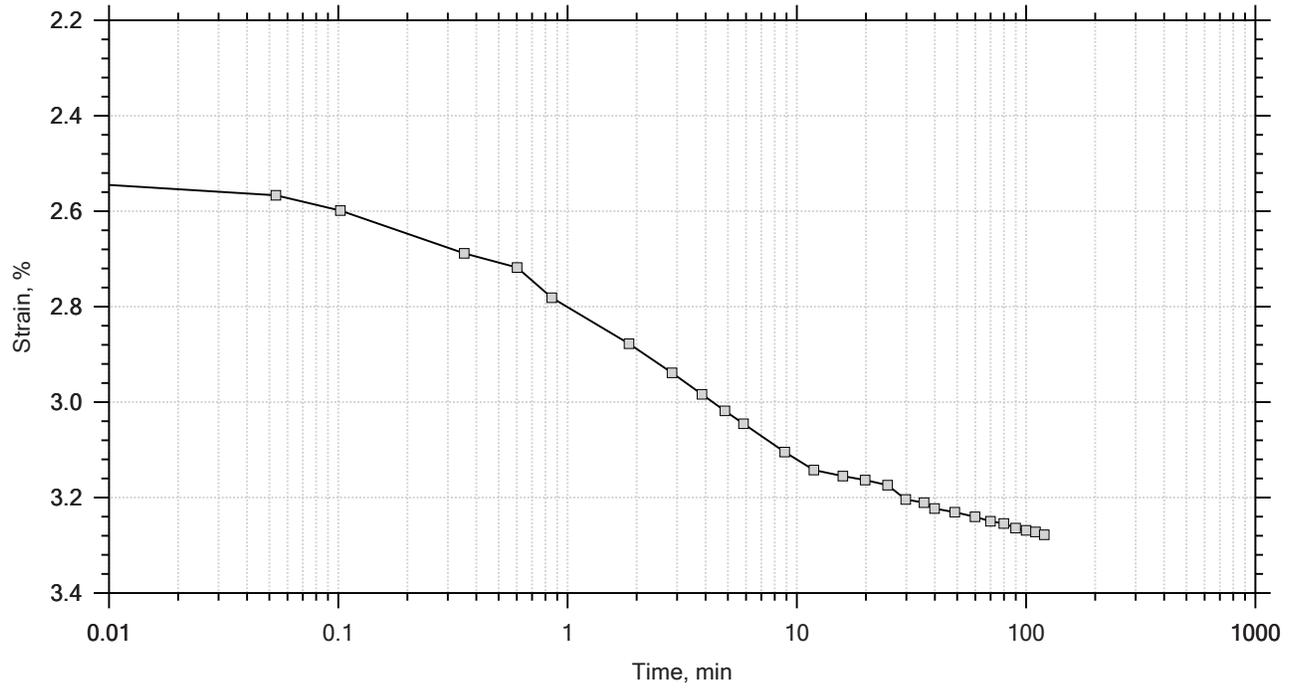
Time Curve 4 of 11  
 Constant Load Step  
 Stress: 0.5 tsf



|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

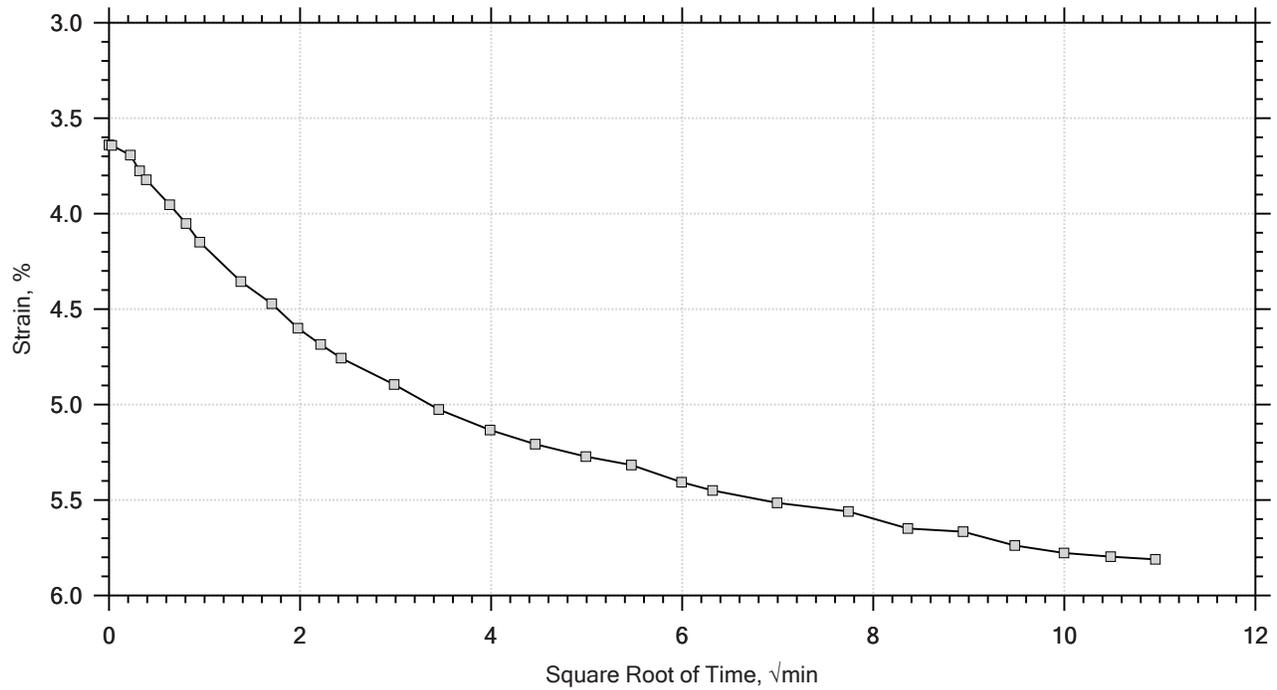
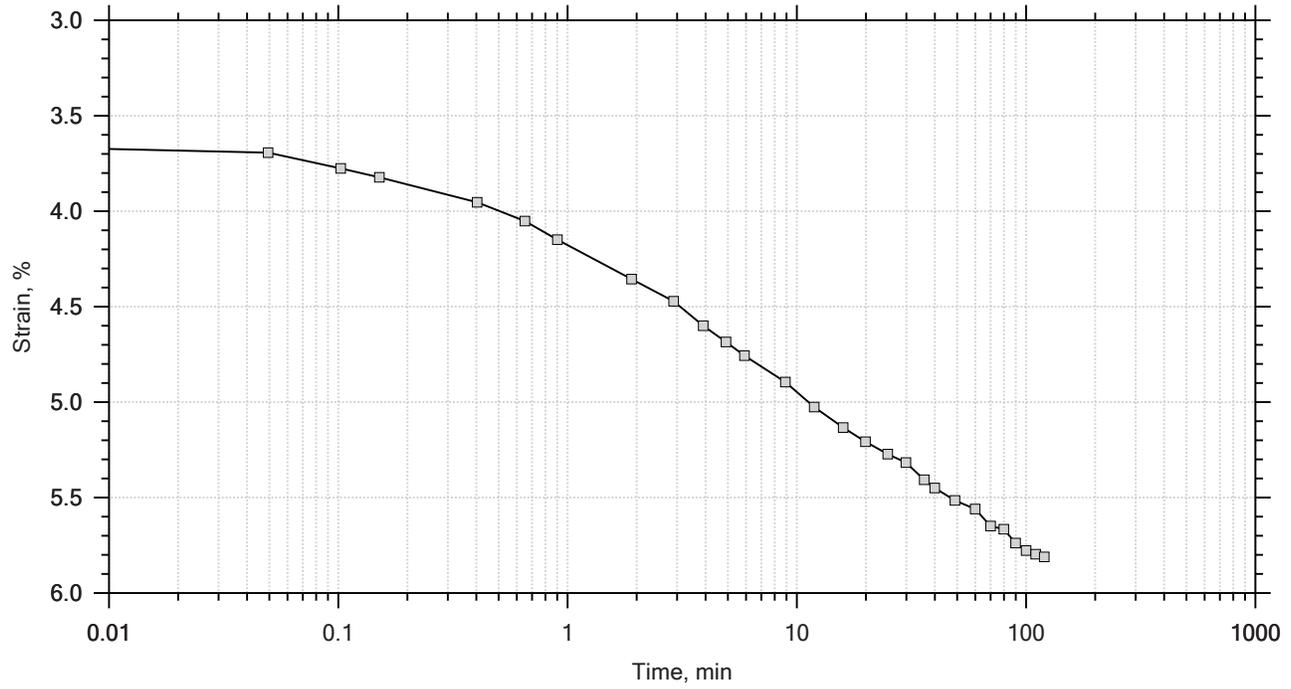
Time Curve 5 of 11  
 Constant Load Step  
 Stress: 1 tsf



|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

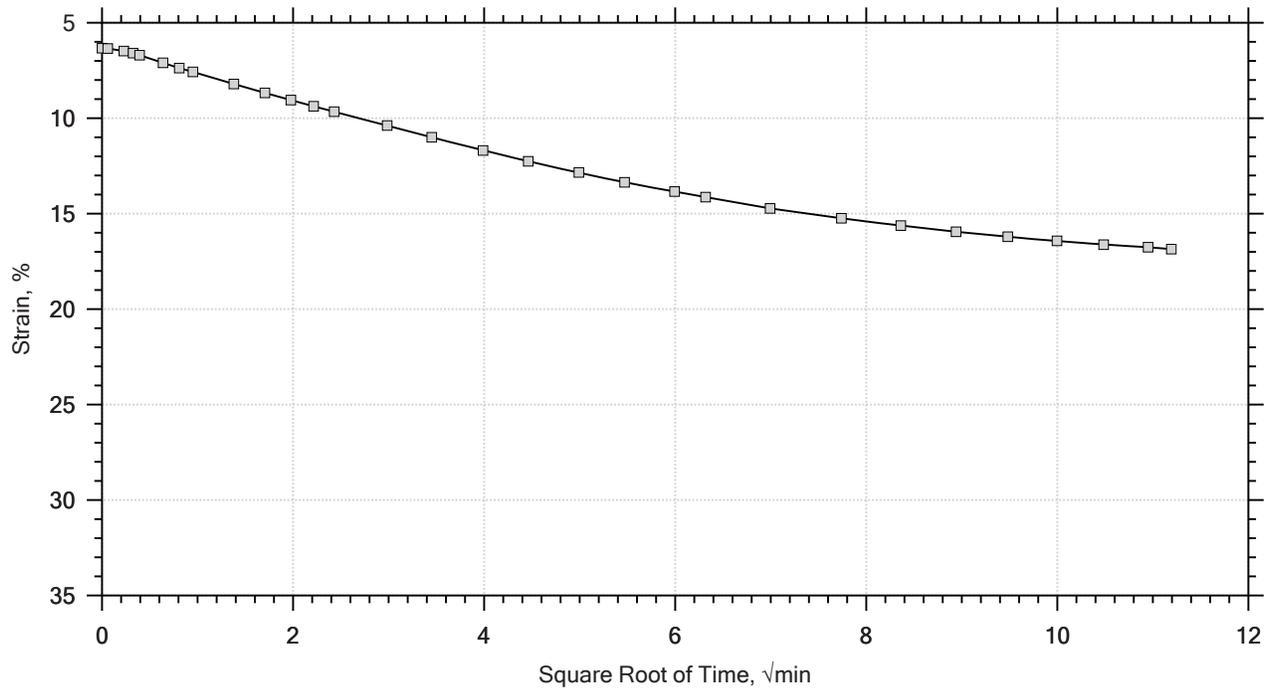
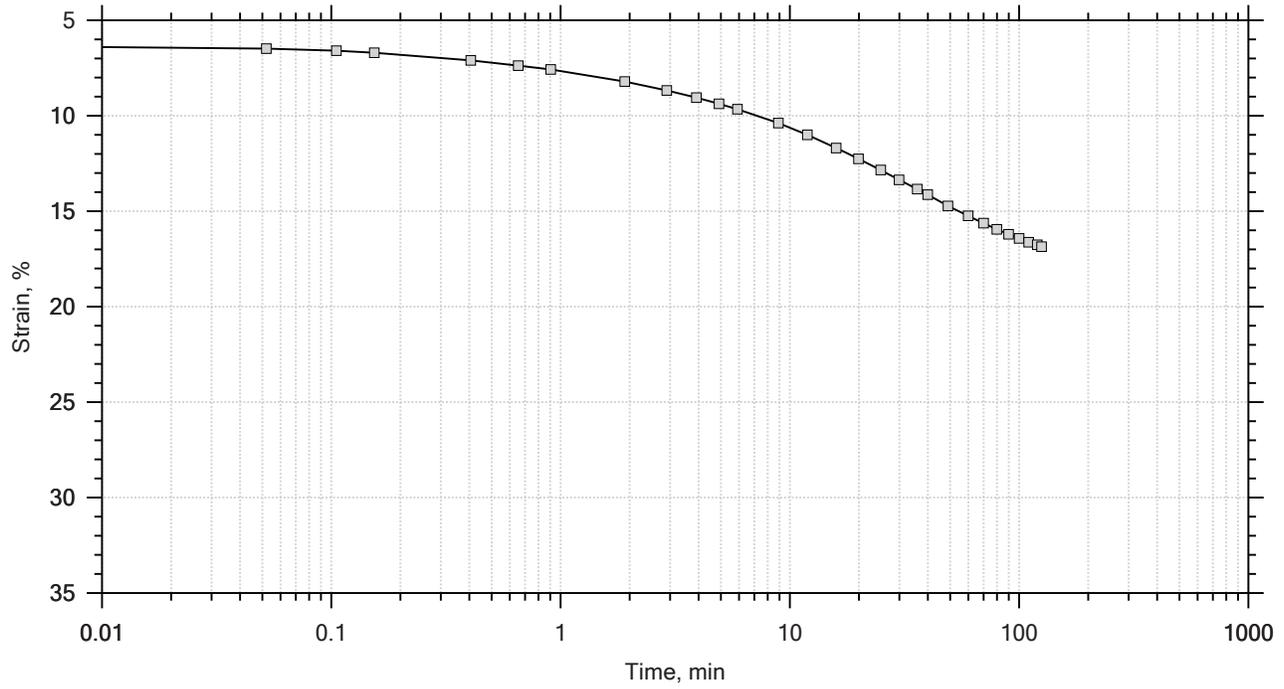
Time Curve 6 of 11  
 Constant Load Step  
 Stress: 2 tsf



