

# S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek

Oconee County, SC

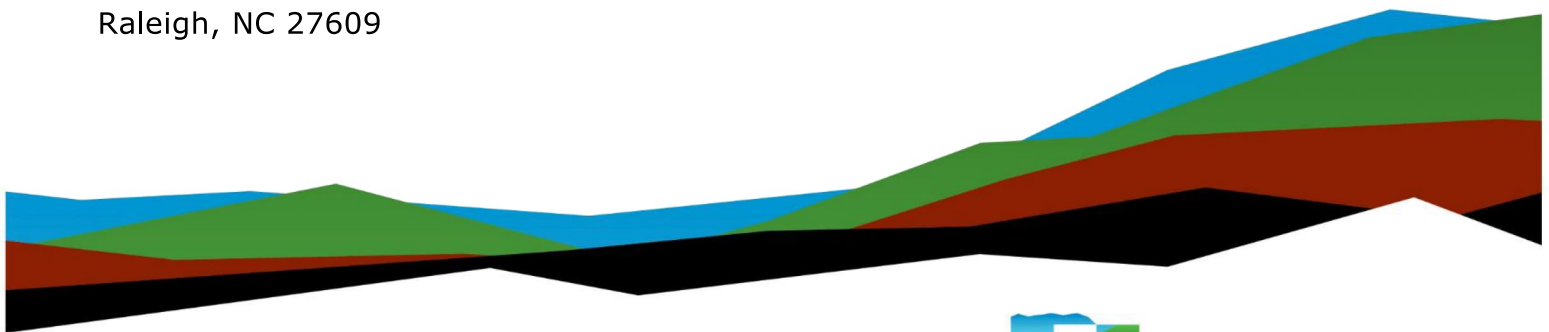
## Geotechnical Baseline Report

April 11, 2025| SCDOT Project ID: P041166

Terracon Project No.: 8623P180

### Prepared for:

HNTB Corporation  
343 E. Six Forks Road, Suite 200  
Raleigh, NC 27609



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April 11, 2025

HNTB Corporation  
343 E. Forks Road, Suite 200  
Raleigh, NC 27609

Attn: Mr. Spencer Franklin, PE, Senior Vice President  
P: 919-546-8997

Re: Geotechnical Baseline Report (GBR)  
S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek  
Oconee County, South Carolina  
SCDOT Project ID.: P041166  
Terracon Project No.: 8623P180

Dear Mr. Franklin:

Terracon Consultants Inc. (Terracon) has completed the exploration, testing and limited engineering analysis services for the referenced project. The services were conducted in general accordance with our Task Order Number 001, dated May 25, 2023.

## Introduction

HNTB Corporation (HNTB) has contracted Terracon to perform subsurface exploration, laboratory testing and limited preliminary engineering recommendations for the replacement of the S-37-51 Bridge over Snow Creek in Oconee County, South Carolina. The results of the subsurface exploration and laboratory testing have been separately presented in a Geotechnical Subsurface Data Report (GSDR). For convenience, the data is provided here in this Geotechnical Baseline Report (GBR) along with a characterization of the subsurface conditions for the project. Limited preliminary geotechnical design and construction considerations associated with the requested scope of work are included in this GBR. This GBR was prepared in general accordance with the 2022 SCDOT Geotechnical Design Manual (GDM).

## Project Description

The project site is located at the S-37-51 (Snow Creek Road) crossing over Snow Creek in Oconee County, South Carolina. Site location and exploration plans are presented in Appendix A of this report. Based on the conceptual plans by HNTB dated 3/27/2025, the replacement

bridge will be constructed on the same alignment as the current bridge. The current plan indicates the new bridge will be a 140-ft long multi span bridge constructed with an adjacent cored slab for span A and an adjacent box beam for span B.

## Geotechnical Testing

The geotechnical exploration for this project was performed on December 14, 2023. The results of our fieldwork and our associated laboratory testing are included in Appendices A and B.

### Field Exploration

Our field exploration consisted of the following:

- Two (2) Standard Penetration Test (SPT) Borings (S-37-51-1 and S-37-51-2)
- Two (2) offset auger probes near S-37-51-1 and S-37-51-2 for bulk sample collection
- One (1) Downhole Shear Wave Velocity Test (DHT-1) performed in casing installed within Boring S-37-51-1
- Two (2) Cone Penetration Test soundings (S-37-51-1C and S-37-51-2C).

The tests were performed at the approximate locations as approved by SCDOT. A description of our testing methods and graphical logs outlining the soil conditions at each test location are presented in Appendix A. The test locations were established in the field by Terracon and surveyed by Thomas & Hutton after completion.

### Laboratory Testing

The following laboratory tests were performed on the soil samples collected at the site.

- Sixteen (16) Natural Moisture Content Tests
- Seven (7) Atterberg Limits Tests
- Four (4) Fines Content Tests
- Six (6) Grain Size Tests
- Four (4) Grain Size Tests with Hydrometer
- One (1) Remolded, Consolidated-Undrained (CU) Triaxial Compression Test with Pore Pressure Readings
- One (1) Standard Proctor Test
- One (1) Corrosivity Suite (pH, chloride content, sulfate content, and resistivity tests)
- Four (4) Compressive Strength of Rock Cores

The general scope of the laboratory testing frequency was determined by the SCDOT. The laboratory testing assignment was performed by our engineers. The laboratory procedures and results of the laboratory tests are presented in Appendix B.

## Subsurface Conditions

### Regional Geology

The bridge site is located on route S-37-51 (Snow Creek Road) southwest of the town of Seneca in Oconee County, South Carolina. The site lies generally within the Piedmont Physiographic Province. More specifically, the site is mapped within the Six Mile Thrust Sheet. According to regional geologic mapping and published geologic reports, the project site is mapped in an area that contains biotite-plagioclase-quartz gneiss and biotite-muscovite schist. The bridge end bents and approach embankments contain existing fill above alluvial and/or residual soils, very dense residual soils classified as Intermediate Geomaterials (IGM) and bedrock.

### Soil and Rock Stratification

Borings encountered 6 to 7 inches of asphalt followed by 4 to 5 inches of gravel. Beneath the existing roadway section, embankment fill soil consisting of very loose to loose silty/clayey sand and firm to very stiff sandy clay was encountered to approximately 12 to 14 feet below the existing ground surface. Under the fill soils, the borings encountered a layer of alluvium soil consisting of very loose clayey sand and firm sandy clay to a depth of approximately 17 to 20 feet below the existing ground surface. Below the alluvium, residual soils consisting of loose to very dense silty sand were encountered to approximate depths of 28 to 48.6 feet below ground surface, with some residual soils characterized as being intermediate geomaterials (IGM) exhibiting SPT N values of more than 100 blows per foot (bpf), followed by bedrock. Bedrock was present to the maximum depth explored of 63.6 feet and 38 feet at borings S-37-51-1 and S-37-51-2, respectively.

Geology	Approximate Elevation of Layer Bottom (ft, NAVD88)	USCS Soil Type	Measured Field N Value	Plasticity Index	Fines Content	REC / RQD
Asphalt / Gravel	798 to 800	--	--	--	--	--
Fill	787	SC-SM, SC, CL	2 to 22	6 to 13	37 to 69	--
Alluvium	781 to 782	SC, CL	0 to 5	8 to 19	32 to 58	--
Residuum	750 to 773	SM	6 to 100+	--	14 to 23	--
Rock	PMDE <sup>1</sup>	--	--	--	--	97 to 100% / 87 to 100%

1. PMDE = Present to Maximum Depth Explored



## Seismic Conditions

According to SCDOT Seismic Design Specifications for Highway Bridges version 2.0, the proposed bridge will be an Operational Classification II (OC II). Per SCDOT GDM 2022, the proposed bridge shall be designed to meet the performance limits for an OC II bridge.

### Acceleration Design Response Spectrum (ADRS)

The shear wave and compression wave velocity results, as measured at Boring S-37-51-1 using downhole seismic tests, were provided to SCDOT. SCDOT used these velocity measurements to develop Acceleration Design Response Spectrum (ADRS) curves by determining the seismic hazard and evaluating the local site effects on the response spectra.

SCDOT provided "3-Point Acceleration Design Response Spectrum" curves along with a table that included pseudo-spectral accelerations (PSA) for 5% critical damping and at selected frequencies, consistent with a Geologically Realistic (B-C Boundary) condition (shear wave velocity,  $V_s = 2,500$  feet per second). PSA values were provided for the:

- Functional Evaluation Earthquake (FEE): 15% probability of exceedance in 75 years
- Safety Evaluation Earthquake (SEE): 3% probability of exceedance in 75 years

The table below provides the maximum considered earthquake peak ground acceleration (PGA), the short period acceleration ( $S_{DS}$ ), and one-second period acceleration ( $S_{D1}$ ) for the FEE and SEE earthquakes at the ground surface. A copy of the "3-Point Acceleration Design Response Spectrum" provided by SCDOT is included in Appendix C.

Seismic Design Parameter	FEE	SEE
PGA	0.03	0.07
$S_{DS}$	0.08	0.15
$S_{D1}$	0.01	0.02

### Soil Shear Strength Loss (SSL) Analysis

A layer of alluvium soil (very loose clayey sand) was encountered in Boring S-37-51-2 and is located near the groundwater level. Therefore, soil shear strength loss (SSL) screening should be performed to assess potential for liquefaction related settlement and stability impacts on the planned bridge foundations and embankment slopes. Additional soil and groundwater evaluation may be required.

## Design and Construction Considerations

### Foundations

Driven steel H-piles driven to practical refusal on rock or within IGM materials (i.e., >20 blows per inch with appropriately sized hammer) are expected to be feasible for the proposed bridge end bents.

The approximate elevation to the top of very dense residual soils (IGM) at End Bent 1 is 775 feet NAVD88 and is about 2 feet thick overlying bedrock with an RQD of 87% at the top of rock. At End Bent 3, IGM was not encountered, and the top of rock is at an approximate elevation of 750 feet NAVD88 with an RQD of 98% at the top of rock. Per section 16.3.1 of the GDM, reinforced pile tips will be needed to minimize potential pile damage while penetrating through IGM to the top of rock. Pile drivability using the wave equation should be performed along with estimating stresses during driving and, in general, verifying the ability of the Contractor's selected hammer to drive the piles to the desired penetration while preventing overstressing of the pile. Appropriate group effect should be considered as necessary per GDM Chapter 16.

According to the conceptual bridge plans by HNTB dated 3/27/2025, approximately 7 to 8 feet of fill is expected at the end bent embankments. Foundations should typically be installed after the approach embankment construction to reduce potential downdrag settlement issues. The pile design should account for downdrag loads, should new fill be placed after installing foundation piles.

Drilled shafts are anticipated to be feasible for the proposed bridge interior Bent 2. Assuming redundant drilled shafts, Table 9-4 GDM 2022 allows using a resistance factor of 0.60 (both side resistance and end bearing) for a single redundant drilled shaft in rock. It is assumed that the drilled shaft will be cased to the top of rock and the side resistance along the casing length will not be considered in estimating axial resistance. Appropriate group effects should be considered as necessary per GDM Chapter 16.