|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

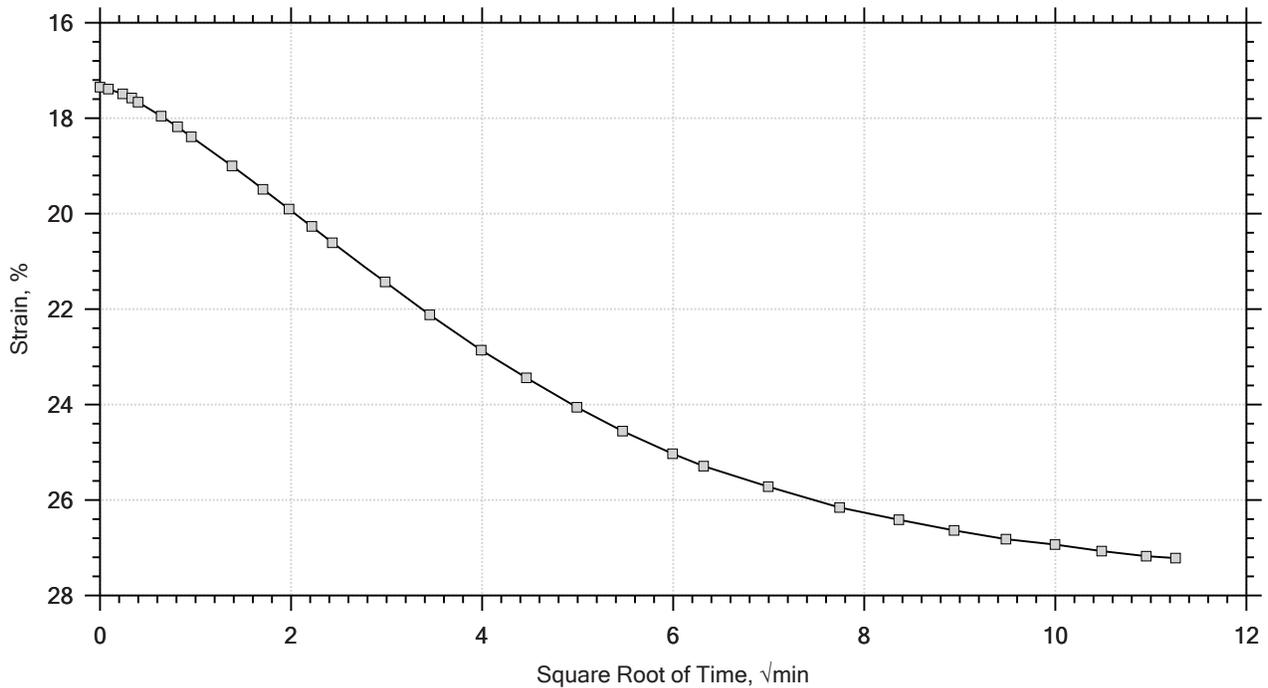
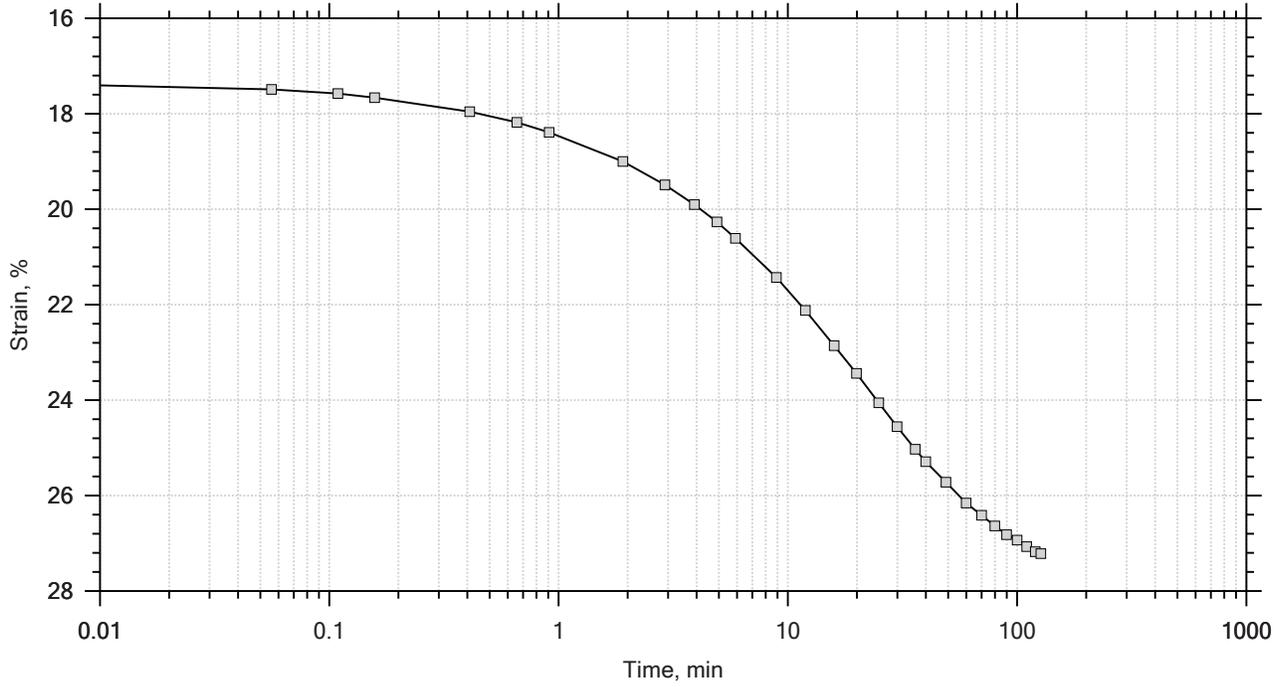
Time Curve 7 of 11  
 Constant Load Step  
 Stress: 4 tsf



|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

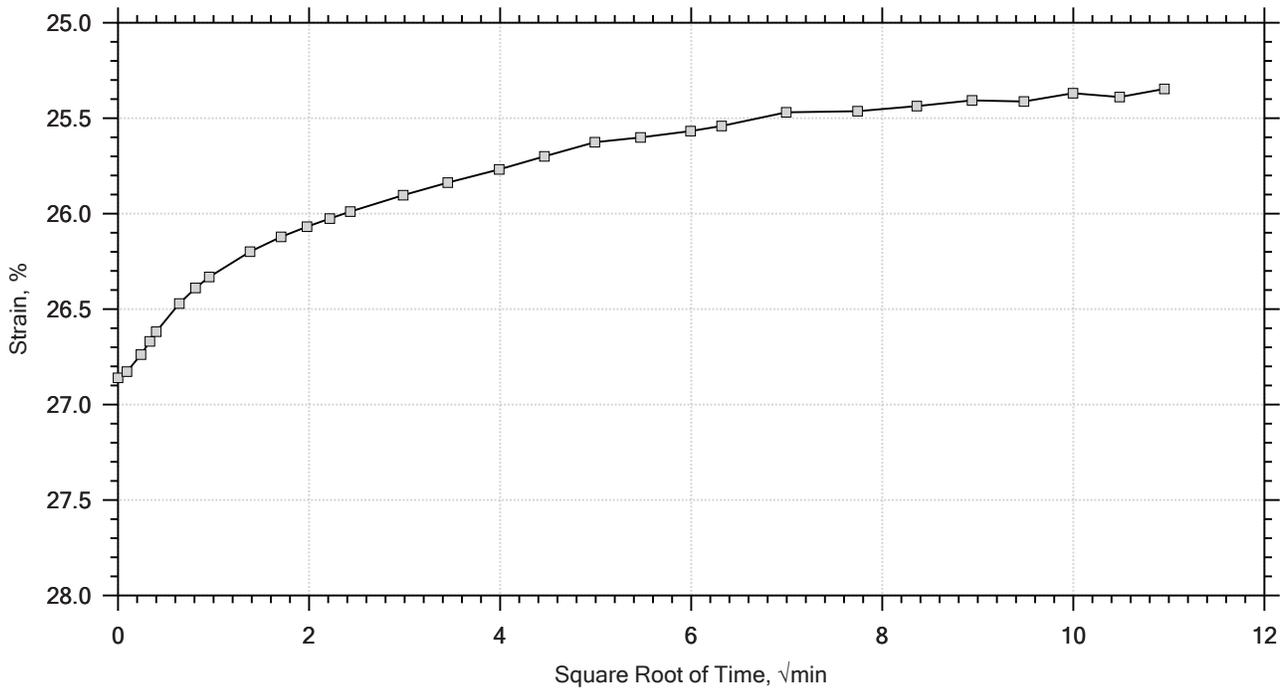
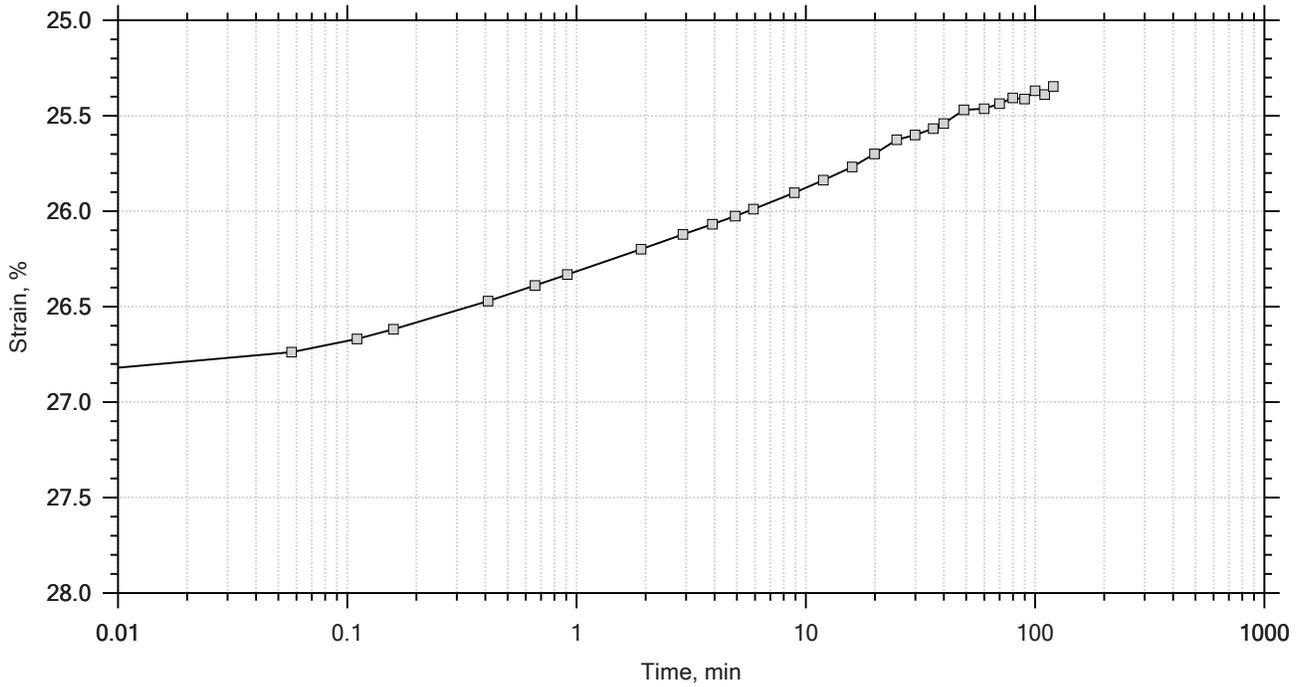
Time Curve 8 of 11  
 Constant Load Step  
 Stress: 8 tsf



|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 11  
Constant Load Step  
Stress: 2 tsf



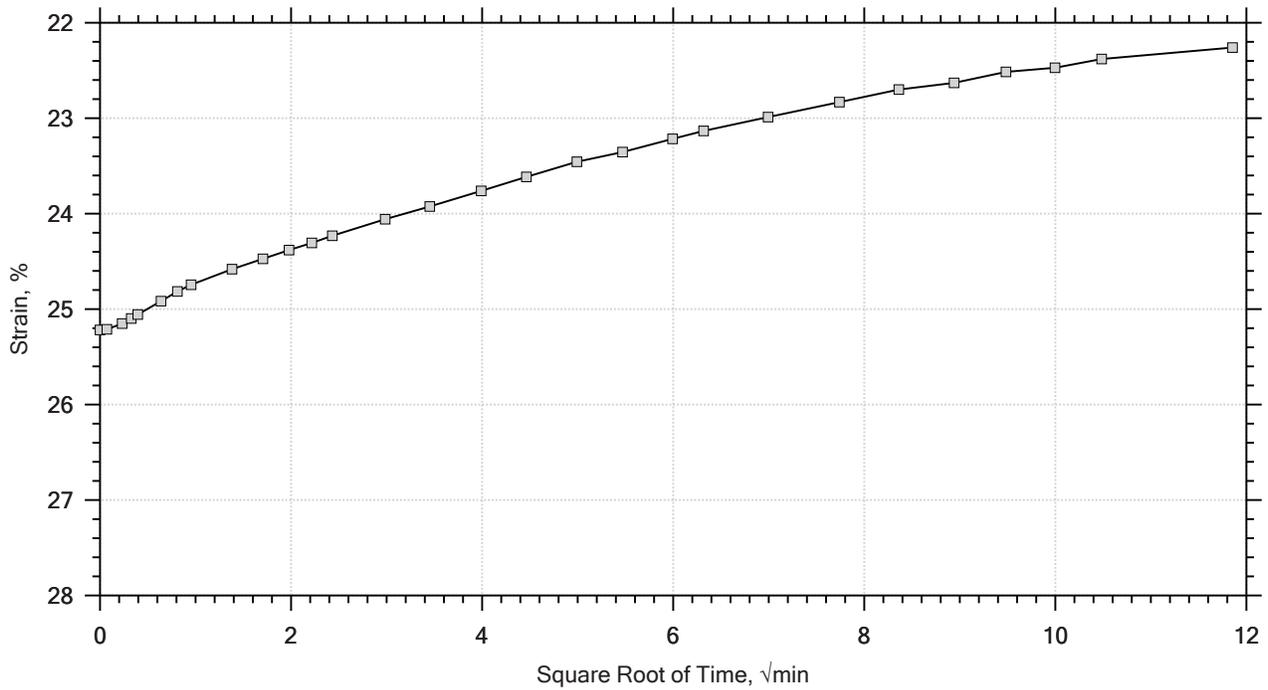
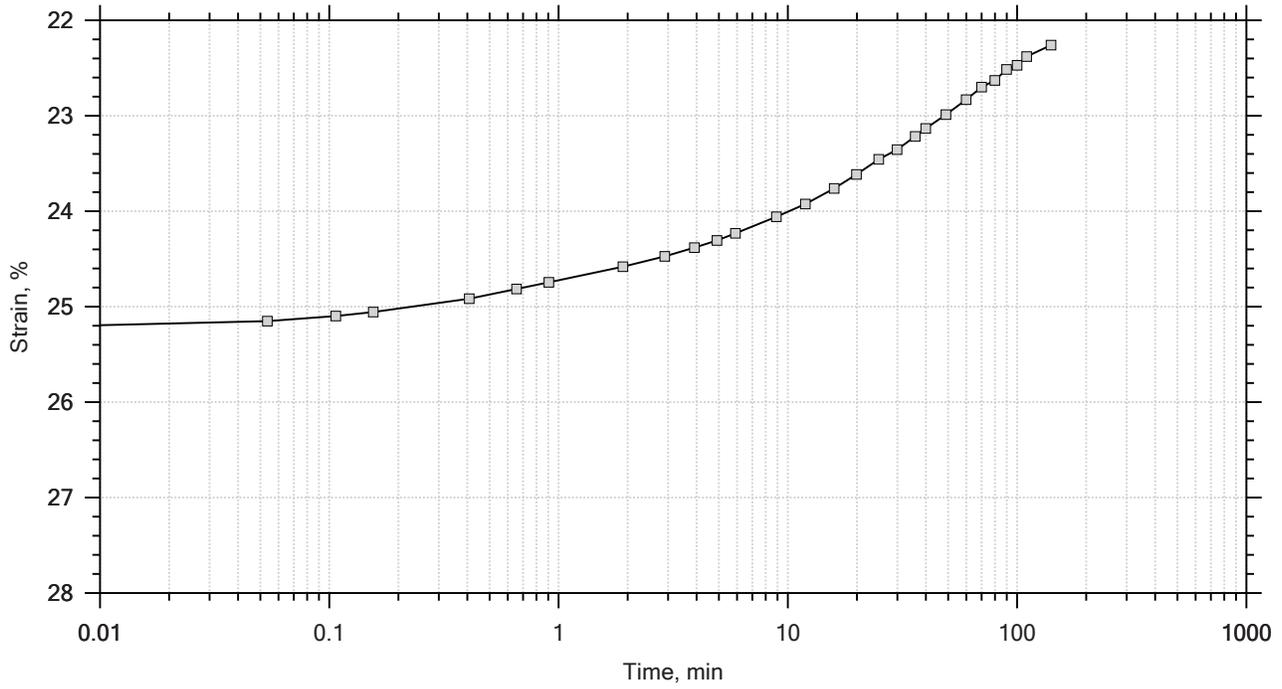
|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 11