We have observed variability in the top of rock and thickness of IGM, as seen in **Soil and Rock Stratification**. Therefore, there is a potential for variability in foundation tip elevations at each bent location. Resistance of piles driven to practical refusal in IGM or rock will be limited by their structural resistance.

## Corrosion Testing

Corrosion testing was performed on a composite sample obtained from split spoons in the upper 2 to 14 feet. Corrosion testing included pH, resistivity, chlorides, and sulfates content as summarized in Table below. Corrosion test results are included in Appendix B.

Corrosion Test	Results Bent 1, Boring S-37-51-2 Composite Sample from 2 to 14 feet	Indication of Corrosivity <sup>1</sup>
pH	6.43	Less than 5.5
Resistivity	8,243 ohm-cm	Less than 2,000 ohm-cm
Chloride	93 ppm	Greater than 500 ppm
Sulfate	54 ppm	Greater than 1,000 ppm

1. AASHTO LRFD bridge design specifications, Ninth Edition 2020, Section 10.7.5.

Based on the criteria for electro-chemical properties in the GDM Section 7.18, the electro-chemical classification of the project site is non-aggressive. Interpretation of these data should be communicated with the project's structural engineer.

## Embankment Construction

Based on the conceptual plans by HNTB, fill will be placed to support the bridge approach slabs and extend beyond the bridge, whereas cut excavation is expected in front of the end abutments to create a shelf leading to the creek banks with relatively short 2H:1V rip rap lined slopes shown at the end abutment positions. Bulk samples were obtained near both end bents from the top 5 feet of existing embankment material. Per our scope, a bulk sample was tested for soil classification and was also remolded to about 95% of the Standard-effort Proctor prior to being tested for shear strength envelopes under CU Triaxial Compression with pore pressure readings. Test results are presented in Appendix B and summarized in the table below.

Sample No.	Station	Offset (ft)	Sample Depth (ft)	USCS Soil Type	Compaction		Shear Strength <sup>1</sup>	
					Optimum Moisture (%)	Max Dry Density (pcf)	Total	Effective
S-37-51-1/2 Bulk	110+72 111+99	5 L 4 L	0 – 5	SC	18.8	103.0	c=1.5 psi ø=15°	c'=0.6 psi ø'=27°

1. Based on a maximum deviator stress failure criterion

## Geotechnical Baseline Report

S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek | Oconee County, SC  
April 11, 2025 | Terracon Project No. 8623P180 | SCDOT Project ID: P041166



## Closure

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or we may be of further service, please contact us.

Sincerely,

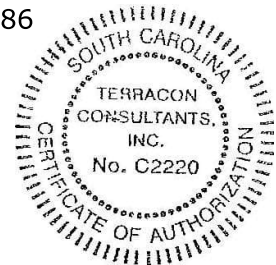
**Terracon Consultants, Inc.**

A handwritten signature in black ink that reads 'Maggie McKenney'.

Maggie McKenney, EIT  
Senior Staff Engineer

A circular professional seal for Jonathan Ard, a Licensed Professional Engineer in South Carolina, No. 30886. The seal is stamped in blue ink and includes the text 'SOUTH CAROLINA', 'LICENSED PROFESSIONAL ENGINEER', and 'JONATHAN ARD'.

Jonathan Ard, PE  
Manager, Regional Services  
SC Registration No. 30886



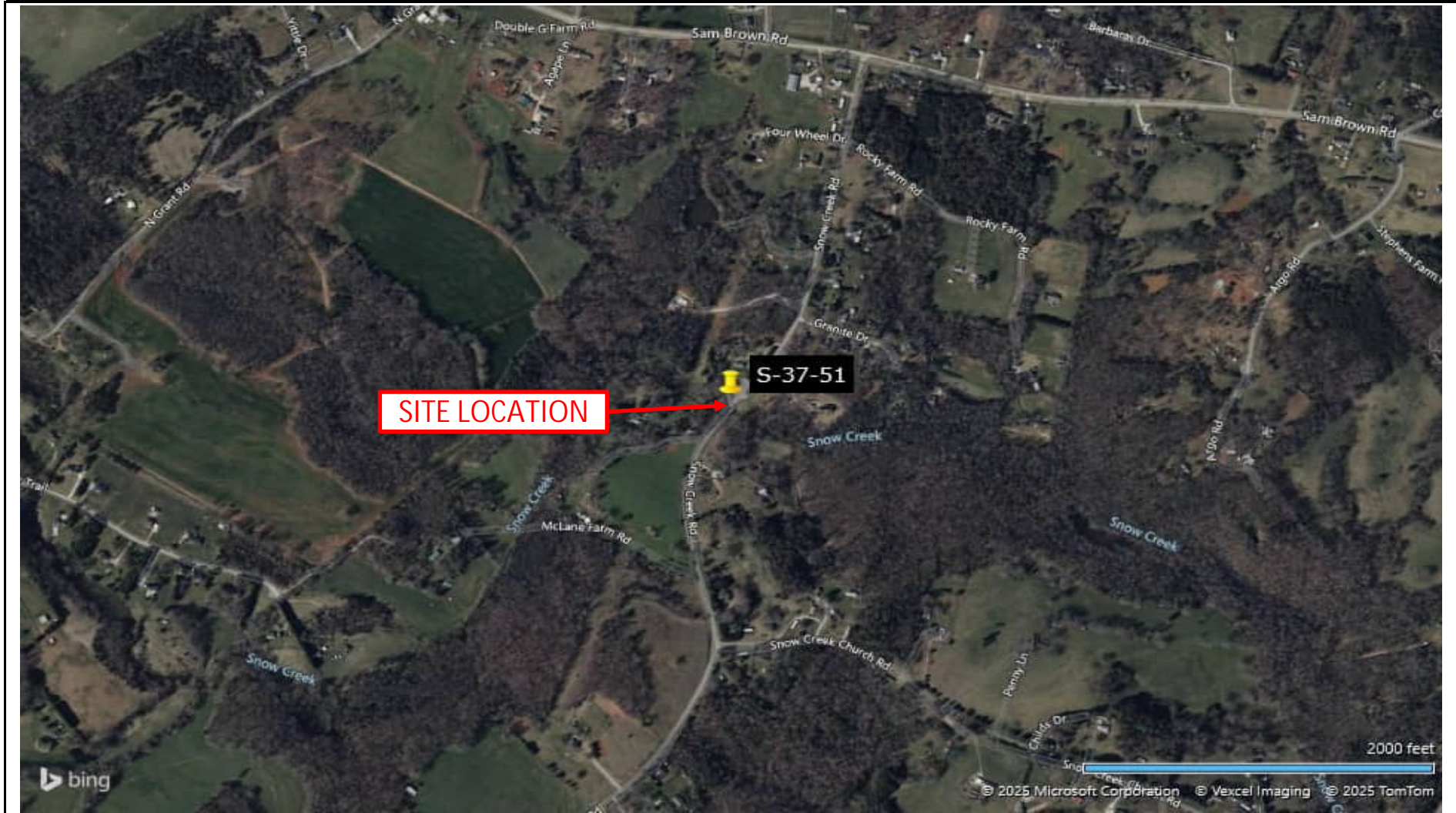
## **Appendix A**

### **Field Exploration**

- Exhibit A-1 – Site Location Map
- Exhibit A-2 – Aerial Exploration Plan
- Exhibit A-3 – Exploration Location Diagram
- Exhibit A-4 – Field Testing Summary
- Exhibit A-5 – GeoScoping Form (2 Pages)
- Exhibit A-6 – Field Exploration Description (3 Pages)
- Exhibit A-7 – Soil/Rock Description Terms (2 Pages)
- Exhibit A-8 – Soil/Rock Symbols
- Exhibit A-9 – Soil Test Logs (4 Pages)
- Exhibit A-10 – Grout Logs (4 Pages)
- Exhibit A-11 – Rock Core Photograph Logs (2 Pages)
- Exhibit A-12 – Geophysical Testing Results
- Exhibit A-13 – CPT Sounding Logs (2 Pages)

Note: All exhibits are one page unless noted above





AERIAL PHOTOGRAPHY PROVIDED BY BING  
 DIAGRAM IS FOR GENERAL LOCATION ONLY,  
 AND IS NOT INTENDED FOR CONSTRUCTION  
 PURPOSES

Project Mgr:	JA	Project No.	8623P180
Drawn by:	MM	Scale:	AS SHOWN
Checked by:	JA	Date:	4/7/2025
Approved by:	JA		

**ierracon**  
 72 POINTE CIR  
 GREENVILLE, SC 29615

**SITE LOCATION MAP**  
**S-37-51 (Snow Creek Road) Bridge**  
**Replacement over Snow Creek**  
 Oconee County, SC P041166

**EXHIBIT**  
**A-1**



AERIAL PHOTOGRAPHY PROVIDED BY BING  
DIAGRAM IS FOR GENERAL LOCATION ONLY,  
AND IS NOT INTENDED FOR CONSTRUCTION  
PURPOSES

Project Mgr:	JA	Project No.	8623P180
Drawn by:	MM	Scale:	AS SHOWN
Checked by:	JA	Date:	4/7/2025
Approved by:	JA		

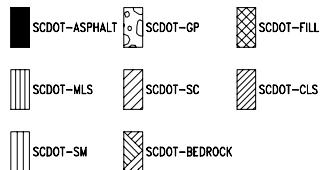


AERIAL EXPLORATION PLAN	
S-37-51 (Snow Creek Road) Bridge	
Replacement over Snow Creek	
Oconee County, SC	P041166

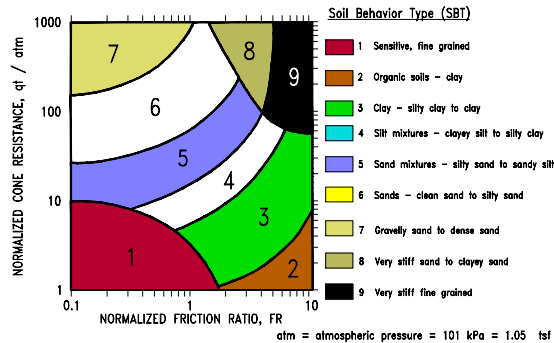
EXHIBIT  
**A-2**

## LEGEND

APPROXIMATE EXPLORATION LOCATION

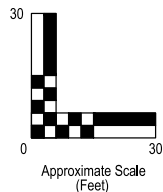


CPT Soil Classification Graphic Symbols

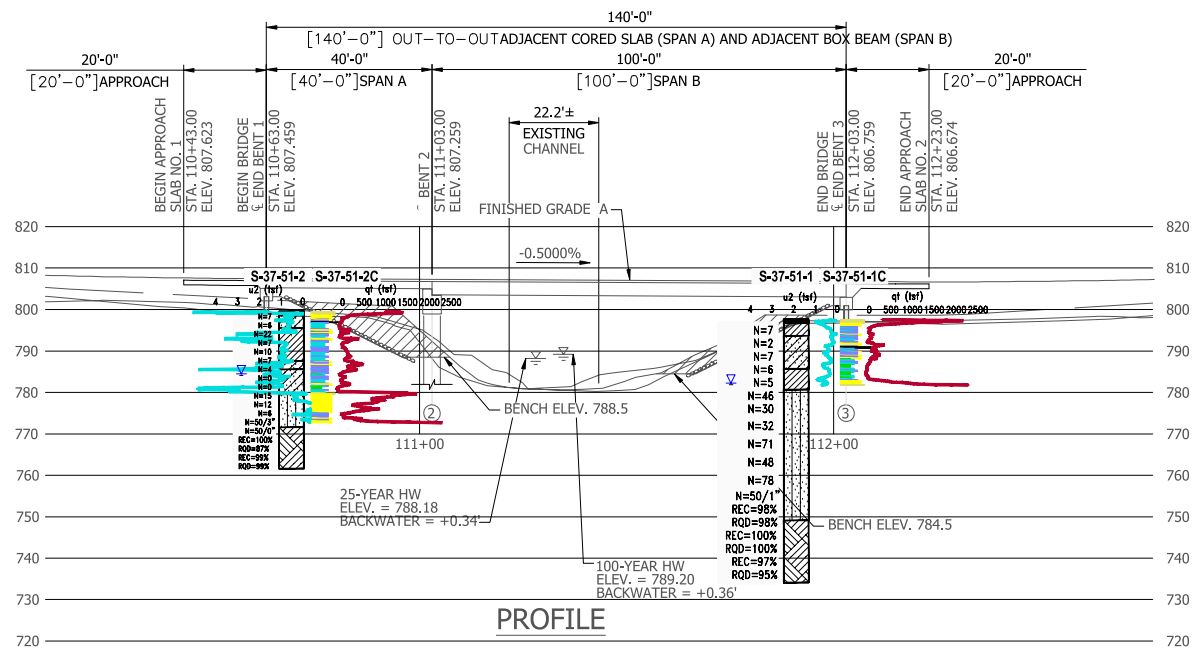
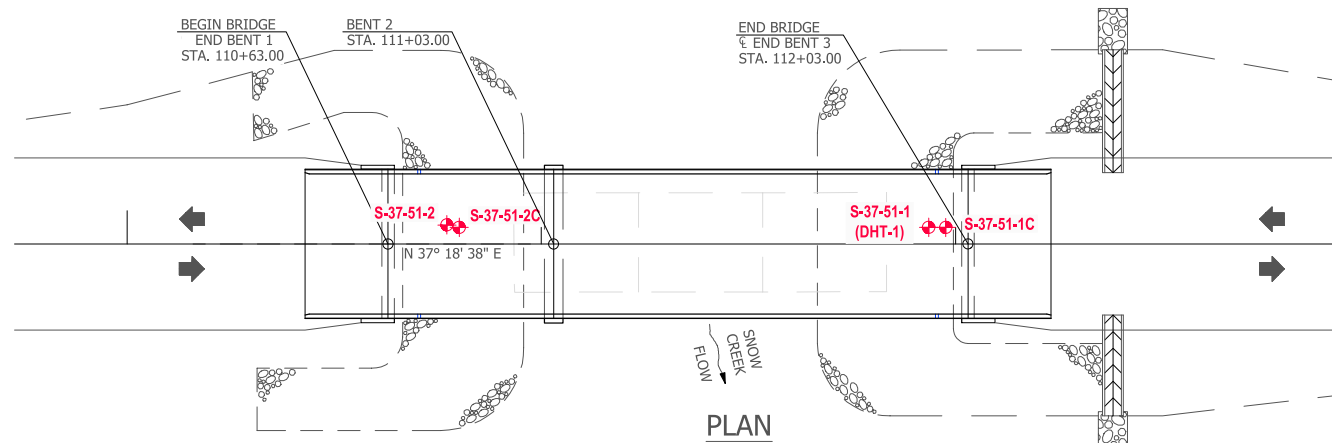


Water Level Reading at time of drilling.

Water Level Reading after drilling.



THIS DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES



Project Mgr: MM  
Drawn By: RLW  
Checked By: MM/MRF  
Approved By: JNA

Project No. 8623P180  
Scale: AS SHOWN  
File No. 8623P180 PC  
Date: APRIL 2025

**Terracon**  
T2 Points Circle Greenville, SC 29615  
864-292-2801 864-292-3361

EXPLORATION LOCATION DIAGRAM  
SCDOT PROJECT ID: P041166  
S-37-51 (SNOW CREEK ROAD) BRIDGE REPLACEMENT  
OVER SNOW CREEK  
OCONEE COUNTY, SOUTH CAROLINA

EXHIBIT  
A-3



Field Testing Summary - Exhibit A-4

S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek | Oconee County, SC

Terracon Project No.: 8623P180 | SCDOT Project ID: P041166



Test Number	Type	Test Hole Local	Northing	Easting	Latitude	Longitude	Station <sup>1</sup>	Offset <sup>1</sup>	Elevation <sup>2</sup> (ft)	Depth (ft)
S-37-51-1	STB	End Bridge	1021085.82	1400032.40	34.623801	-82.994393	111+93	4-L	798.7	63.6
S-37-51-1C	CPT	End Bridge	1021089.28	1400034.85	34.623810	-82.994386	111+97	3.8-L	798.6	15.9
S-37-51-2	STB	Begin Bridge	1021007.20	1399971.75	34.623581	-82.994590	110+77	4.6-L	800.9	38.0
S-37-51-2C	CPT	Begin Bridge	1021007.99	1399972.64	34.623584	-82.994587	110+80	4.4-L	800.9	26.9

1. Stations and offsets are based on the state plane coordinates collected by Thomas & Hutton, and Terracon measuring from the centerline.
2. Elevations are based on NAVD 88.
3. A composite bulk sample was collected approximately 6 feet northeast of S-37-51-1 and 5 feet southwest of S-37-51-2.

## Exhibit A-5: GeoScoping Form

PROJECT INFORMATION			
Project ID:	P041166	Date of Trip:	12/14/2023
County:	Oconee	Location:	Seneca
Rd/ Route:	S-37-51	Local Name:	Snow Creek Road
Attendees:	M. McKenney		

EXISTING BRIDGE INFORMATION			
Bridge Length:	90 ft	Bridge Width:	26 ft
Superstructure Type:	Concrete framing and decking	Substructure Type:	Timber Piles
Begin Bridge Sta <sup>1</sup> :	110+63	End Bridge Sta <sup>1</sup> :	112+03
Begin Bridge Embankment Sta <sup>1</sup> :	109+63	End Bridge Embankment Sta <sup>1</sup> :	113+03
Structure Number:	01892	Posted Weight Limit:	21 tons
Crossing:	Snow Creek	Skew:	N/A
Latitude:	34.62367°	Longitude:	-82.99451°
Existing Fill Height:	approx 12 to 14 ft	Approx Existing Slope Angle:	2H:1V
1. Begin & End Bridge Embankment 100 ft down Sta. or up Sta., respectively. Sta. estimated from overlay of bridge plan provided by HNTB.			

EXISTING ROADWAY EMBANKMENT INFORMATION			
Begin Project Sta:	109+00	Begin Bridge Embankment Sta:	109+63
Accessibility Issues:	None Observed		
Ground Cover:	Asphalt pavement and grassed shoulders		
Existing Fill Height:	14 feet, sloping	Approx Existing Slope Angle:	2H:1V
Local Development:	developed - residential		
Topography:	graded slope to creek		
Traffic Control Necessary:	Yes		
Surface Soils:	clayey sand	Muck:	No
Exposed Rock in Stream Bed:	No	Exposed Rock in banks:	No
Wetlands on Site:	Yes	Wetland Adjacent:	Yes
Depth FG to Water:	18 feet	Water Depth:	0.5 feet
Depth to Existing Ground:	approximately 18.5 feet at center of bridge		
Scour Condition at EB:	Critical	Scour Condition at IB:	Critical

End Bridge Embankment Sta:	113+03	End Project Sta:	114+00
Accessibility Issues:	None Observed		
Ground Cover:	Asphalt pavement and grassed shoulders		
Existing Fill Height:	12 feet, sloping	Approx Existing Slope Angle:	2H:1V
Local Development:	developed - residential		
Topography:	graded slope to creek		
Traffic Control Necessary:	Yes		
Surface Soils:	sandy lean clay	Muck:	No
Exposed Rock in Stream Bed:	No	Exposed Rock in banks:	No
Wetlands on Site:	Yes	Wetland Adjacent:	Yes
Depth FG to Water:	18 feet	Water Depth:	0.5 feet
Depth to Existing Ground:	approximately 18.5 feet at center of bridge		
Scour Condition at EB:	Critical	Scour Condition at IB:	Critical

## Exhibit A-5: GeoScoping Form

UTILITIES INFORMATION	
Attached:	An AT&T telecommunications line was observed to be attached along the northwest side of the bridge.
Above Ground:	Overhead power was observed crossing diagonally over the bridge.
Underground:	An underground gas line was observed along the northwest side of the bridge. An underground water line was observed along the southeast side of the bridge.

Comments:

## **Field Exploration Description Overview**

The testing locations were determined by Terracon and submitted to SCDOT for approval. Terracon located the test locations in the field using handheld GPS and measurements from existing structures shown on the provided drawings. The borings were surveyed by Thomas & Hutton after testing and drilling was complete. The locations, as shown in the Exploration Plans, are shown to the scale indicated.

A field log of each test location was prepared by our engineer. The final boring logs included with this report represent the engineer's description of the encountered conditions modified as necessary based on laboratory test results of the individual samples.

### **Soil Test Borings (STB)**

All boring and sampling operations were conducted in general accordance with the following procedures:

- SCDOT Geotechnical Design Manual 2022
- ASTM D5783, "Standard Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geo-environmental Exploration"
- ASTM D6151, "Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling"
- ASTM D1586 "Test Method for Penetration Test and Split-Barrel Sampling of Soils"
- ASTM D4220 "Standard Practices for Preserving and Transporting Soil"
- ASTM D2113 "Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration"
- ASTM D5079 "Standard Practices for Preserving and Transporting Rock Core Samples"

Each soil test boring was advanced using rotary wash drilling techniques. Soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel sampler, also known as a standard split-spoon. The sampler is advanced into the soil a total of 18 to 24 inches by striking the drill rod using a 140-pound automatic hammer falling 30 inches. The number of blows required to advance the sampler for each of three to four, 6-inch increments is recorded. The sum of the number of blows for the second and third increments is called the "Standard Penetration Value", or N-value ( $N_{meas}$ , blows per foot). The N-value, when properly evaluated, is an index to the soil strength.