Constant Load Step

Stress: 0.5 tsf



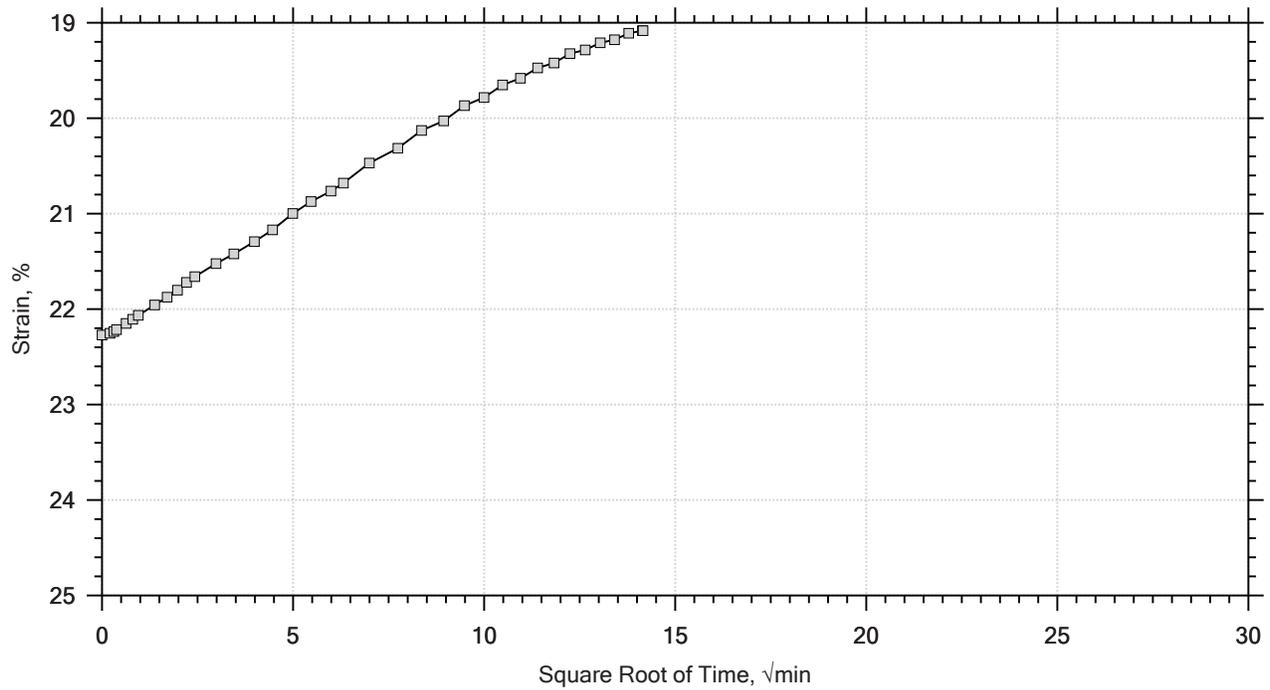
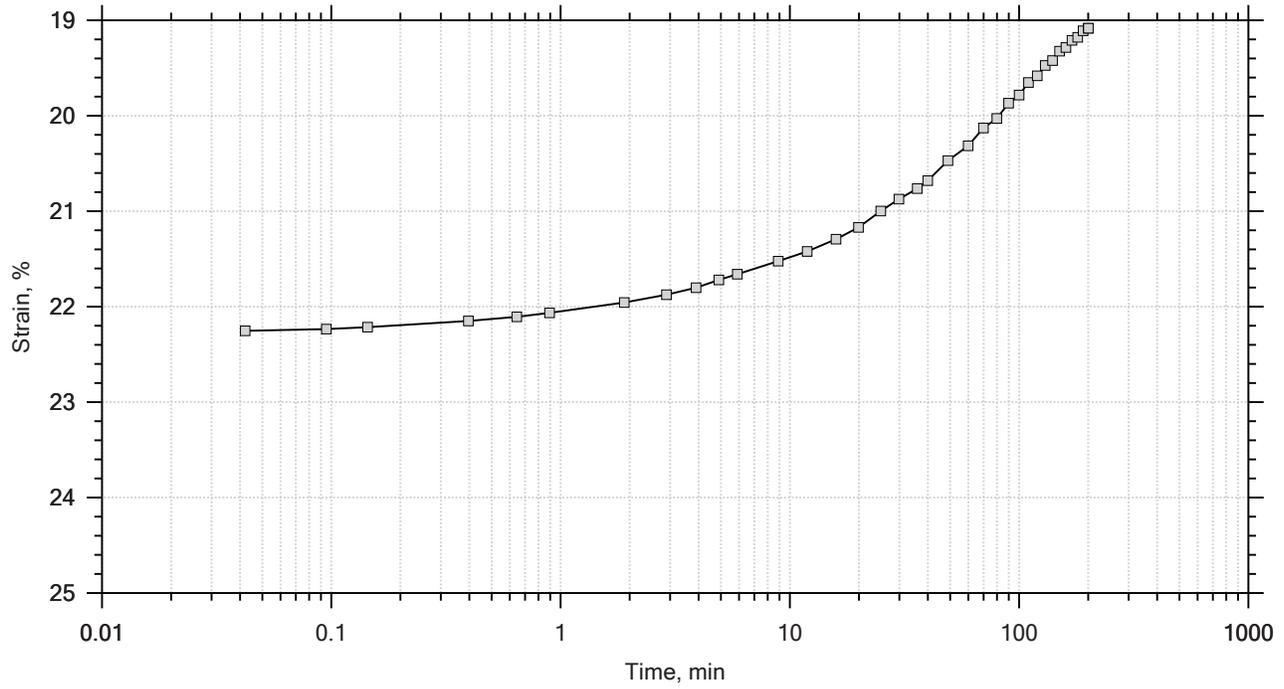
|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |

# One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 11

Constant Load Step

Stress: 0.125 tsf



|                                                                                     |                                                            |                     |                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------|-------------------------|
|  | Project: US-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |



# One-Dimensional Consolidation by ASTM D2435 - Method B

|                            |                                  |                       |
|----------------------------|----------------------------------|-----------------------|
| Specimen Diameter: 2.50 in | Estimated Specific Gravity: 2.73 | Liquid Limit: ---     |
| Initial Height: 1.00 in    | Initial Void Ratio: 2.17         | Plastic Limit: ---    |
| Final Height: 0.81 in      | Final Void Ratio: 1.56           | Plasticity Index: --- |

|                               | Before Test<br>Trimmings | Before Test<br>Specimen | After Test<br>Specimen | After Test<br>Trimmings |
|-------------------------------|--------------------------|-------------------------|------------------------|-------------------------|
| Container ID                  | a31                      | RING                    | a34                    | a34                     |
| Mass Container, gm            | 16.39                    | 17.08                   | 17.08                  | 17.08                   |
| Mass Container + Wet Soil, gm | 92.25                    | 139.52                  | 126.08                 | 126.08                  |
| Mass Container + Dry Soil, gm | 61.37                    | 86.4                    | 86.4                   | 86.4                    |
| Mass Dry Soil, gm             | 44.98                    | 69.32                   | 69.32                  | 69.32                   |
| Water Content, %              | 68.65                    | 76.63                   | 57.24                  | 57.24                   |
| Void Ratio                    | ---                      | 2.17                    | 1.56                   | ---                     |
| Degree of Saturation, %       | ---                      | 96.53                   | 100.00                 | ---                     |
| Dry Unit Weight, pcf          | ---                      | 53.798                  | 66.486                 | ---                     |

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-21 Replacement Bridge                          | Location: ---       | Project No.: GTX-305005 |
|                                                                                     | Boring No.: AP-4                                           | Tested By: jm       | Checked By: mcm         |
|                                                                                     | Sample No.: UD-1                                           | Test Date: 10/3/16  | Depth: 38-40 ft         |
|                                                                                     | Test No.: IP-7                                             | Sample Type: intact | Elevation: ---          |
|                                                                                     | Description: Moist, very dark greenish gray clay with sand |                     |                         |
|                                                                                     | Remarks: System 5077 Swell Pressure = 0.0682 tsf           |                     |                         |
|                                                                                     |                                                            |                     |                         |





**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1282 **DATE SAMPLE RECEIVED:** 8/29/2016  
**DESCRIPTION OF SOIL:** VARIOUS  
**TESTED BY:** MB **DATE OF TESTING:** 8/29/2016  
**DATE OF WEIGHING:** 9/1/2016

|                          |                  |            |  |  |  |
|--------------------------|------------------|------------|--|--|--|
| <b>BORING NO.</b>        | AP-5/UD-1 & UD-2 | AP-5/UD-4  |  |  |  |
| <b>SAMPLE NO.</b>        | 16-1282E         | 16-1282H   |  |  |  |
| <b>SAMPLE DEPTH</b>      | 6.0-10.0'        | 30.0-32.0' |  |  |  |
| <b>WATER CONTENT, W%</b> | 21.6             | 26.6       |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

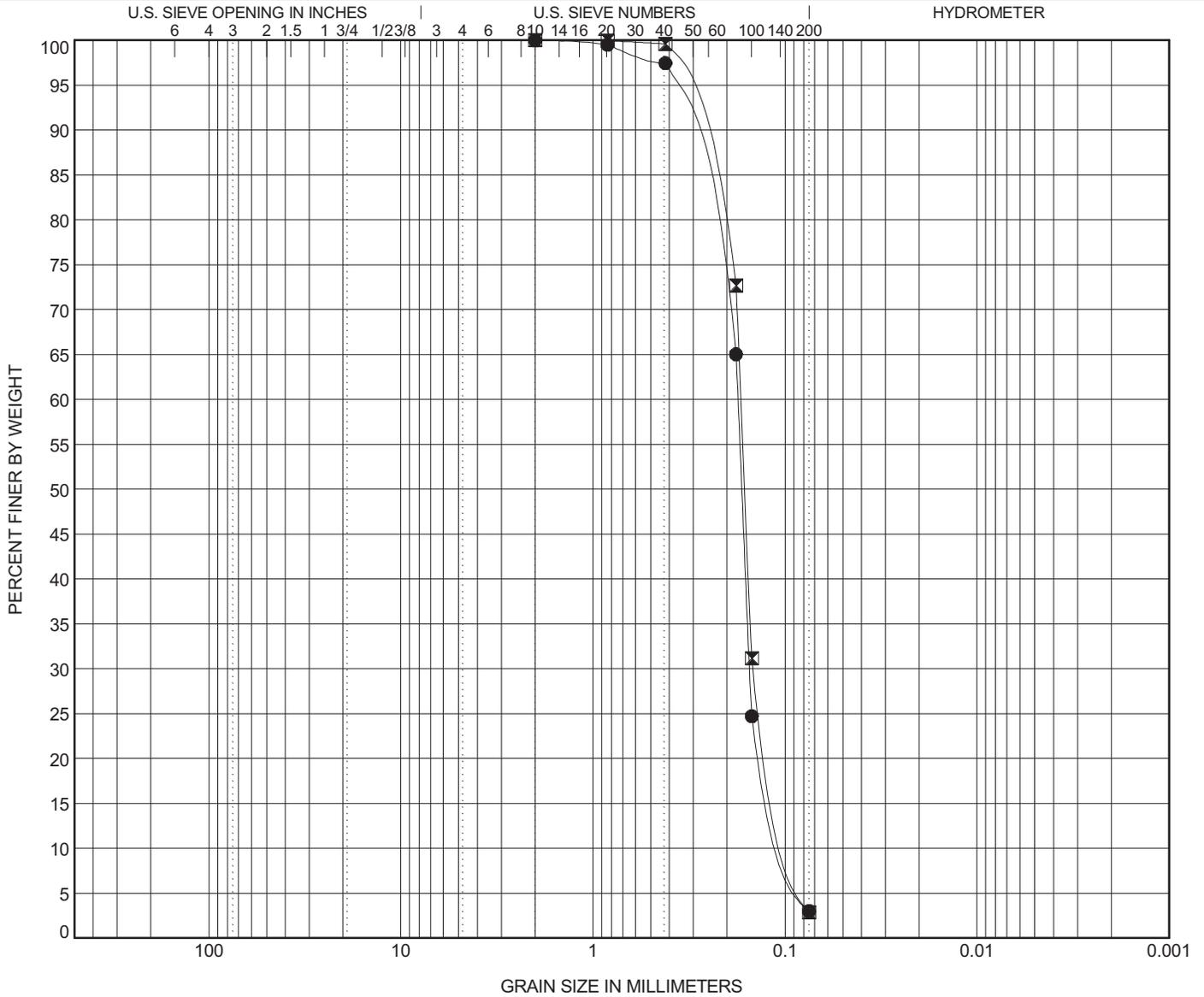


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                   |  |  |  |  | LL | PL | PI | Cc   | Cu   |
|----------|-------|----------------------------------|--|--|--|--|----|----|----|------|------|
| ● AP-5   | 10.0  | Poorly Graded Fine SAND (SP) A-3 |  |  |  |  | NP | NP | NP | 1.42 | 1.88 |
| ☒ AP-5   | 32.0  | Poorly Graded Fine SAND (SP) A-3 |  |  |  |  | NP | NP | NP | 1.39 | 1.91 |