Soil classification provides a general guide to the engineering properties of various soil types and enables the engineer to apply his experience to current situations. In our exploration, samples obtained during drilling operations are examined and visually classified by a geotechnical engineer using the procedures outlined in ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System). Laboratory testing was also performed on select split-spoon samples to evaluate index properties for further classification. The soils are described according to color, texture, and relative density or

consistency (based on standard penetration resistance). The designations shown on the logs are described in the 2022 SCDOT Geotechnical Design Manual, Chapter 6.

The borings were advanced either to the planned drilling depth at which they were terminated, or to refusal of the drilling equipment. Select borings were continued below this depth using diamond bit rock coring techniques. NQ2 sized cores were recovered from the borehole. The rock recovery ratios (REC, percentage of the total core run), Rock Quality Designation (RQD, percentage of the total core run of pieces greater than 4 inches) were recorded along with a description of the rock. An explanation of the rock descriptions shown on the logs is provided in the SCDOT GDM Chapter 6. Photos of the recovered rock core specimens are provided in the Rock Core Photograph Log.

Groundwater readings were collected from the soil test borings after 24 hours if site constraints allowed the borings to stay open. If collected, water levels are indicated on the boring logs. The borings were advanced using mud rotary drilling techniques, and time-of-drilling water levels may not be reliable.

At the conclusion of the work, the boreholes holes were backfilled with the drill cuttings and clean sand. The upper 20 feet of the tests in the existing roadways and embankments were grouted with a cement bentonite grout. Test locations performed in existing pavements were capped with cold-patch asphalt.

### **Cone Penetration Test (CPT) Soundings**

Cone Penetration Test soundings were conducted in accordance with ASTM D5778 *Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils*.

### **Downhole Shear Wave Velocity Test (DHT)**

One downhole seismic test was performed in a cased borehole drilled for this project. After the test boring was completed, the boring was filled with a fluid water/cement/bentonite grout and then a threaded PVC pipe casing (capped at the bottom end) was inserted into the borehole, providing a uniform bond between the soil and pipe exterior.

The downhole seismic test consisted of placing two downhole triaxial geophones at selected depth intervals in the borehole casing. The geophone was connected to a recording device (Seismic Source Daq Link 5 Seismograph) at the surface and clamped to the side of the casing at the selected test depth. The geophones are equipped with a spring-arm that is released at the bottom of the boring. The spring expands and forces the geophone against the casing wall. The interval between each geophone and each test depth was 3 feet for the entire depth of the cased borehole. An instrumented hammer was then used to strike a steel plate with cleats at the bottom (often called a shear wave golf shoe) that penetrated the ground and prevented sliding when struck. The steel plate was oriented to generate horizontal shear waves (SH) at the surface. An additional plate was also struck to better produce compression waves. The horizontal distance was measured, and the plate was set exactly 10 feet from the

**Exhibit A-6 – Field Exploration Description**

S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek | Oconee County, SC  
Terracon Project No. 8623P180 | SCDOT Project ID: P041166



borehole. The recorder was set to record the arrival times of the shear waves at the geophone locations. At least 15 blows (5 in each direction on the golf shoe, and 5 on the steel plate) were struck for each test depth to electronically stack and polarize the observed data, and to increase the signal-to-noise ratio. The data was stored on computer disks for processing and computation. The geophone was raised to the next depth interval and the process was repeated.

Shear Wave Velocity Test Results shows the downhole shear wave velocity and compressive wave velocity test results. The data was evaluated using the Fixed Interval method. S-wave arrival times using the Interval method were picked based on the onset of the signal (first break) as observed in the software package TomTime by GeoTom.

## SOIL DESCRIPTION TERMS

### Relative Density/Consistency Terms

<u>Relative Density</u> <sup>1</sup>			<u>Consistency</u> <sup>2</sup>		
Descriptive Term	Relative Density	SPT Blow Count	Descriptive Term	Unconfined Compression Strength (q <sub>u</sub> ) (tsf)	SPT Blow Count
Very Loose	0 to 15%	4 and less	Very Soft	0.25 and less	2 and less
Loose	16 to 35%	5 to 10	Soft	0.26 to 0.50	3 to 4
Medium Dense	36 to 65%	11 to 30	Firm	0.51 to 1.00	5 to 8
Dense	66 to 85%	31 to 50	Stiff	1.01 to 2.00	9 to 15
Very Dense	86 to 100%	51 and more	Very Stiff	2.01 to 4.00	16 to 30
			Hard	4.01 and more	31 and more

### Moisture Condition

<u>Descriptive Term</u>	<u>Criteria</u>
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually in coarse-grained soils below the water table

### Color

Describe the sample color while sample is still moist.

### Angularity<sup>1</sup>

<u>Descriptive Term</u>	<u>Criteria</u>
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

### HCl Reaction<sup>3</sup>

<u>Descriptive Term</u>	<u>Criteria</u>
None Reactive	No visible reaction
Weakly Reactive	Some reaction, with bubbles forming slowly
Strongly Reactive	Violent reaction, with bubbles forming immediately

### Cementation<sup>3</sup>

<u>Descriptive Term</u>	<u>Criteria</u>
Weakly Cemented	Crumbles or breaks with handling or little finger pressure
Cemented	Crumbles or breaks with considerable finger pressure
Strongly Cemented	Will not crumble or break with finger pressure

### Particle-Size Range<sup>1</sup>

<u>Gravel</u>	Diameter, mm	Sieve Size	<u>Sand</u>	Diameter, mm	Sieve Size
Fine	4.76 to 19.1	#4 to ¾ inch	Fine	0.074 to 0.42	#200 to #40
Coarse	19.1 to 76.2	¾ inch to 3 inch	Medium	0.42 to 2.00	#40 to #10
			Coarse	4.00 to 4.76	#10 to #4

### Primary Soil Type<sup>1, 2</sup>

The primary soil type will be shown in all capital letters.

### USCS Soil Designation

Indicate USCS soil designation as defined in ASTM D-2487 and D-2488

### AASHTO Soil Designation

Indicate AASHTO soil designation as defined in AASHTO M-145 and ASTM D-3282

<sup>1</sup>Applies to coarse-grained soils (major portion retained on No. 200 sieve)

<sup>2</sup>Applies to fine-grained soils (major portion passing No. 200 sieve)

<sup>3</sup>Use as required

## DESCRIPTION OF ROCK PROPERTIES

### WEATHERING

Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately Severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

### HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

### Joint, Bedding, and Foliation Spacing in Rock<sup>a</sup>

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

<sup>a</sup>Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.

### Rock Quality Designation (RQD)<sup>a</sup>

RQD, as a percentage	Diagnostic Description
Exceeding 90	Excellent
90 – 75	Good
75 – 50	Fair
50 – 25	Poor
Less than 25	Very poor

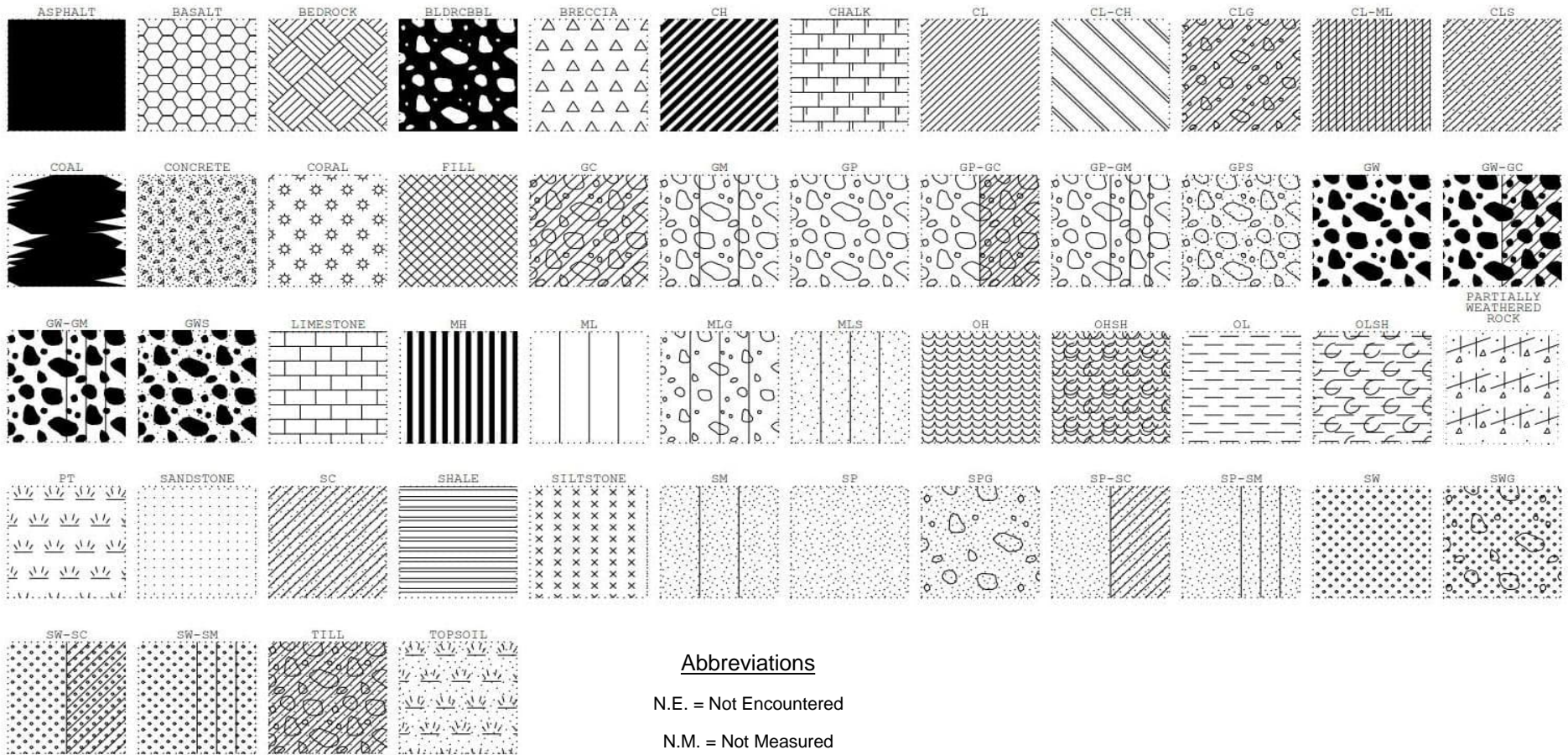
<sup>a</sup>RQD (given as a percentage) = length of core in pieces 4 in. and longer/length of run.

### Joint Openness Descriptors

Openness	Descriptor
No Visible Separation	Tight
Less than 1/32 in.	Slightly open
1/32 to 3/8 in.	Moderately open
1/8 to 3/8 in.	Open
3/8 in. to 0.1 ft.	Moderately wide
Greater than 0.1 ft.	Wide

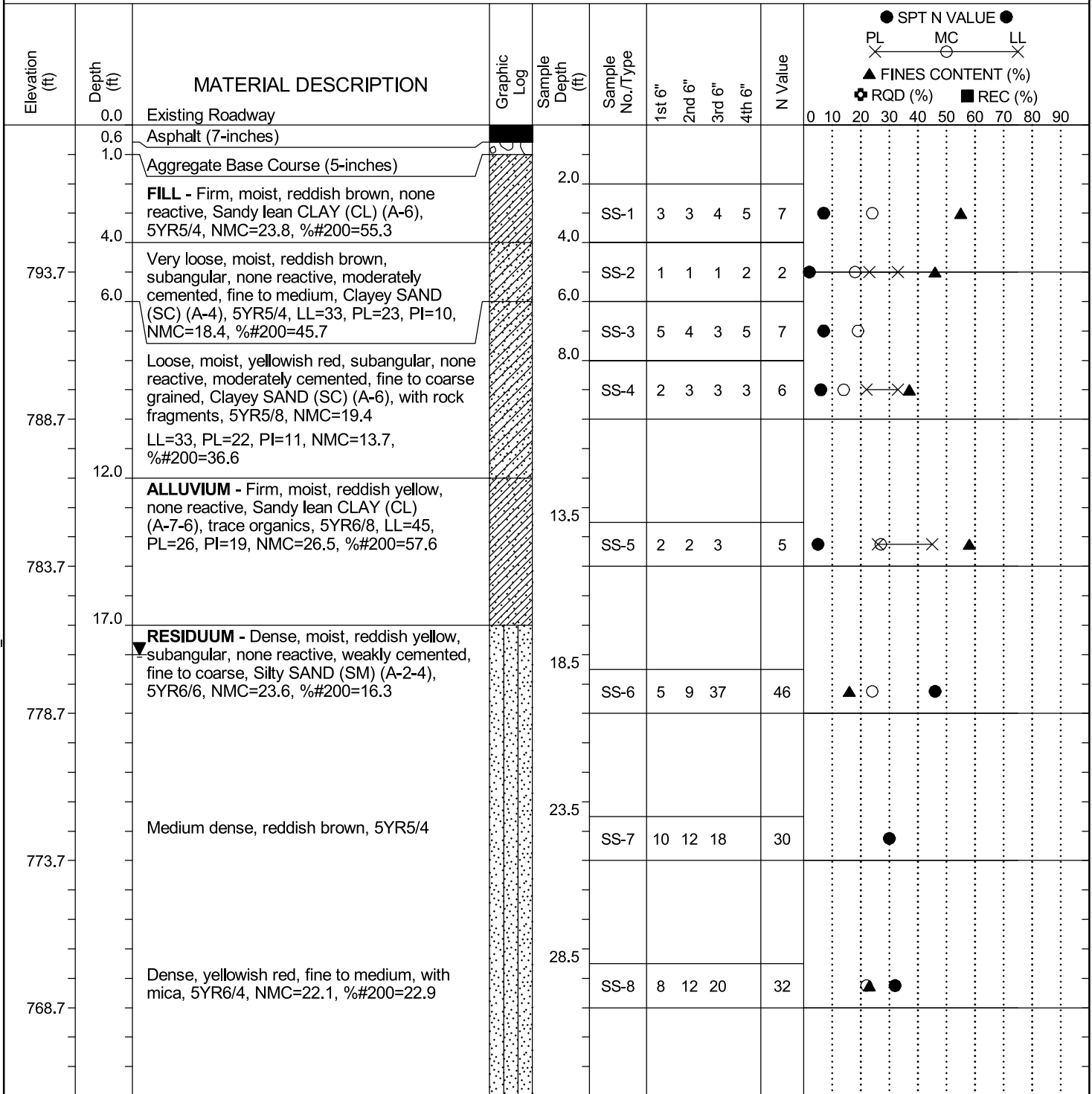
References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.





Project Manager:	MEM	Project No.	8623P180	 <p>72 Pointe Circle PH. (864) 292-2901</p> <p>Greenville, SC 29615 FAX. (864) 292-6361</p>	<p>SOIL AND ROCK SYMBOLS</p>	<p>Exhibit A-8</p>
Drawn by:	KJZ	Scale:	N.T.S.			
Checked by:	SG	File Name:	Soil – Rock – Log			
Approved by:	DJC	Date:	Jul 2023			

Project ID: P041166				County: Oconee		Boring No.: S-37-51-1		
Site Description:		S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek					Route: S-37-51	
Eng./Geo.: M. McKenney		Boring Location: 111+93		Offset: 4L		Alignment: Existing		
Elev.: 798.7 ft		Latitude: 34.623801		Longitude: -82.994393		Date Started: 12/14/2023		
Total Depth: 63.6 ft		Soil Depth: 48.6 ft		Core Depth: 15 ft		Date Completed: 12/14/2023		
Bore Hole Diameter (in): 4		Sampler Configuration		Liner Required: Y (N)		Liner Used: Y (N)		
Drill Machine: DR#554		Drill Method: RW/RC		Hammer Type: Automatic		Energy Ratio: 88.5%		
Core Size: NQ2		Driller: B. Burnette		Groundwater: TOB N.M.		24HR 18 ft		