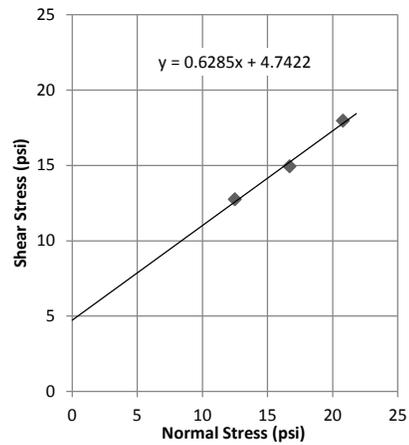
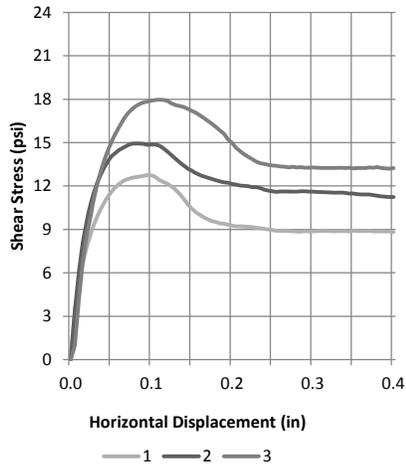
| BOREHOLE | DEPTH | D100 | D95   | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-------|---------|-------|-------|-------|
| ● AP-5   | 10.0  | 2    | 0.394 | 0.168 | 0.094 | 0.0     | 97.0  | 3.0   |       |
| ☒ AP-5   | 32.0  | 2    | 0.363 | 0.162 | 0.089 | 0.0     | 97.1  | 2.9   |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 11/4/16



# DIRECT SHEAR TEST REPORT

## ASTM - D3080 / AASHTO T236



| Sample 1                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 12.5               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 23.6%              |
| Wet Density (pcf)             | 121.0              |
| Dry Density (pcf)             | 97.9               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 90.9%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 3.33               |
| 0.010                         | 5.26               |
| 0.015                         | 6.68               |
| 0.020                         | 7.86               |
| 0.030                         | 9.56               |
| 0.040                         | 10.71              |
| 0.050                         | 11.58              |
| 0.060                         | 12.15              |
| 0.070                         | 12.47              |
| 0.080                         | 12.59              |
| 0.090                         | 12.71              |
| 0.100                         | 12.74              |
| 0.125                         | 11.98              |
| 0.150                         | 10.46              |
| 0.175                         | 9.57               |
| 0.200                         | 9.27               |
| 0.225                         | 9.14               |
| 0.250                         | 8.95               |
| 0.300                         | 8.86               |
| 0.350                         | 8.90               |
| 0.400                         | 8.83               |
| Max Shear Stress              | <b>12.75</b>       |

| Sample 2                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 16.7               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 24.4%              |
| Wet Density (pcf)             | 122.0              |
| Dry Density (pcf)             | 98.1               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 94.2%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 3.38               |
| 0.010                         | 6.12               |
| 0.015                         | 8.12               |
| 0.020                         | 9.63               |
| 0.030                         | 11.79              |
| 0.040                         | 13.12              |
| 0.050                         | 14.03              |
| 0.060                         | 14.49              |
| 0.070                         | 14.81              |
| 0.080                         | 14.93              |
| 0.090                         | 14.91              |
| 0.100                         | 14.88              |
| 0.125                         | 14.13              |
| 0.150                         | 13.06              |
| 0.175                         | 12.48              |
| 0.200                         | 12.13              |
| 0.225                         | 11.92              |
| 0.250                         | 11.64              |
| 0.300                         | 11.61              |
| 0.350                         | 11.48              |
| 0.400                         | 11.25              |
| Max Shear Stress              | <b>14.93</b>       |

| Sample 3                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 20.8               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 24.3%              |
| Wet Density (pcf)             | 122.2              |
| Dry Density (pcf)             | 98.3               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 94.4%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 0.96               |
| 0.010                         | 4.22               |
| 0.015                         | 6.77               |
| 0.020                         | 8.66               |
| 0.030                         | 11.48              |
| 0.040                         | 13.54              |
| 0.050                         | 14.98              |
| 0.060                         | 16.09              |
| 0.070                         | 16.96              |
| 0.080                         | 17.49              |
| 0.090                         | 17.77              |
| 0.100                         | 17.90              |
| 0.125                         | 17.71              |
| 0.150                         | 17.19              |
| 0.175                         | 16.30              |
| 0.200                         | 14.97              |
| 0.225                         | 13.85              |
| 0.250                         | 13.43              |
| 0.300                         | 13.29              |
| 0.350                         | 13.22              |
| 0.400                         | 13.25              |
| Max Shear Stress              | <b>17.97</b>       |

Project Name US 21 Bridge Replacement over Harbor River

Project Number G5396 Date 9/8/16

SCDOT Project ID P026862

Location/Sample AP-5, UD-1 & UD-2 / Sample #16-1282A

Depth/Elevation 6.0' - 10.0'

Type of Test : Direct Shear - 4" by 4" Square Shear Box

Sample Type : Remolded 1" Thick, Innundated

Description: Grey Poorly Graded Fine SAND with Silt (SP-SM), A-3

PI= NP % Fines= 3.0

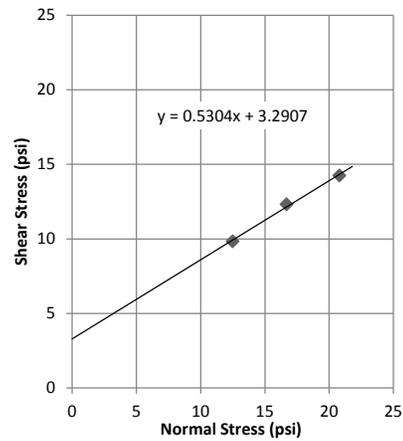
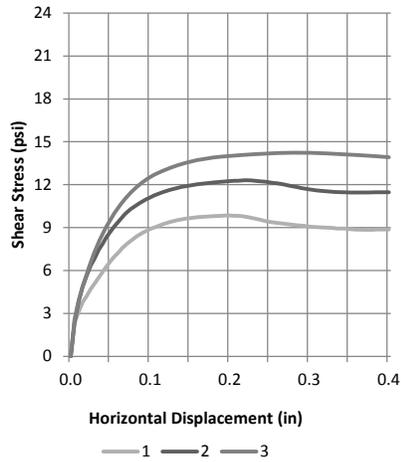
SG= 2.65 Box Gap= 1.0 mm

φ= 32.1° C<sub>apparent</sub>= 4.74 psi



# DIRECT SHEAR TEST REPORT

## ASTM - D3080 / AASHTO T236



| Sample 1                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 12.5               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 23.3%              |
| Wet Density (pcf)             | 119.0              |
| Dry Density (pcf)             | 96.5               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 86.6%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 2.35               |
| 0.010                         | 3.13               |
| 0.015                         | 3.77               |
| 0.020                         | 4.22               |
| 0.030                         | 5.09               |
| 0.040                         | 5.91               |
| 0.050                         | 6.64               |
| 0.060                         | 7.27               |
| 0.070                         | 7.83               |
| 0.080                         | 8.27               |
| 0.090                         | 8.61               |
| 0.100                         | 8.91               |
| 0.125                         | 9.38               |
| 0.150                         | 9.66               |
| 0.175                         | 9.79               |
| 0.200                         | 9.84               |
| 0.225                         | 9.71               |
| 0.250                         | 9.41               |
| 0.300                         | 9.08               |
| 0.350                         | 8.89               |
| 0.400                         | 8.88               |
| Max Shear Stress              | <b>9.84</b>        |

| Sample 2                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 16.7               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 23.0%              |
| Wet Density (pcf)             | 118.6              |
| Dry Density (pcf)             | 96.4               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 85.3%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 2.43               |
| 0.010                         | 3.84               |
| 0.015                         | 4.83               |
| 0.020                         | 5.64               |
| 0.030                         | 6.84               |
| 0.040                         | 7.87               |
| 0.050                         | 8.73               |
| 0.060                         | 9.43               |
| 0.070                         | 10.04              |
| 0.080                         | 10.50              |
| 0.090                         | 10.83              |
| 0.100                         | 11.12              |
| 0.125                         | 11.64              |
| 0.150                         | 11.95              |
| 0.175                         | 12.13              |
| 0.200                         | 12.26              |
| 0.225                         | 12.29              |
| 0.250                         | 12.16              |
| 0.300                         | 11.68              |
| 0.350                         | 11.44              |
| 0.400                         | 11.47              |
| Max Shear Stress              | <b>12.31</b>       |

| Sample 3                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 20.8               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 22.8%              |
| Wet Density (pcf)             | 119.6              |
| Dry Density (pcf)             | 97.4               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 86.6%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 2.63               |
| 0.010                         | 3.94               |
| 0.015                         | 4.88               |
| 0.020                         | 5.74               |
| 0.030                         | 7.31               |
| 0.040                         | 8.56               |
| 0.050                         | 9.57               |
| 0.060                         | 10.41              |
| 0.070                         | 11.10              |
| 0.080                         | 11.71              |
| 0.090                         | 12.18              |
| 0.100                         | 12.54              |
| 0.125                         | 13.16              |
| 0.150                         | 13.60              |
| 0.175                         | 13.85              |
| 0.200                         | 14.01              |
| 0.225                         | 14.09              |
| 0.250                         | 14.18              |
| 0.300                         | 14.23              |
| 0.350                         | 14.11              |
| 0.400                         | 13.92              |
| Max Shear Stress              | <b>14.24</b>       |

Project Name US 21 Bridge Replacement over Harbor River

Project Number G5396 Date 9/21/16

SCDOT Project ID P026862

Location/Sample AP-5, UD-4 / Sample #16-1282B

Depth/Elevation 30.0' - 32.0'

Type of Test : Direct Shear - 4" by 4" Square Shear Box

Sample Type : Remolded 1" Thick, Innundated

Description: Grey Poorly Graded Fine SAND with Silt (SP-SM), A-3

PI= NP % Fines= 2.9

SG= 2.65 Box Gap= 1.0 mm

φ= 27.9° C<sub>apparent</sub>= 3.29 psi



3112 Devine Street Columbia, SC 29205

Geotechnical · Environmental · Materials



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1189 **DATE SAMPLE RECEIVED:** 7/19/2016  
**DESCRIPTION OF SOIL:** Poorly Graded F/M SAND (SP-SM) with Silt A-3  
**TESTED BY:** MB **DATE OF TESTING:** 7/25/2016  
**DATE OF WEIGHING:** 7/26/2016

|                          |          |  |  |  |  |
|--------------------------|----------|--|--|--|--|
| <b>BORING NO.</b>        | BS-1     |  |  |  |  |
| <b>SAMPLE NO.</b>        | 16-1189C |  |  |  |  |
| <b>SAMPLE DEPTH</b>      | 0.0-5.0' |  |  |  |  |
| <b>WATER CONTENT, W%</b> | 5.3      |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

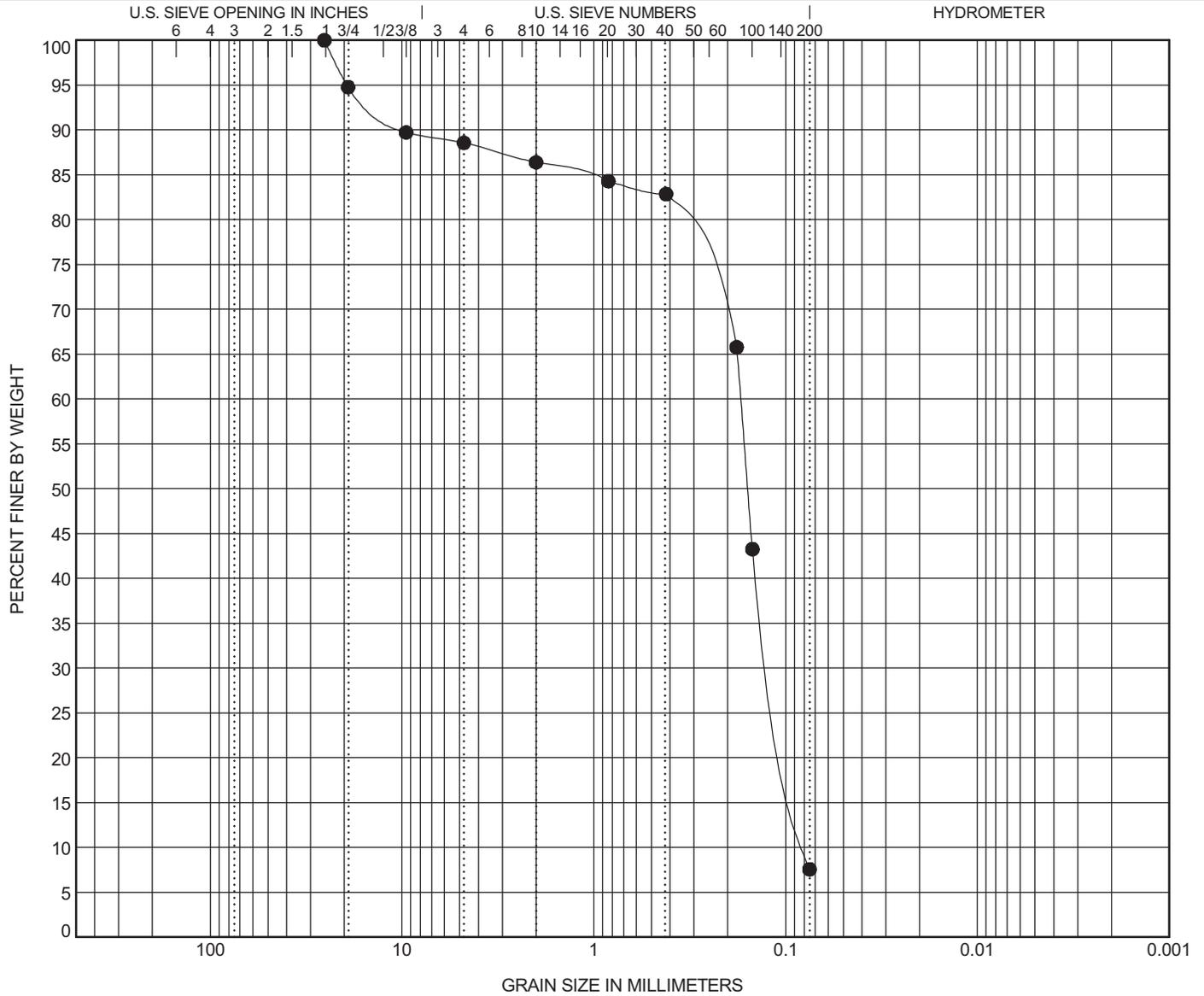


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                               | LL | PL | PI | Cc   | Cu   |
|----------|-------|----------------------------------------------|----|----|----|------|------|
| ● BS-1   | 5.0   | Poorly Graded F/M SAND (SP-SM) with Silt A-3 | NP | NP | NP | 0.99 | 2.18 |

| BOREHOLE | DEPTH | D100 | D95    | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|--------|-------|-------|---------|-------|-------|-------|
| ● BS-1   | 5.0   | 25.4 | 19.331 | 0.158 | 0.079 | 11.4    | 81.0  | 7.6   |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16