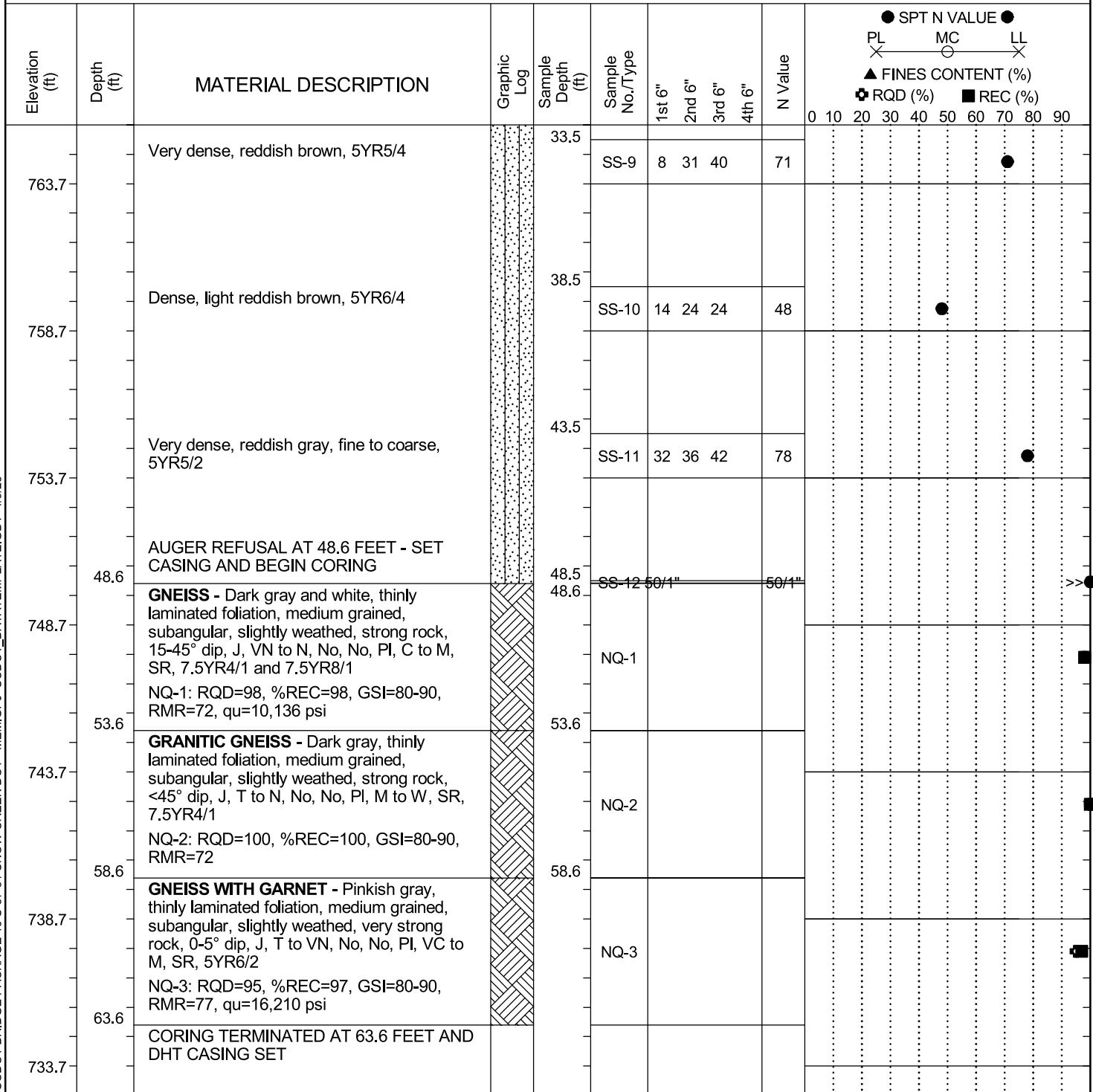


## LEGEND

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	

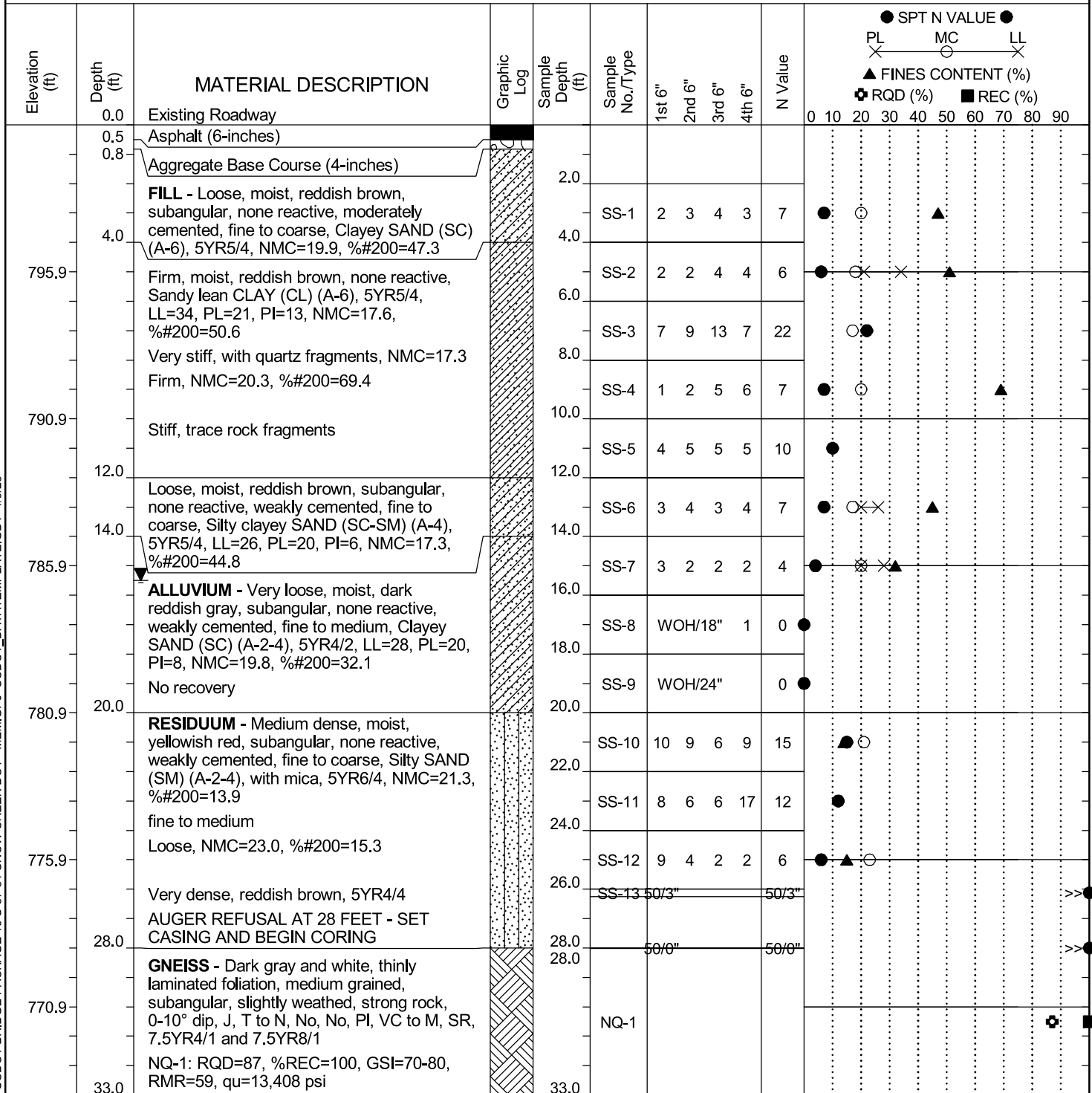
<b>Project ID:</b>	P041166	<b>County:</b>	Oconee	<b>Boring No.:</b>	S-37-51-1
<b>Site Description:</b>	S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek			<b>Route:</b>	S-37-51
<b>Eng./Geo.:</b>	M. Mc Kenney	<b>Boring Location:</b>	111+93	<b>Offset:</b>	4L
<b>Elev.:</b>	798.7 ft	<b>Latitude:</b>	34.623801	<b>Longitude:</b>	-82.994393
<b>Date Started:</b>	12/14/2023				
<b>Total Depth:</b>	63.6 ft	<b>Soil Depth:</b>	48.6 ft	<b>Core Depth:</b>	15 ft
<b>Date Completed:</b>	12/14/2023				
<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>	DR#554	<b>Drill Method:</b>	RW/RC	<b>Hammer Type:</b>	Automatic
<b>Energy Ratio:</b>	88.5%				
<b>Core Size:</b>	NQ2	<b>Driller:</b>	B. Burnette	<b>Groundwater:</b>	TOB N.M.
<b>24HR</b>	18 ft				



## LEGEND

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

<b>Project ID:</b>	P041166	<b>County:</b>	Oconee	<b>Boring No.:</b>	S-37-51-2
<b>Site Description:</b>	S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek			<b>Route:</b>	S-37-51
<b>Eng./Geo.:</b>	M. McKenney	<b>Boring Location:</b>	110+77	<b>Offset:</b>	4.6L
<b>Elev.:</b>	800.9 ft	<b>Latitude:</b>	34.623581	<b>Longitude:</b>	-82.99459
<b>Date Started:</b>	12/14/2023				
<b>Total Depth:</b>	38 ft	<b>Soil Depth:</b>	28 ft	<b>Core Depth:</b>	10 ft
<b>Date Completed:</b>	12/14/2023				
<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>	DR#554	<b>Drill Method:</b>	RW/RC	<b>Hammer Type:</b>	Automatic
<b>Energy Ratio:</b>	88.5%				
<b>Core Size:</b>	NQ2	<b>Driller:</b>	B. Burnette	<b>Groundwater:</b>	TOB N.M.
<b>24HR</b>	15.5 ft				



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	

<b>Project ID:</b>	P041166	<b>County:</b>	Oconee	<b>Boring No.:</b>	S-37-51-2
<b>Site Description:</b>	S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek			<b>Route:</b>	S-37-51
<b>Eng./Geo.:</b>	M. Mc Kenney	<b>Boring Location:</b>	110+77	<b>Offset:</b>	4.6L
<b>Elev.:</b>	800.9 ft	<b>Latitude:</b>	34.623581	<b>Longitude:</b>	-82.99459
<b>Date Started:</b>	12/14/2023				
<b>Total Depth:</b>	38 ft	<b>Soil Depth:</b>	28 ft	<b>Core Depth:</b>	10 ft
<b>Date Completed:</b>	12/14/2023				
<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>	DR#554	<b>Drill Method:</b>	RW/RC	<b>Hammer Type:</b>	Automatic
<b>Energy Ratio:</b>	88.5%				
<b>Core Size:</b>	NQ2	<b>Driller:</b>	B. Burnette	<b>Groundwater:</b>	TOB N.M.
<b>24HR</b>	15.5 ft				

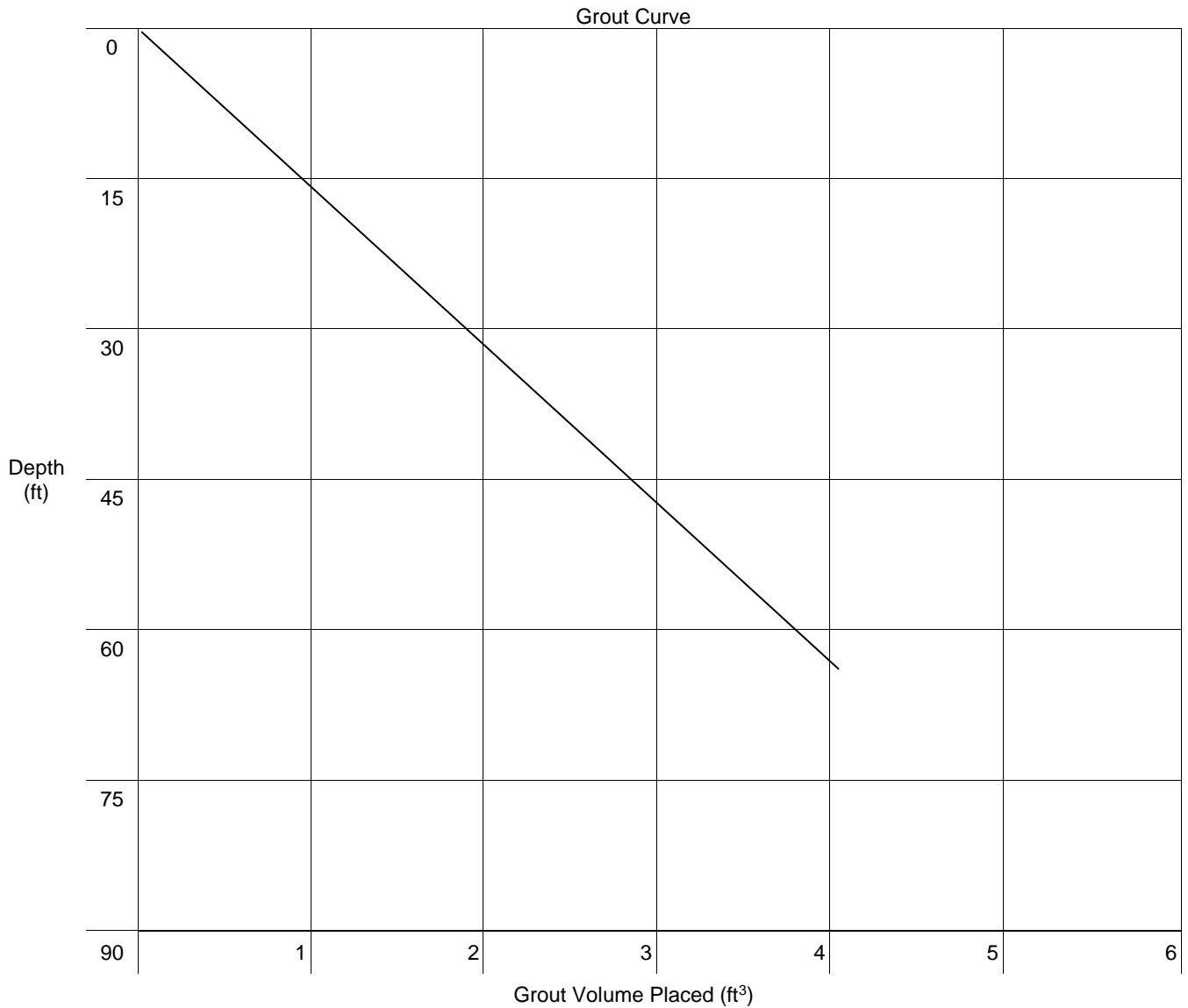
Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value	<div> <div> ● SPT N VALUE ● </div> <div> PL X MC O LL X </div> <div> ▲ FINES CONTENT (%) </div> <div> ⊕ RQD (%) ■ REC (%) </div> </div>
765.9	38.0	<b>GNEISS WITH QUARTZITE</b> - Dark gray and white, thinly laminated foliation, medium grained, subangular, slightly weathered, strong rock, 0-45° dip, J, T to N, Pa, Qz, Pl, M, SR, 7.5YR4/1 and 7.5YR8/1 NQ-2: RQD=99, %REC=99, GSI=80-90, RMR=72, qu=11,560 psi			NQ-2						<div> 0 10 20 30 40 50 60 70 80 90 </div>
760.9		CORING TERMINATED AT 38 FEET									
755.9											
750.9											
745.9											
740.9											
735.9											