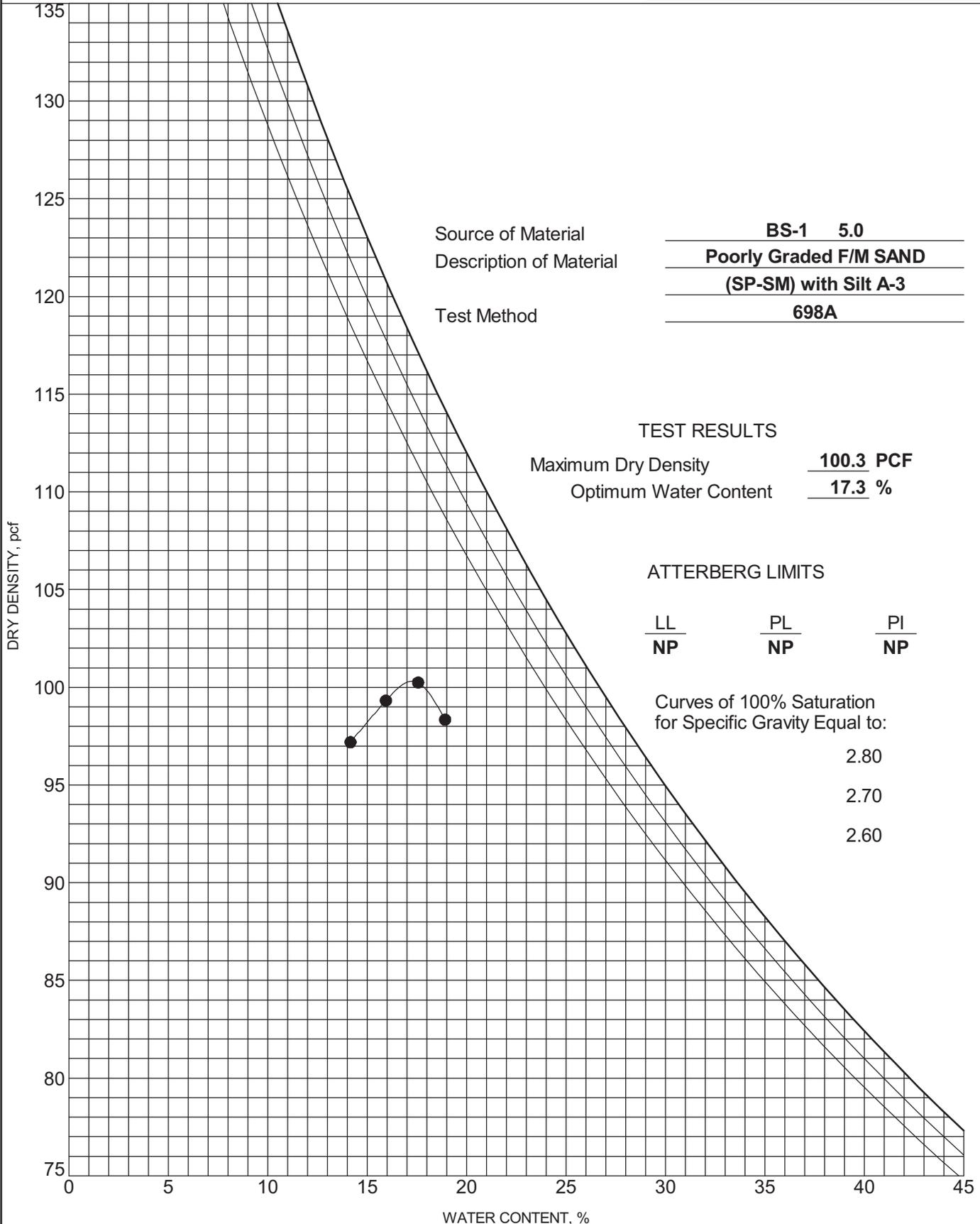


# MOISTURE-DENSITY RELATIONSHIP

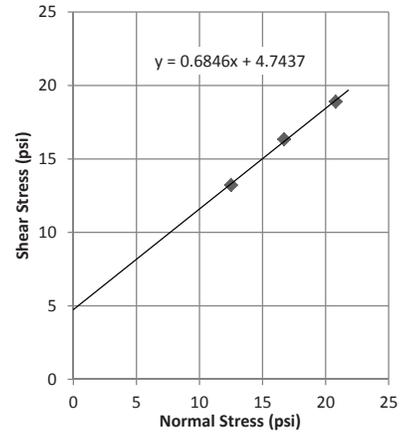
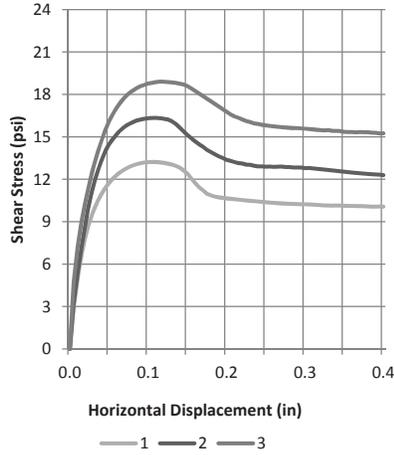
PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



**DIRECT SHEAR TEST REPORT**  
**ASTM - D3080 / AASHTO T236**



| Sample 1                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 12.5               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 19.0%              |
| Wet Density (pcf)             | 114.3              |
| Dry Density (pcf)             | 96.0               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 69.8%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 2.94               |
| 0.010                         | 4.93               |
| 0.015                         | 6.73               |
| 0.020                         | 7.92               |
| 0.030                         | 9.75               |
| 0.040                         | 10.91              |
| 0.050                         | 11.75              |
| 0.060                         | 12.31              |
| 0.070                         | 12.70              |
| 0.080                         | 12.95              |
| 0.090                         | 13.13              |
| 0.100                         | 13.22              |
| 0.125                         | 13.11              |
| 0.150                         | 12.40              |
| 0.175                         | 10.97              |
| 0.200                         | 10.64              |
| 0.225                         | 10.51              |
| 0.250                         | 10.37              |
| 0.300                         | 10.23              |
| 0.350                         | 10.12              |
| 0.400                         | 10.06              |
| Max Shear Stress              | <b>13.22</b>       |

| Sample 2                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 16.7               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 19.3%              |
| Wet Density (pcf)             | 114.0              |
| Dry Density (pcf)             | 95.6               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 70.0%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 3.24               |
| 0.010                         | 5.38               |
| 0.015                         | 7.19               |
| 0.020                         | 8.89               |
| 0.030                         | 11.54              |
| 0.040                         | 13.28              |
| 0.050                         | 14.46              |
| 0.060                         | 15.21              |
| 0.070                         | 15.71              |
| 0.080                         | 16.03              |
| 0.090                         | 16.22              |
| 0.100                         | 16.32              |
| 0.125                         | 16.23              |
| 0.150                         | 15.15              |
| 0.175                         | 14.08              |
| 0.200                         | 13.38              |
| 0.225                         | 13.04              |
| 0.250                         | 12.88              |
| 0.300                         | 12.78              |
| 0.350                         | 12.54              |
| 0.400                         | 12.29              |
| Max Shear Stress              | <b>16.34</b>       |

| Sample 3                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 20.8               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 18.9%              |
| Wet Density (pcf)             | 114.8              |
| Dry Density (pcf)             | 96.5               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 70.2%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 4.73               |
| 0.010                         | 7.23               |
| 0.015                         | 9.00               |
| 0.020                         | 10.43              |
| 0.030                         | 12.89              |
| 0.040                         | 14.64              |
| 0.050                         | 16.09              |
| 0.060                         | 17.07              |
| 0.070                         | 17.78              |
| 0.080                         | 18.25              |
| 0.090                         | 18.57              |
| 0.100                         | 18.77              |
| 0.125                         | 18.87              |
| 0.150                         | 18.59              |
| 0.175                         | 17.70              |
| 0.200                         | 16.76              |
| 0.225                         | 16.12              |
| 0.250                         | 15.82              |
| 0.300                         | 15.58              |
| 0.350                         | 15.35              |
| 0.400                         | 15.25              |
| Max Shear Stress              | <b>18.90</b>       |

Project Name US 21 Bridge Replacement over Harbor River  
 Project Number G5396 Date 8/3/2016  
 SCDOT Project ID P026862  
 Location/Sample BS-1 / Sample #16-1189  
 Depth/Elevation 0.0' - 5.0'

Type of Test : Direct Shear - 4" by 4" Square Shear Box  
 Sample Type : Remolded 1" Thick, Non-Innundated  
 Description: Grey Poorly Graded Fine to Medium SAND  
 with Silt (SP-SM), A-3  
 Pl= NP % Fines= 7.6  
 SG= 2.65 Box Gap= 0.75mm  
 φ= 34.4° C<sub>apparent</sub>= 4.74 psi



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1190 **DATE SAMPLE RECEIVED:** 7/19/2016  
**DESCRIPTION OF SOIL:** Poorly Graded F/M SAND (SP-SM) with Silt A-3  
**TESTED BY:** MB **DATE OF TESTING:** 7/25/2016  
**DATE OF WEIGHING:** 7/26/2016

|                          |          |  |  |  |  |
|--------------------------|----------|--|--|--|--|
| <b>BORING NO.</b>        | BS-2     |  |  |  |  |
| <b>SAMPLE NO.</b>        | 16-1190C |  |  |  |  |
| <b>SAMPLE DEPTH</b>      | 0.0-5.0' |  |  |  |  |
| <b>WATER CONTENT, W%</b> | 5.6      |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

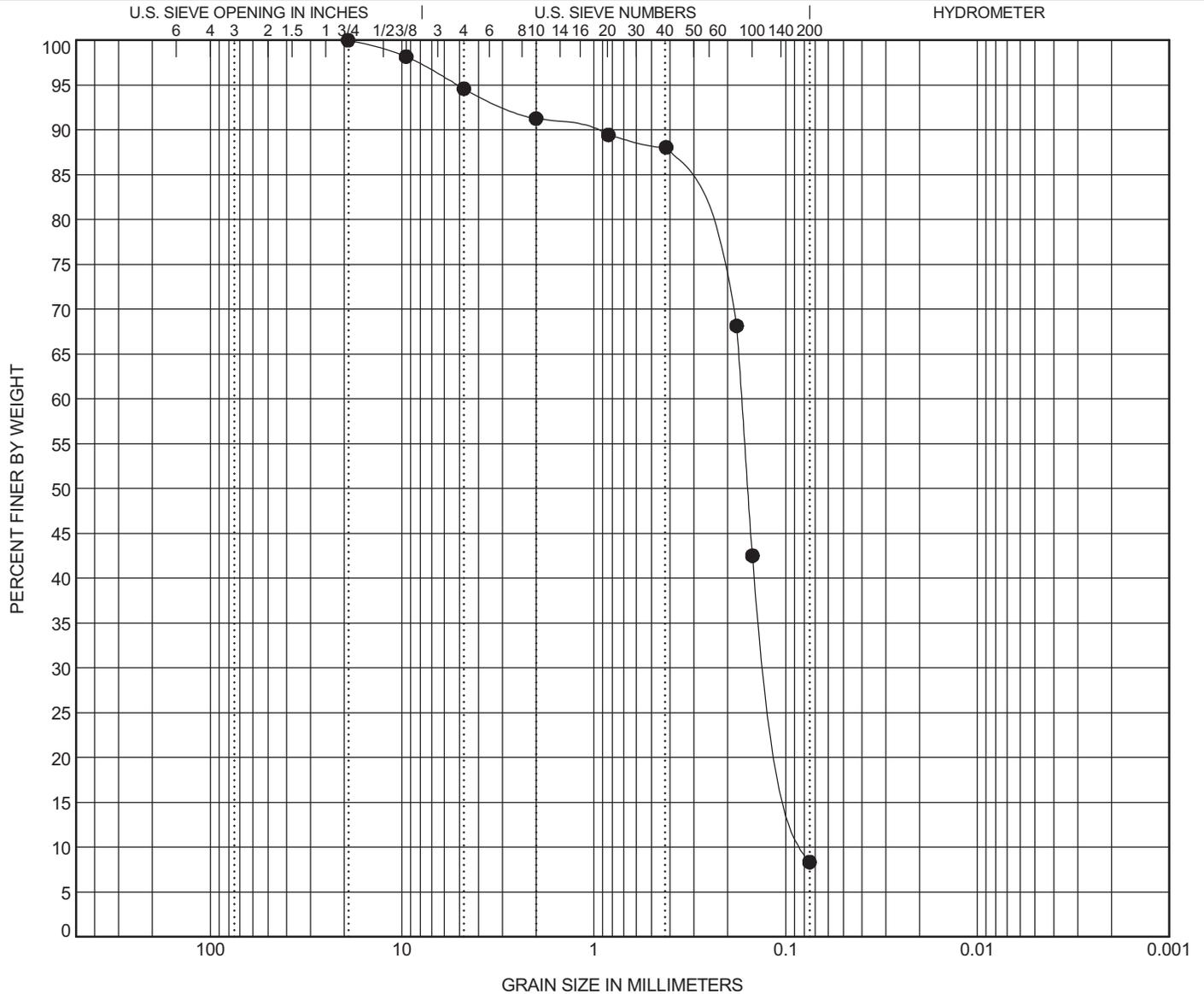


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                               |  |  |  |  | LL | PL | PI | Cc   | Cu   |
|----------|-------|----------------------------------------------|--|--|--|--|----|----|----|------|------|
| ● BS-2   | 5.0   | Poorly Graded F/M SAND (SP-SM) with Silt A-3 |  |  |  |  | NP | NP | NP | 1.02 | 2.19 |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|-------|---------|-------|-------|-------|
| ● BS-2   | 5.0   | 19.1 | 5.143 | 0.157 | 0.078 | 5.4     | 86.2  | 8.3   |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16





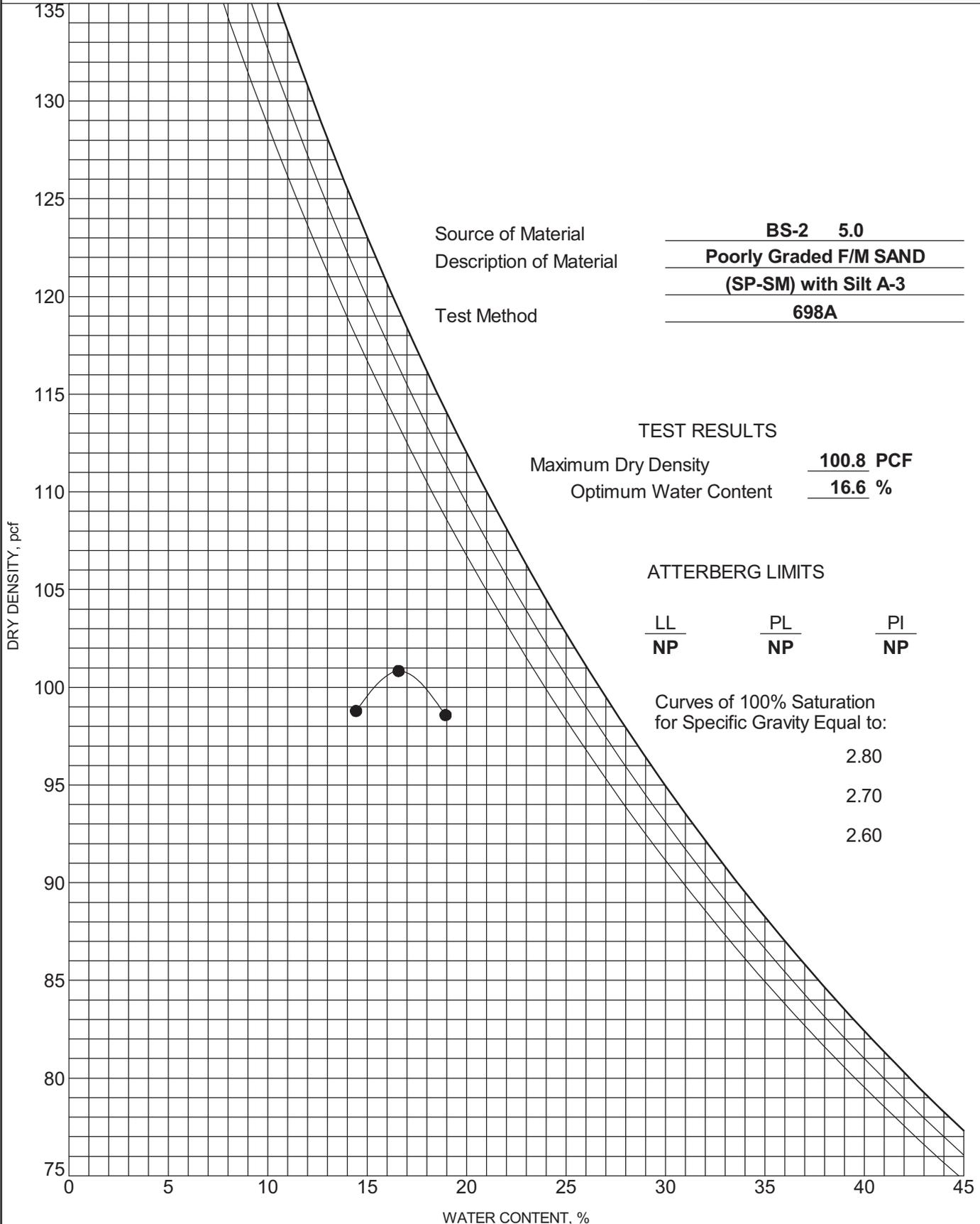


# MOISTURE-DENSITY RELATIONSHIP

PROJECT ID P026862

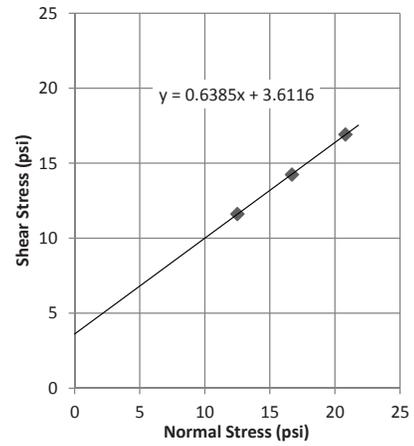
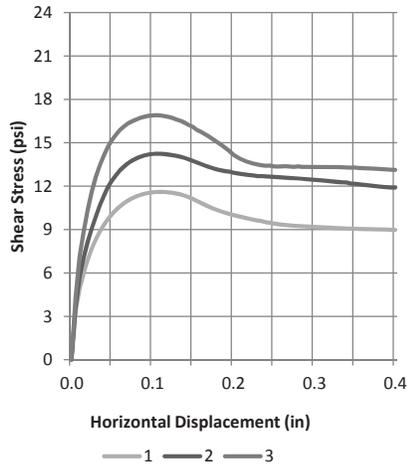
PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



COMPACTION G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16

**DIRECT SHEAR TEST REPORT**  
**ASTM - D3080 / AASHTO T236**



| Sample 1                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 12.5               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 19.5%              |
| Wet Density (pcf)             | 115.2              |
| Dry Density (pcf)             | 96.4               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 72.2%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 3.34               |
| 0.010                         | 4.94               |
| 0.015                         | 6.00               |
| 0.020                         | 6.88               |
| 0.030                         | 8.32               |
| 0.040                         | 9.34               |
| 0.050                         | 10.09              |
| 0.060                         | 10.61              |
| 0.070                         | 11.01              |
| 0.080                         | 11.30              |
| 0.090                         | 11.49              |
| 0.100                         | 11.57              |
| 0.125                         | 11.54              |
| 0.150                         | 11.12              |
| 0.175                         | 10.46              |
| 0.200                         | 10.00              |
| 0.225                         | 9.68               |
| 0.250                         | 9.42               |
| 0.300                         | 9.18               |
| 0.350                         | 9.06               |
| 0.400                         | 8.98               |
| Max Shear Stress              | <b>11.61</b>       |

| Sample 2                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 16.7               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 18.9%              |
| Wet Density (pcf)             | 114.3              |
| Dry Density (pcf)             | 96.2               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 69.5%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 3.67               |
| 0.010                         | 5.74               |
| 0.015                         | 7.08               |
| 0.020                         | 8.16               |
| 0.030                         | 9.91               |
| 0.040                         | 11.34              |
| 0.050                         | 12.40              |
| 0.060                         | 13.10              |
| 0.070                         | 13.60              |
| 0.080                         | 13.91              |
| 0.090                         | 14.12              |
| 0.100                         | 14.23              |
| 0.125                         | 14.14              |
| 0.150                         | 13.73              |
| 0.175                         | 13.23              |
| 0.200                         | 12.93              |
| 0.225                         | 12.74              |
| 0.250                         | 12.65              |
| 0.300                         | 12.44              |
| 0.350                         | 12.16              |
| 0.400                         | 11.90              |
| Max Shear Stress              | <b>14.24</b>       |

| Sample 3                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 20.8               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 18.6%              |
| Wet Density (pcf)             | 114.3              |
| Dry Density (pcf)             | 96.4               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 68.9%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 4.35               |
| 0.010                         | 7.14               |
| 0.015                         | 8.89               |
| 0.020                         | 10.36              |
| 0.030                         | 12.65              |
| 0.040                         | 14.14              |
| 0.050                         | 15.20              |
| 0.060                         | 15.89              |
| 0.070                         | 16.34              |
| 0.080                         | 16.61              |
| 0.090                         | 16.79              |
| 0.100                         | 16.89              |
| 0.125                         | 16.70              |
| 0.150                         | 16.09              |
| 0.175                         | 15.24              |
| 0.200                         | 14.17              |
| 0.225                         | 13.55              |
| 0.250                         | 13.37              |
| 0.300                         | 13.34              |
| 0.350                         | 13.28              |
| 0.400                         | 13.13              |
| Max Shear Stress              | <b>16.91</b>       |

Project Name US 21 Bridge Replacement over Harbor River

Project Number G5396 Date 8/12/16

SCDOT Project ID P026862

Location/Sample BS-2 / Sample #16-1190

Depth/Elevation 0.0' - 5.0'

Type of Test : Direct Shear - 4" by 4" Square Shear Box

Sample Type : Remolded 1" Thick, Non-Innundated

Description: Grey Poorly Graded Fine to Medium SAND with Silt (SP-SM), A-3

PI= NP % Fines= 8.3

SG= 2.65 Box Gap= 1.0 mm

φ= 32.6° C<sub>apparent</sub>= 3.61 psi



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1191 **DATE SAMPLE RECEIVED:** 7/19/2016  
**DESCRIPTION OF SOIL:** Poorly Graded F/M SAND (SP) A-3  
**TESTED BY:** MB **DATE OF TESTING:** 7/25/2016  
**DATE OF WEIGHING:** 7/26/2016

|                          |          |  |  |  |  |
|--------------------------|----------|--|--|--|--|
| <b>BORING NO.</b>        | BS-3     |  |  |  |  |
| <b>SAMPLE NO.</b>        | 16-1191C |  |  |  |  |
| <b>SAMPLE DEPTH</b>      | 0.0-5.0' |  |  |  |  |
| <b>WATER CONTENT, W%</b> | 1.3      |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

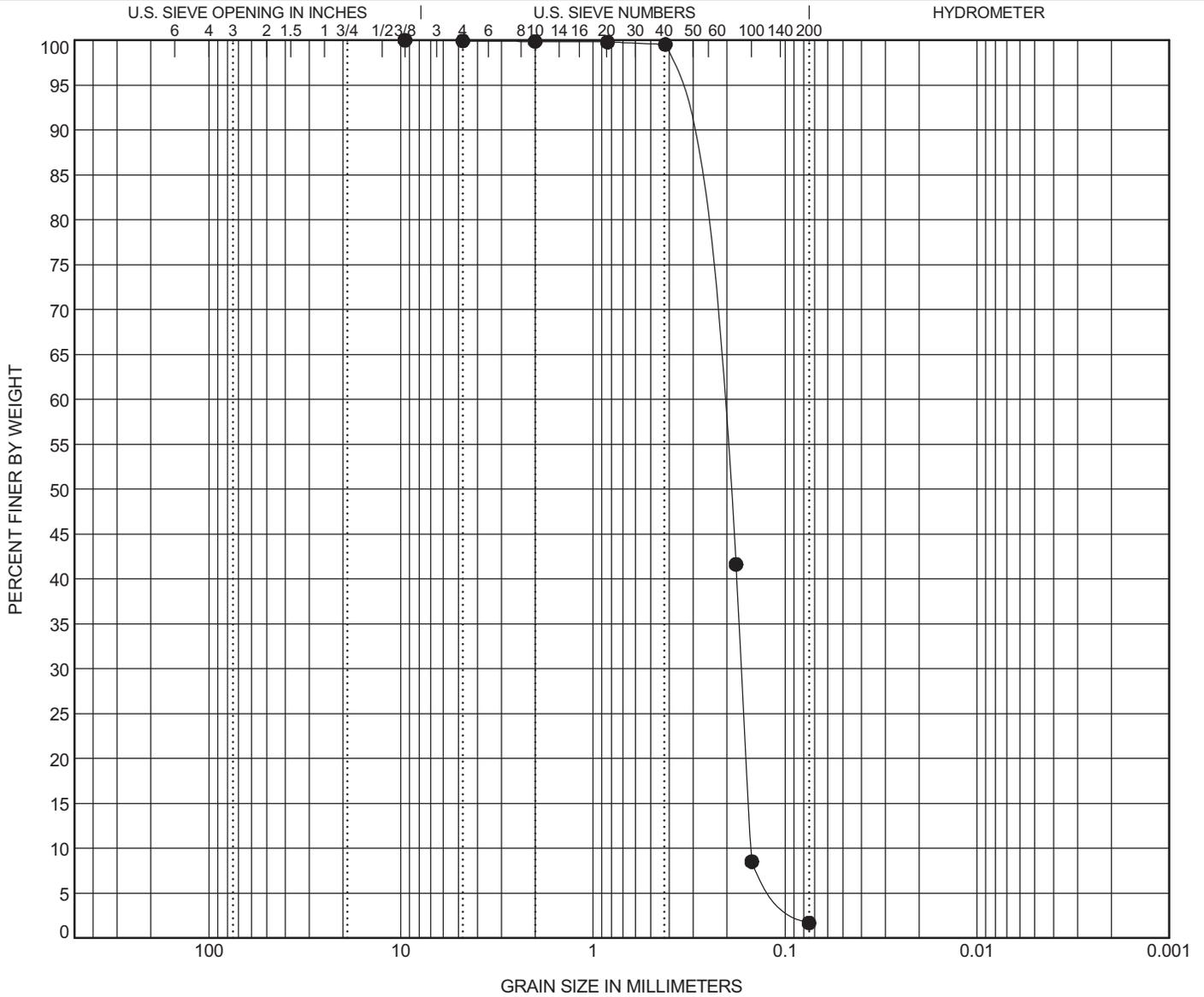


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                  | LL | PL | PI | Cc   | Cu   |
|----------|-------|---------------------------------|----|----|----|------|------|
| ● BS-3   | 5.0   | Poorly Graded F/M SAND (SP) A-3 | NP | NP | NP | 0.80 | 1.57 |

| BOREHOLE | DEPTH | D100 | D95   | D50   | D10  | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-------|-------|------|---------|-------|-------|-------|
| ● BS-3   | 5.0   | 9.52 | 0.393 | 0.203 | 0.15 | 0.1     | 98.2  | 1.7   |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16