## LEGEND

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

## Exhibit A-10: GROUT LOG OF TEST HOLES FOR GEOTECHNICAL ON-CALL

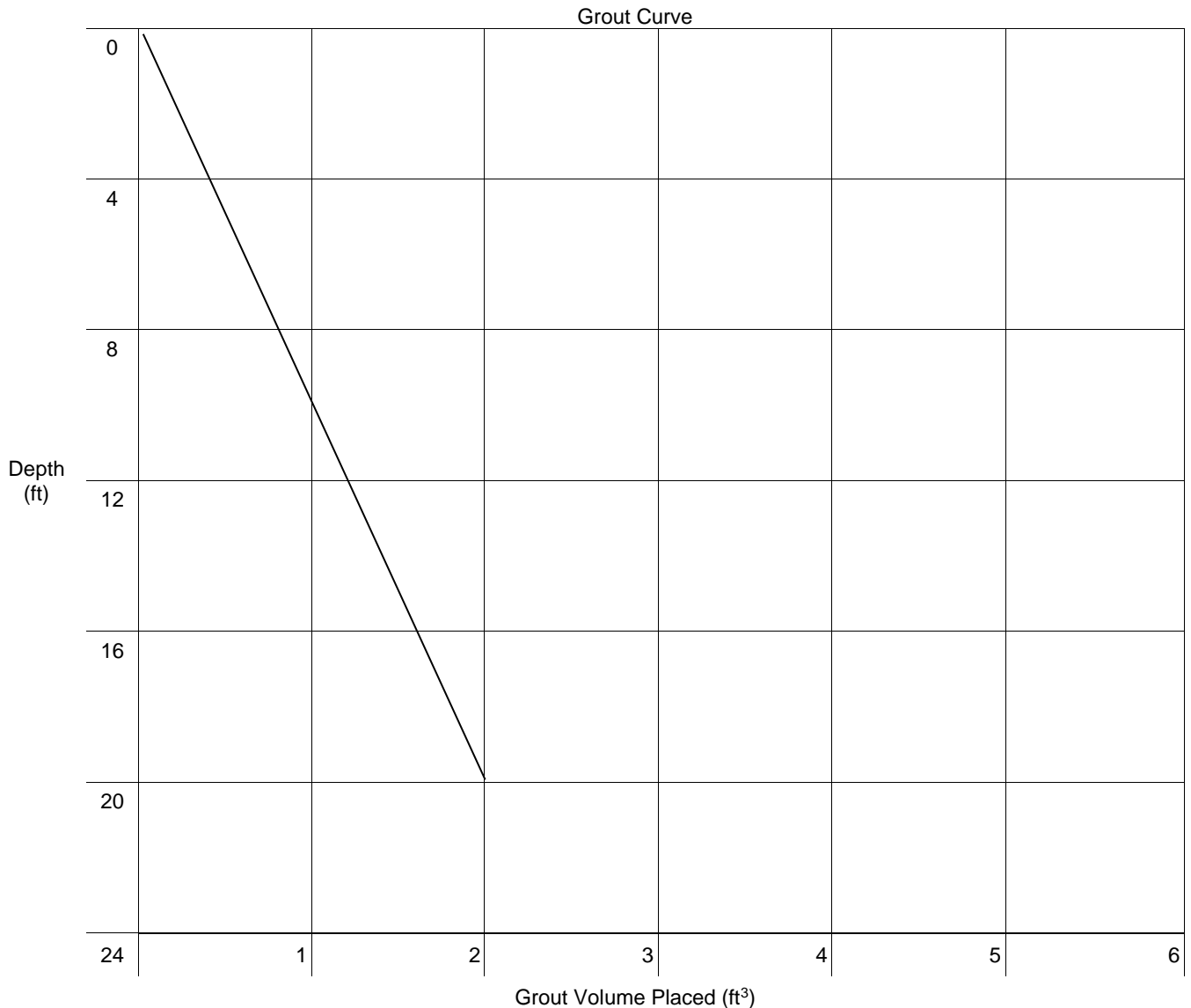
Project Name:	S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek					Test Hole No.:	S-37-51-1
Project ID:	P041166					Station:	111+93
Consultant Firm:	Terracon Consultants, Inc.					Offset:	4L
Grouted By:	Burnette	Date	12/15/23				
Notes:	Mix design: 1 pound cement mix, 1 pound bentonite, 6 pounds water						



Number of Bags On-Site	20	ea.	
Depth of Test Hole Grouted	63	ft.	
Diameter of Test Hole	0.33	ft.	
Area of Test Hole	0.09	ft²	
Volume of Test Hole	5.4	ft³	
Volume of Casing (If applicable)	1.3	ft³	
Theoretical Volume of Test Hole	4.1	ft³	
Number of Bags Used	6.5	ea.	
Volume Placed	4.1	ft³	

## Exhibit A-10: GROUT LOG OF TEST HOLES FOR GEOTECHNICAL ON-CALL

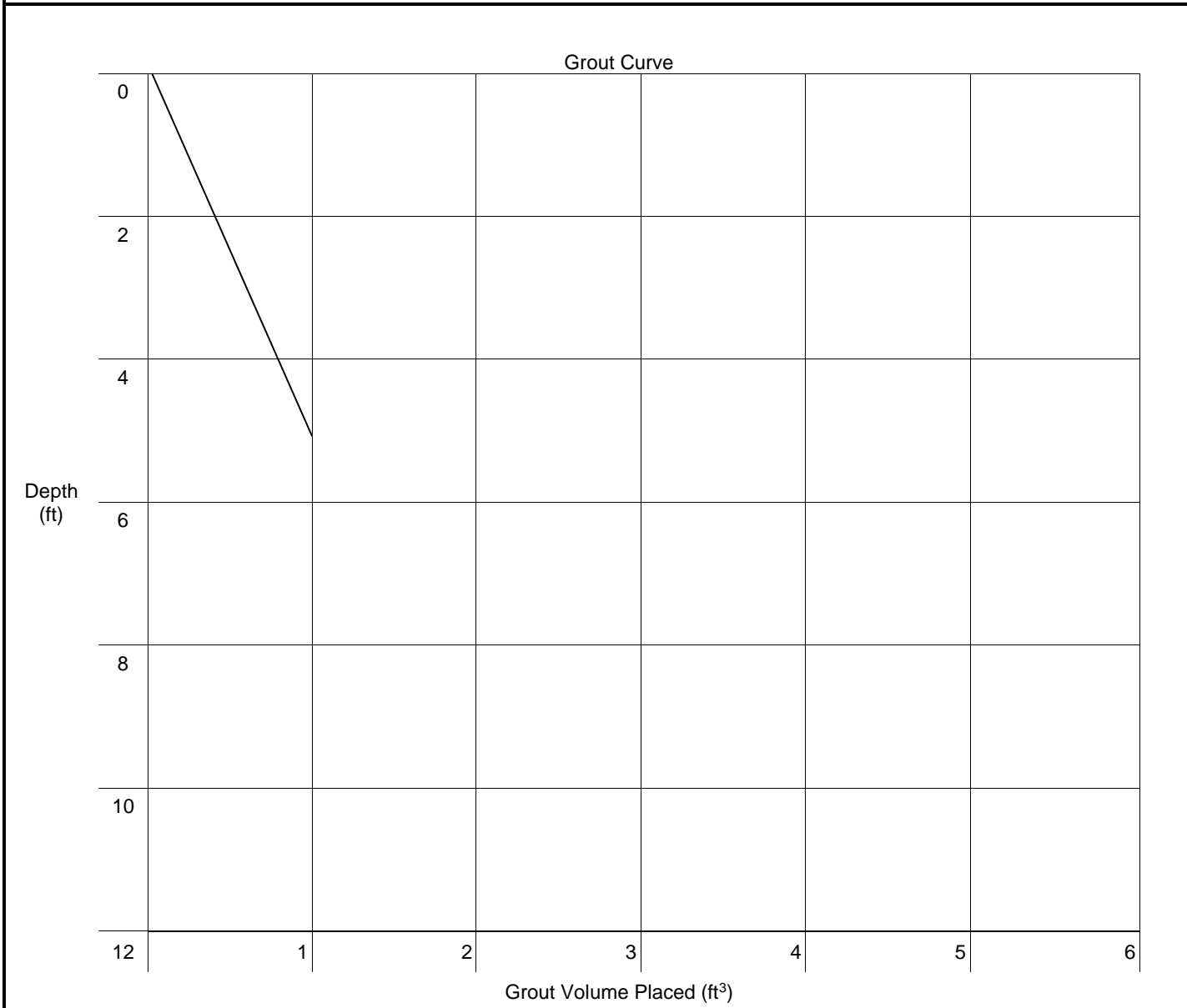
Project Name:	S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek					Test Hole No.:	S-37-51-2
Project ID:	P041166					Station:	110+77
Consultant Firm:	Terracon Consultants, Inc.					Offset:	4.6L
Grouted By:	Burnette	Date	12/15/2023				
Notes:	Mix design: 1 pound cement mix, 1 pound bentonite, 6 pounds water						



Number of Bags On-Site	20	ea.
Depth of Test Hole Grouted	20	ft.
Diameter of Test Hole	0.33	ft.
Area of Test Hole	0.09	ft²
Volume of Test Hole	1.74	ft³
Volume of Casing (If applicable)	-	ft³
Theoretical Volume of Test Hole	1.74	ft³
Number of Bags Used	2.5	ea.
Volume Placed	2	ft³

## Exhibit A-10: GROUT LOG OF TEST HOLES FOR GEOTECHNICAL ON-CALL

Project Name:	S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek		S-37-51-1
Project ID:	P041166	Test Hole No.:	Bulk
Consultant Firm:	Terracon Consultants, Inc.	Station:	111+99
Grouted By:	Burnette	Date	12/15/2023
Notes:	Mix design: 1 pound cement mix, 1 pound bentonite, 6 pounds water		Offset: 4L