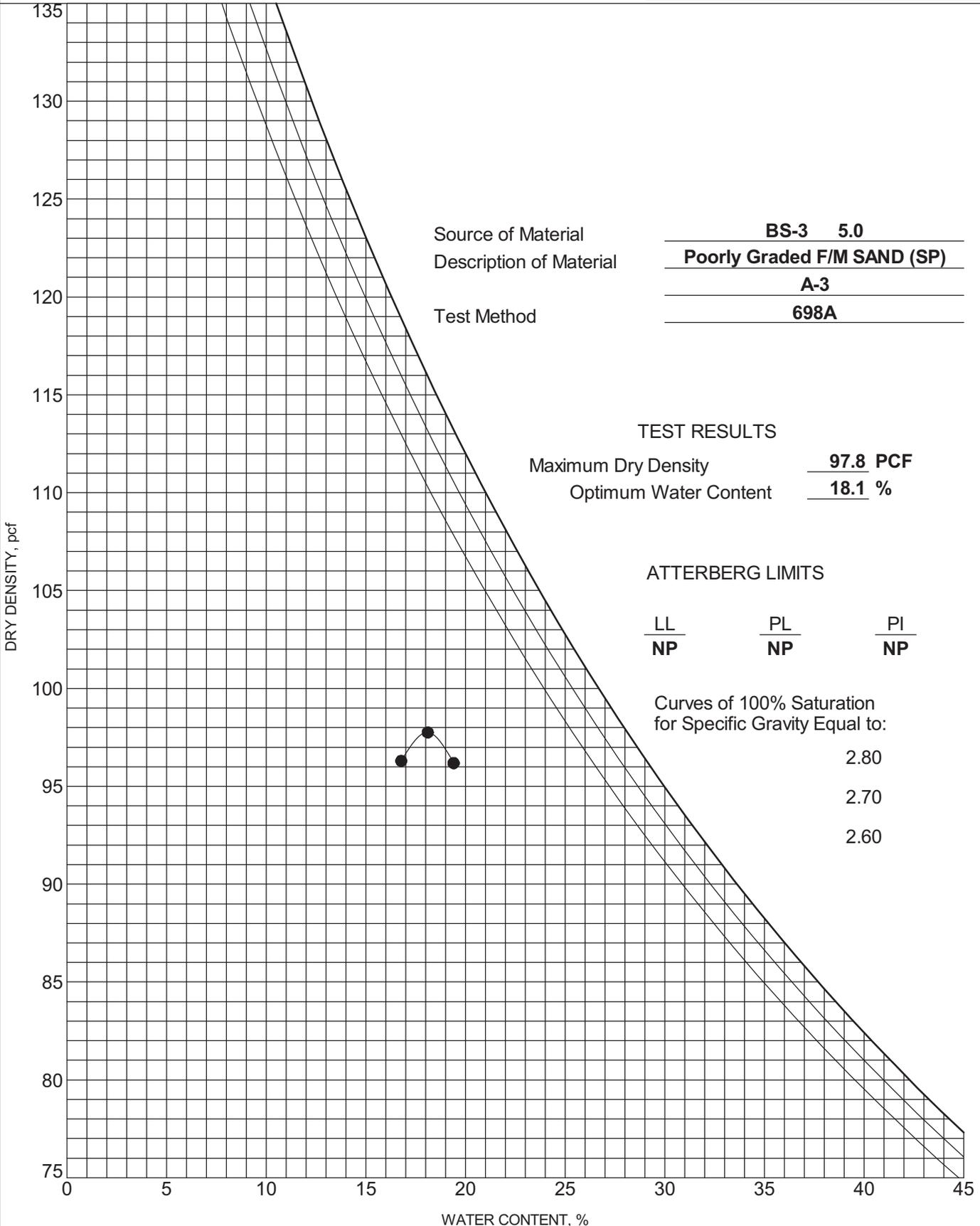


# MOISTURE-DENSITY RELATIONSHIP

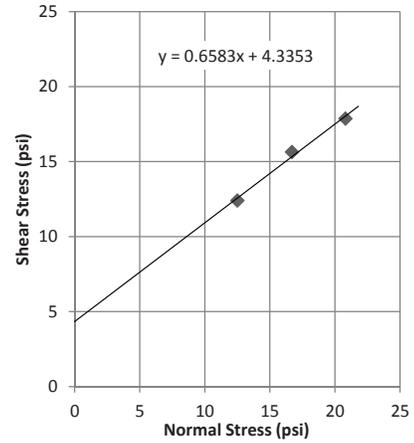
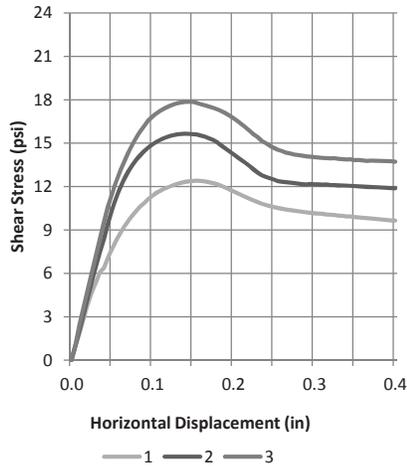
PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



**DIRECT SHEAR TEST REPORT**  
**ASTM - D3080 / AASHTO T236**



| Sample 1                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 12.5               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 17.6%              |
| Wet Density (pcf)             | 112.5              |
| Dry Density (pcf)             | 95.7               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 64.0%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 0.98               |
| 0.010                         | 1.93               |
| 0.015                         | 2.88               |
| 0.020                         | 3.83               |
| 0.030                         | 5.35               |
| 0.040                         | 6.38               |
| 0.050                         | 7.68               |
| 0.060                         | 8.76               |
| 0.070                         | 9.63               |
| 0.080                         | 10.31              |
| 0.090                         | 10.87              |
| 0.100                         | 11.38              |
| 0.125                         | 12.08              |
| 0.150                         | 12.39              |
| 0.175                         | 12.24              |
| 0.200                         | 11.68              |
| 0.225                         | 11.04              |
| 0.250                         | 10.59              |
| 0.300                         | 10.14              |
| 0.350                         | 9.89               |
| 0.400                         | 9.64               |
| Max Shear Stress              | <b>12.41</b>       |

| Sample 2                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 16.7               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 17.5%              |
| Wet Density (pcf)             | 111.6              |
| Dry Density (pcf)             | 95.0               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 62.6%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 1.03               |
| 0.010                         | 2.11               |
| 0.015                         | 3.27               |
| 0.020                         | 4.25               |
| 0.030                         | 6.56               |
| 0.040                         | 8.35               |
| 0.050                         | 10.40              |
| 0.060                         | 11.91              |
| 0.070                         | 13.03              |
| 0.080                         | 13.85              |
| 0.090                         | 14.45              |
| 0.100                         | 14.93              |
| 0.125                         | 15.54              |
| 0.150                         | 15.63              |
| 0.175                         | 15.22              |
| 0.200                         | 14.24              |
| 0.225                         | 13.17              |
| 0.250                         | 12.49              |
| 0.300                         | 12.16              |
| 0.350                         | 12.04              |
| 0.400                         | 11.88              |
| Max Shear Stress              | <b>15.64</b>       |

| Sample 3                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 20.8               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 18.1%              |
| Wet Density (pcf)             | 112.5              |
| Dry Density (pcf)             | 95.2               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 65.1%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 1.09               |
| 0.010                         | 2.48               |
| 0.015                         | 3.71               |
| 0.020                         | 4.81               |
| 0.030                         | 7.17               |
| 0.040                         | 9.55               |
| 0.050                         | 11.50              |
| 0.060                         | 13.05              |
| 0.070                         | 14.34              |
| 0.080                         | 15.40              |
| 0.090                         | 16.20              |
| 0.100                         | 16.84              |
| 0.125                         | 17.66              |
| 0.150                         | 17.85              |
| 0.175                         | 17.44              |
| 0.200                         | 16.74              |
| 0.225                         | 15.60              |
| 0.250                         | 14.68              |
| 0.300                         | 14.02              |
| 0.350                         | 13.83              |
| 0.400                         | 13.72              |
| Max Shear Stress              | <b>17.87</b>       |

Project Name US 21 Bridge Replacement over Harbor River

Project Number G5396 Date 8/31/16

SCDOT Project ID P026862

Location/Sample BS-3 / Sample #16-1191

Depth/Elevation 0.0' - 5.0'

Type of Test : Direct Shear - 4" by 4" Square Shear Box

Sample Type : Remolded 1" Thick, Non-Innundated

Description: Grey Poorly Graded Fine to Medium SAND (SP), A-3

PI= NP % Fines= 1.7

SG= 2.65 Box Gap= 1.0 mm

φ= 33.5° C<sub>apparent</sub>= 4.34 psi



**F&ME CONSULTANTS**  
**3112 Devine Street**  
**Columbia, South Carolina 29205**

**MOISTURE CONTENT DETERMINATION**  
**(AASHTO T265)**

**PROJECT:** US 21 Bridge Replacement over Harbor River **PROJECT NO.:** G5396  
**SAMPLE NUMBER:** 16-1192 **DATE SAMPLE RECEIVED:** 7/19/2016  
**DESCRIPTION OF SOIL:** Poorly Graded F/M SAND (SP) A-3  
**TESTED BY:** MB **DATE OF TESTING:** 7/25/2016  
**DATE OF WEIGHING:** 7/26/2016

|                          |          |  |  |  |  |
|--------------------------|----------|--|--|--|--|
| <b>BORING NO.</b>        | BS-4     |  |  |  |  |
| <b>SAMPLE NO.</b>        | 16-1192C |  |  |  |  |
| <b>SAMPLE DEPTH</b>      | 0.0-5.0' |  |  |  |  |
| <b>WATER CONTENT, W%</b> | 2.6      |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |

|                          |  |  |  |  |  |
|--------------------------|--|--|--|--|--|
| <b>BORING NO.</b>        |  |  |  |  |  |
| <b>SAMPLE NO.</b>        |  |  |  |  |  |
| <b>SAMPLE DEPTH</b>      |  |  |  |  |  |
| <b>WATER CONTENT, W%</b> |  |  |  |  |  |



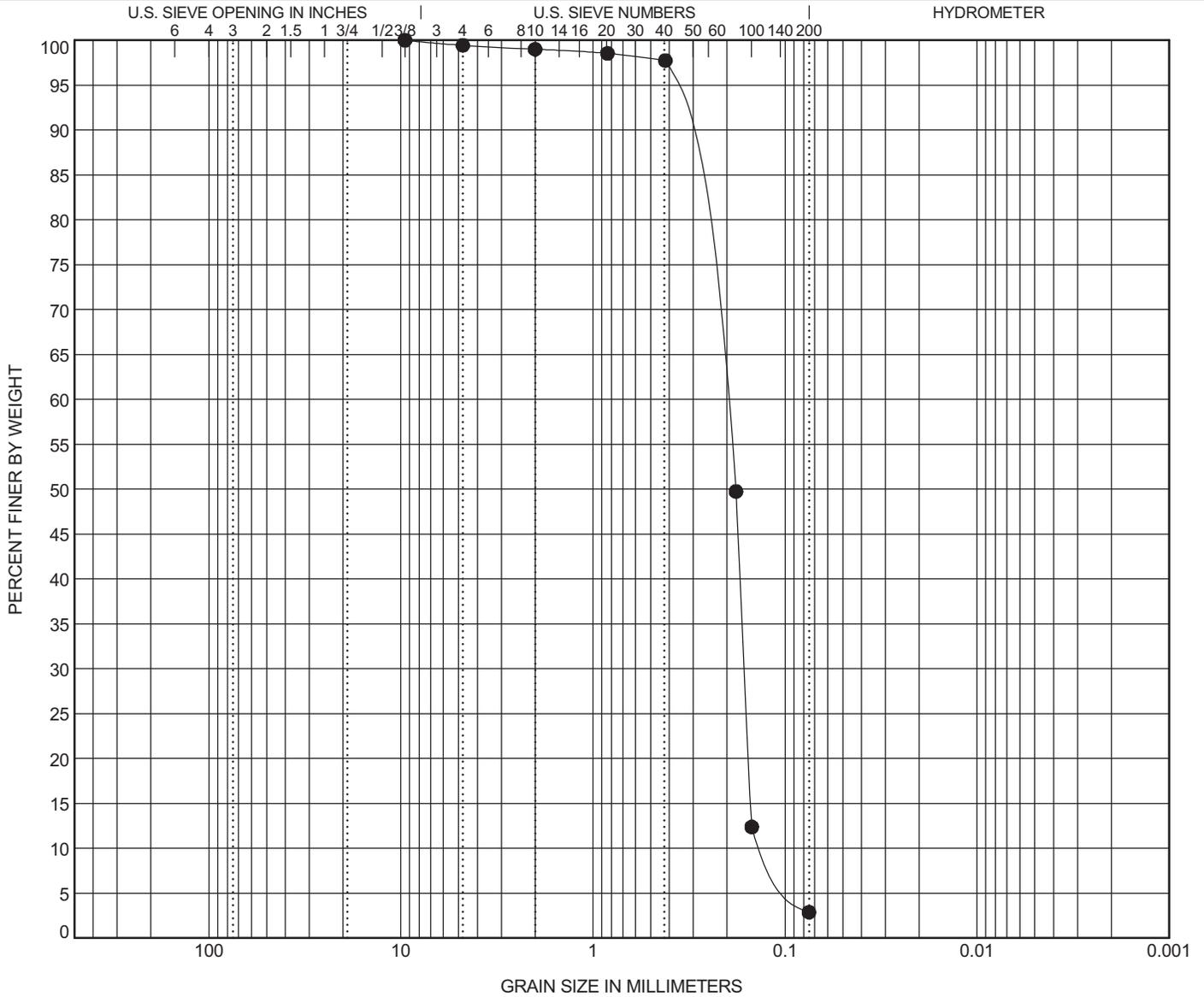


# GRAIN SIZE DISTRIBUTION

PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| BOREHOLE | DEPTH | Classification                  | LL | PL | PI | Cc   | Cu   |
|----------|-------|---------------------------------|----|----|----|------|------|
| ● BS-4   | 5.0   | Poorly Graded F/M SAND (SP) A-3 | NP | NP | NP | 0.98 | 1.72 |

| BOREHOLE | DEPTH | D100 | D95 | D50   | D10   | %Gravel | %Sand | %Silt | %Clay |
|----------|-------|------|-----|-------|-------|---------|-------|-------|-------|
| ● BS-4   | 5.0   | 9.52 | 0.4 | 0.181 | 0.125 | 0.6     | 96.6  | 2.9   |       |

GRAIN SIZE G5396 - HARBOR RIVER SPT AND CPT.GPJ GINT STD US LAB.GDT 10/5/16



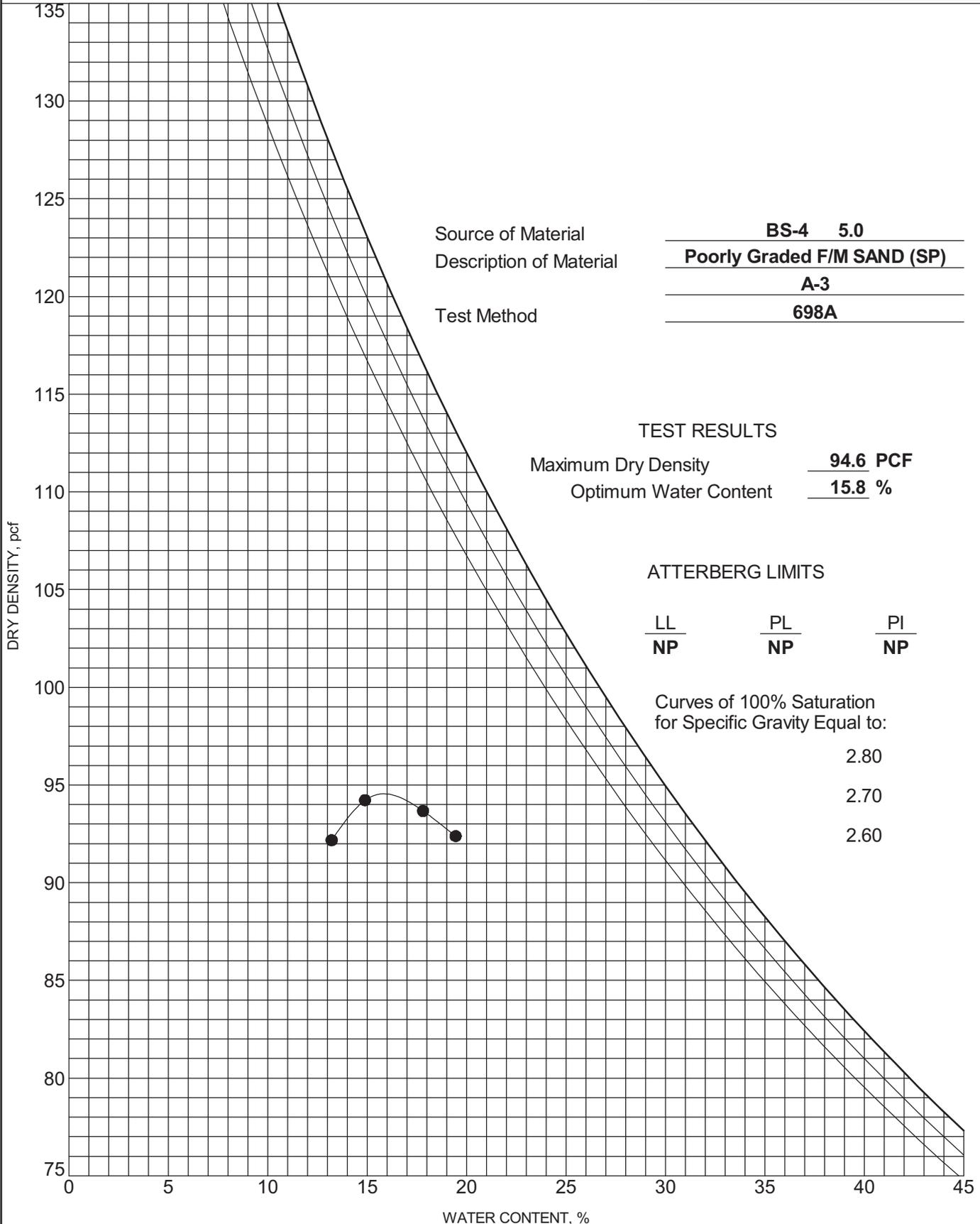


# MOISTURE-DENSITY RELATIONSHIP

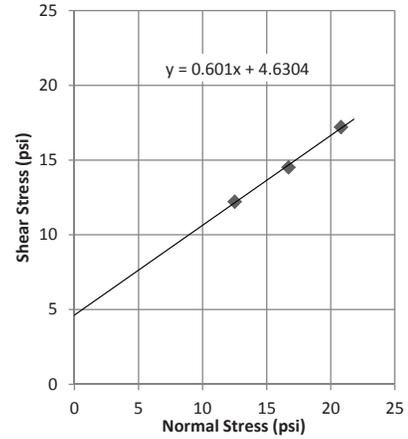
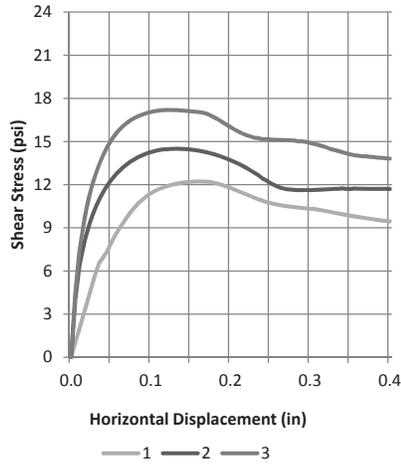
PROJECT ID P026862

PROJECT NAME US 21 Bridge Replacement over Harbor River

PROJECT COUNTY Beaufort



**DIRECT SHEAR TEST REPORT  
ASTM - D3080 / AASHTO T236**



| Sample 1                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 12.5               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 16.8%              |
| Wet Density (pcf)             | 106.8              |
| Dry Density (pcf)             | 91.5               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 55.1%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 0.99               |
| 0.010                         | 1.94               |
| 0.015                         | 2.89               |
| 0.020                         | 3.81               |
| 0.030                         | 5.74               |
| 0.040                         | 6.94               |
| 0.050                         | 7.94               |
| 0.060                         | 8.92               |
| 0.070                         | 9.74               |
| 0.080                         | 10.45              |
| 0.090                         | 10.98              |
| 0.100                         | 11.40              |
| 0.125                         | 11.97              |
| 0.150                         | 12.20              |
| 0.175                         | 12.19              |
| 0.200                         | 11.77              |
| 0.225                         | 11.22              |
| 0.250                         | 10.72              |
| 0.300                         | 10.33              |
| 0.350                         | 9.84               |
| 0.400                         | 9.45               |
| Max Shear Stress              | <b>12.22</b>       |

| Sample 2                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 16.7               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 16.6%              |
| Wet Density (pcf)             | 106.8              |
| Dry Density (pcf)             | 91.6               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 54.6%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 3.99               |
| 0.010                         | 6.27               |
| 0.015                         | 7.61               |
| 0.020                         | 8.71               |
| 0.030                         | 10.34              |
| 0.040                         | 11.46              |
| 0.050                         | 12.32              |
| 0.060                         | 12.94              |
| 0.070                         | 13.42              |
| 0.080                         | 13.79              |
| 0.090                         | 14.07              |
| 0.100                         | 14.28              |
| 0.125                         | 14.49              |
| 0.150                         | 14.46              |
| 0.175                         | 14.18              |
| 0.200                         | 13.69              |
| 0.225                         | 12.99              |
| 0.250                         | 12.11              |
| 0.300                         | 11.63              |
| 0.350                         | 11.70              |
| 0.400                         | 11.70              |
| Max Shear Stress              | <b>14.51</b>       |

| Sample 3                      |                    |
|-------------------------------|--------------------|
| Normal Stress (psi)           | 20.8               |
| Speed (in./min.)              | 0.01               |
| Sample Width (in.)            | 4.00               |
| Percent Moisture              | 16.3%              |
| Wet Density (pcf)             | 108.0              |
| Dry Density (pcf)             | 92.9               |
| t50 (min.)                    | 0.2                |
| Saturation (%)                | 55.2%              |
| Horizontal Displacement (in.) | Shear Stress (psi) |
| 0.000                         | 0.00               |
| 0.005                         | 4.47               |
| 0.010                         | 7.29               |
| 0.015                         | 9.08               |
| 0.020                         | 10.59              |
| 0.030                         | 12.59              |
| 0.040                         | 14.03              |
| 0.050                         | 15.07              |
| 0.060                         | 15.80              |
| 0.070                         | 16.30              |
| 0.080                         | 16.65              |
| 0.090                         | 16.88              |
| 0.100                         | 17.06              |
| 0.125                         | 17.20              |
| 0.150                         | 17.11              |
| 0.175                         | 16.81              |
| 0.200                         | 15.99              |
| 0.225                         | 15.36              |
| 0.250                         | 15.15              |
| 0.300                         | 14.89              |
| 0.350                         | 14.11              |
| 0.400                         | 13.81              |
| Max Shear Stress              | <b>17.21</b>       |

Project Name US 21 Bridge Replacement over Harbor River  
 Project Number G5396 Date 9/1/16  
 SCDOT Project ID P026862  
 Location/Sample BS-4 / Sample #16-1192  
 Depth/Elevation 0.0' - 5.0'

Type of Test : Direct Shear - 4" by 4" Square Shear Box  
 Sample Type : Remolded 1" Thick, Non-Innundated  
 Description: Grey Poorly Graded Fine to Medium SAND (SP), A-3  
 PI= NP % Fines= 2.9  
 SG= 2.65 Box Gap= 1.0 mm  
 φ= 31.0° C<sub>apparent</sub>= 4.63 psi





|                   |                                            |
|-------------------|--------------------------------------------|
| Client:           | FME Consultants                            |
| Project Name:     | US-21 Replacement Bridge over Harbor River |
| Project Location: | ---                                        |
| GTX #:            | 305005                                     |
| Test Date:        | 8/23/2016                                  |
| Tested By:        | jbr                                        |
| Checked By:       | emm                                        |

pH of Water by ASTM D1293

| Boring ID | Sample ID | Depth, ft | Description      | pH of water | Temperature, °C |
|-----------|-----------|-----------|------------------|-------------|-----------------|
| East End  | 16-1283   | ---       | Wet, clear water | 6.9         | 19              |
| West End  | 16-1284   | ---       | Wet, clear water | 6.8         | 19              |

Notes: Method B, pH meter used



|             |                                            |
|-------------|--------------------------------------------|
| Client:     | FME Consultants                            |
| Project:    | US-21 Replacement Bridge over Harbor River |
| Location:   | ---                                        |
| GTX#:       | 305005                                     |
| Test Date:  | 09/01/16                                   |
| Tested By:  | jbr                                        |
| Checked By: | mcm                                        |

**Laboratory Measurement of Soil Resistivity Using  
the Wenner Four-Electrode Method by ASTM G57  
(Laboratory Measurement)**

| Boring ID | Sample ID | Depth, ft. | Sample Description | Electrical Resistivity, ohm-cm | Electrical Conductivity, (ohm-cm) <sup>-1</sup> |
|-----------|-----------|------------|--------------------|--------------------------------|-------------------------------------------------|
| East End  | 16-1283   | ---        | Wet, clear water   | 26                             | 3.87E-02                                        |
| West End  | 16-1284   | ---        | Wet, clear water   | 27                             | 3.72E-02                                        |

Notes: Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box  
Water added to sample to create a thick slurry prior to testing (saturated condition).  
Electrical Conductivity is calculated as inverse of Electrical Resistivity (per ASTM G57)  
Test conducted in standard laboratory atmosphere: 68-73 F



6100 HILLCROFT  
PHONE (713) 369-5400

HOUSTON, TEXAS 77081  
FAX (713) 369-5518

**RESULTS OF TESTS**

PROJECT: US-21 REPLACEMENT BRIDGE (GTX 305005)  
SAMPLE ID: EAST END 16-1283

FOR: GEOTESTING EXPRESS, INC.  
125 NAGOG PARK ACTION, MA 01720

REPORTED TO: ETHAN MARRO

LAB NUMBER: 0817030

REPORT DATE: 08-22-16

CLIENT NUMBER:

JOB NUMBER: 04.1115-0003

REPORT NUMBER:

DATE SAMPLED:

TIME SAMPLED:

SAMPLED BY: CLIENT

DATE RECEIVED:

TIME RECEIVED:

RECEIVED BY:

| PARAMETER         | RESULTS | UNITS | METHOD        | TIME/DATE     | ANALYST |
|-------------------|---------|-------|---------------|---------------|---------|
| Sulfate, Soluble  | 23,227  | mg/L  | ASTM D-516 ** | 1400/08-19-16 | SD      |
| Chloride, Soluble | 16,396  | mg/L  | ASTM D-512 ** | 1100/08-22-16 | SD      |

SO4CL 078-16

Respectfully submitted,

\* Dry weight basis

Steve DeGregorio  
Chemist

SD

\*\* WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.  
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

**END OF REPORT**



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HOUSTON, TEXAS 77081  
FAX (713) 369-5518

**RESULTS OF TESTS**

PROJECT: US-21 REPLACEMENT BRIDGE (GTX 305005)  
SAMPLE ID: WEST END 16-1284

FOR: GEOTESTING EXPRESS, INC.  
125 NAGOG PARK ACTION, MA 01720

REPORTED TO: ETHAN MARRO

LAB NUMBER: 0817031

REPORT DATE: 08-22-16  
CLIENT NUMBER:  
JOB NUMBER: 04.1115-0003  
REPORT NUMBER:  
DATE SAMPLED:  
TIME SAMPLED:  
SAMPLED BY: CLIENT  
DATE RECEIVED:  
TIME RECEIVED:  
RECEIVED BY:

| PARAMETER         | RESULTS | UNITS | METHOD        | TIME/DATE     | ANALYST |
|-------------------|---------|-------|---------------|---------------|---------|
| Sulfate, Soluble  | 22,715  | mg/L  | ASTM D-516 ** | 1400/08-19-16 | SD      |
| Chloride, Soluble | 16,596  | mg/L  | ASTM D-512 ** | 1100/08-22-16 | SD      |

SO4CL 078-16

Respectfully submitted,

\* Dry weight basis

Steve DeGregorio  
Chemist

SD

\*\* WATER EXTRACTION PERFORMED BY USING A 1:10 RATIO OF SAMPLE AND REAGENT WATER FOLLOWED BY CENTRIFUGE AND VACUUME FILTRATION. THE WATER EXTRACT IS THEN ANALYZED USING THE ASTM D-512 AND D-516 METHODS.

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.  
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

**END OF REPORT**