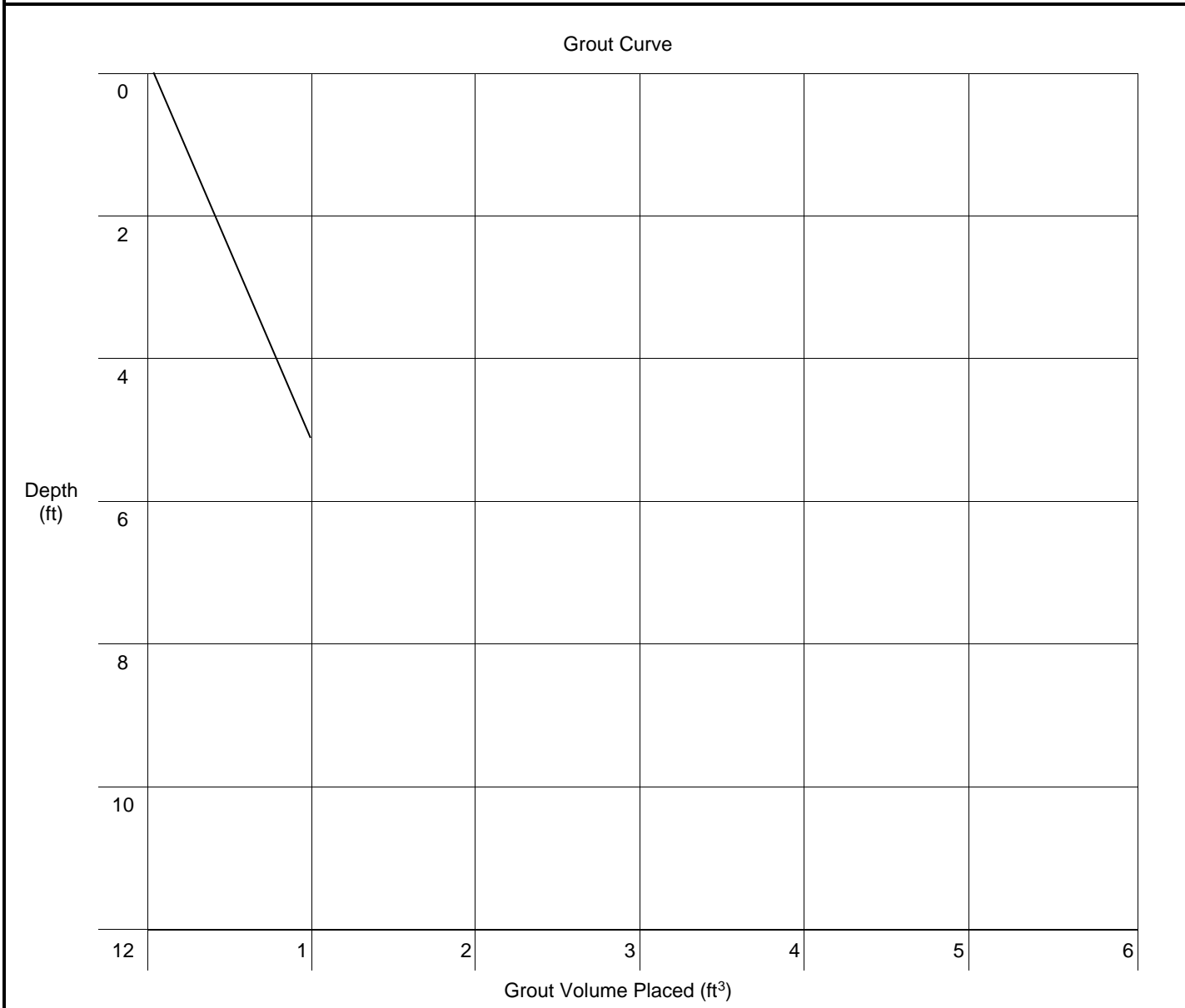


Number of Bags On-Site	20	ea.	
Depth of Test Hole Grouted	5	ft.	
Diameter of Test Hole	0.5	ft.	
Area of Test Hole	0.20	ft <sup>2</sup>	
Volume of Test Hole	1.0	ft <sup>3</sup>	
Volume of Casing (If applicable)	-	ft <sup>3</sup>	
Theoretical Volume of Test Hole	1.0	ft <sup>3</sup>	
Number of Bags Used	2	ea.	
Volume Placed	1.0	ft <sup>3</sup>	



## Exhibit A-10: GROUT LOG OF TEST HOLES FOR GEOTECHNICAL ON-CALL

Project Name:	S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek		S-37-51-2
Project ID:	P041166	Test Hole No.:	Bulk
Consultant Firm:	Terracon Consultants, Inc.	Station:	110+72
Grouted By:	Burnette	Date	12/15/2023
Notes:	Mix design: 1 pound cement mix, 1 pound bentonite, 6 pounds water		Offset: 5L



Number of Bags On-Site	20	ea.	
Depth of Test Hole Grouted	5	ft.	
Diameter of Test Hole	0.5	ft.	
Area of Test Hole	0.20	ft <sup>2</sup>	
Volume of Test Hole	1.0	ft <sup>3</sup>	
Volume of Casing (If applicable)	-	ft <sup>3</sup>	
Theoretical Volume of Test Hole	1.0	ft <sup>3</sup>	
Number of Bags Used	2	ea.	
Volume Placed	1.0	ft <sup>3</sup>	

**Rock Core Photograph Logs – Exhibit A-11**

S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek | Oconee County, SC  
Terracon Project No. 8623P180 | SCDOT Project ID: P041166



S-37-51-1, NQ-1 and NQ-2 (48.6 to 58.6 feet)

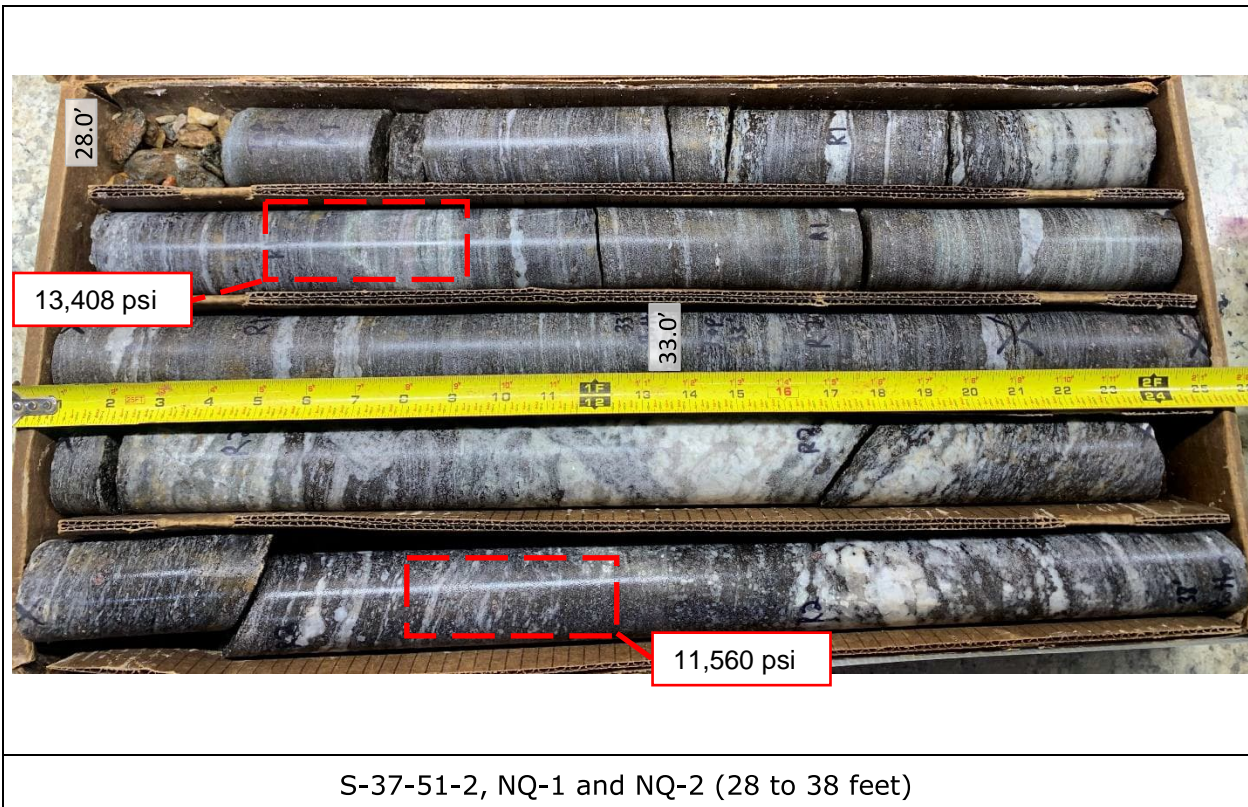


S-37-51-1, NQ-3 (58.6 to 63.6 feet)



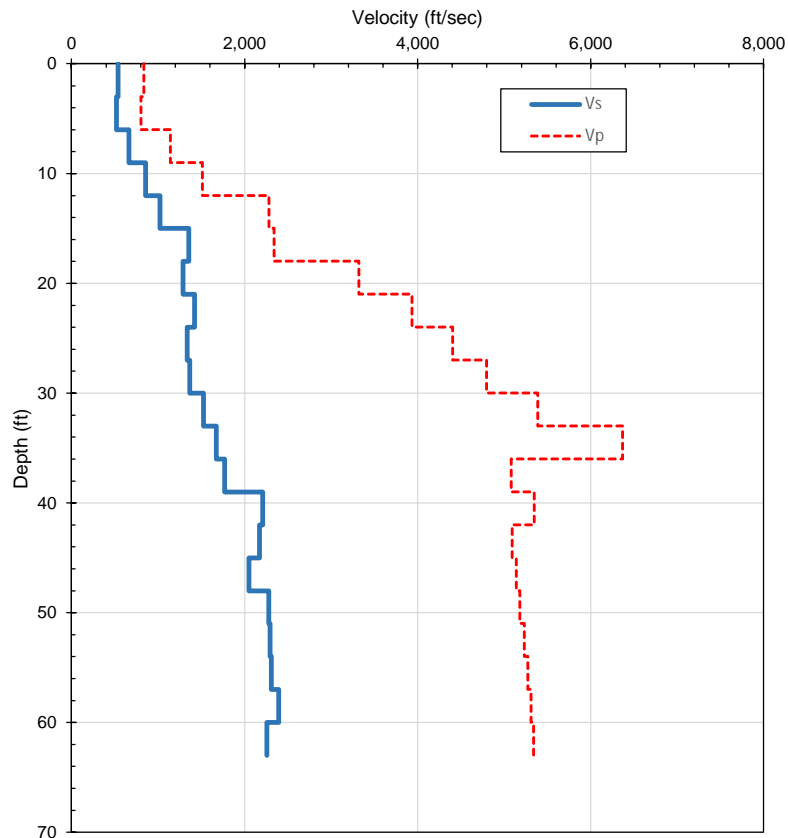
**Rock Core Photograph Logs – Exhibit A-11**

S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek | Oconee County, SC  
Terracon Project No. 8623P180 | SCDOT Project ID: P041166



S-37-51-2, NQ-1 and NQ-2 (28 to 38 feet)

## Downhole Seismic Velocity Fixed Interval Method



Depth (ft)	Vp (ft/sec)	Vs (ft/sec)	Δi (ft)	Δt (sec)	Est. In-Situ Unit Wt (pcf)
3	836	536	3	0.00560	100
6	804	521	3	0.00576	110
9	1143	662	3	0.00453	
12	1513	856	3	0.00350	
15	2284	1020	3	0.00294	
18	2341	1353	3	0.00222	
21	3324	1289	3	0.00233	130
24	3936	1421	3	0.00211	
27	4407	1334	3	0.00225	
30	4800	1366	3	0.00220	
33	5389	1525	3	0.00197	
36	6370	1674	3	0.00179	
39	5083	1767	3	0.00170	
42	5351	2209	3	0.00136	
45	5093	2173	3	0.00138	
48	5142	2049	3	0.00146	
51	5182	2279	3	0.00132	165
54	5234	2294	3	0.00131	
57	5276	2307	3	0.00130	
60	5311	2394	3	0.00125	
63	5341	2258	3	0.00133	
Unit Weight of Soil estimated from SPT results					
Unit Weight of Rock based on average results from compression tests					
Sum of Data Over Profile			63	0.04960	
Weighted Average Shear Wave Velocity Over Profile			1,270 ft/sec		

Project Mgr:	MM
Prepared by:	MM
Checked by:	JA
Approved by:	JA

Project No.	8623P180
Scale:	NA
Date:	2/25/2025



Consulting Engineers and Scientists

72 Pointe Circle  
Ph: (864) 292-2901

Greenville, South Carolina  
Fax: (864) 292-6361

## GEOPHYSICAL TESTING RESULTS

### DOWNHOLE SEISMIC TEST

**S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek  
OCONEE COUNTY, SOUTH CAROLINA**

**P041166**

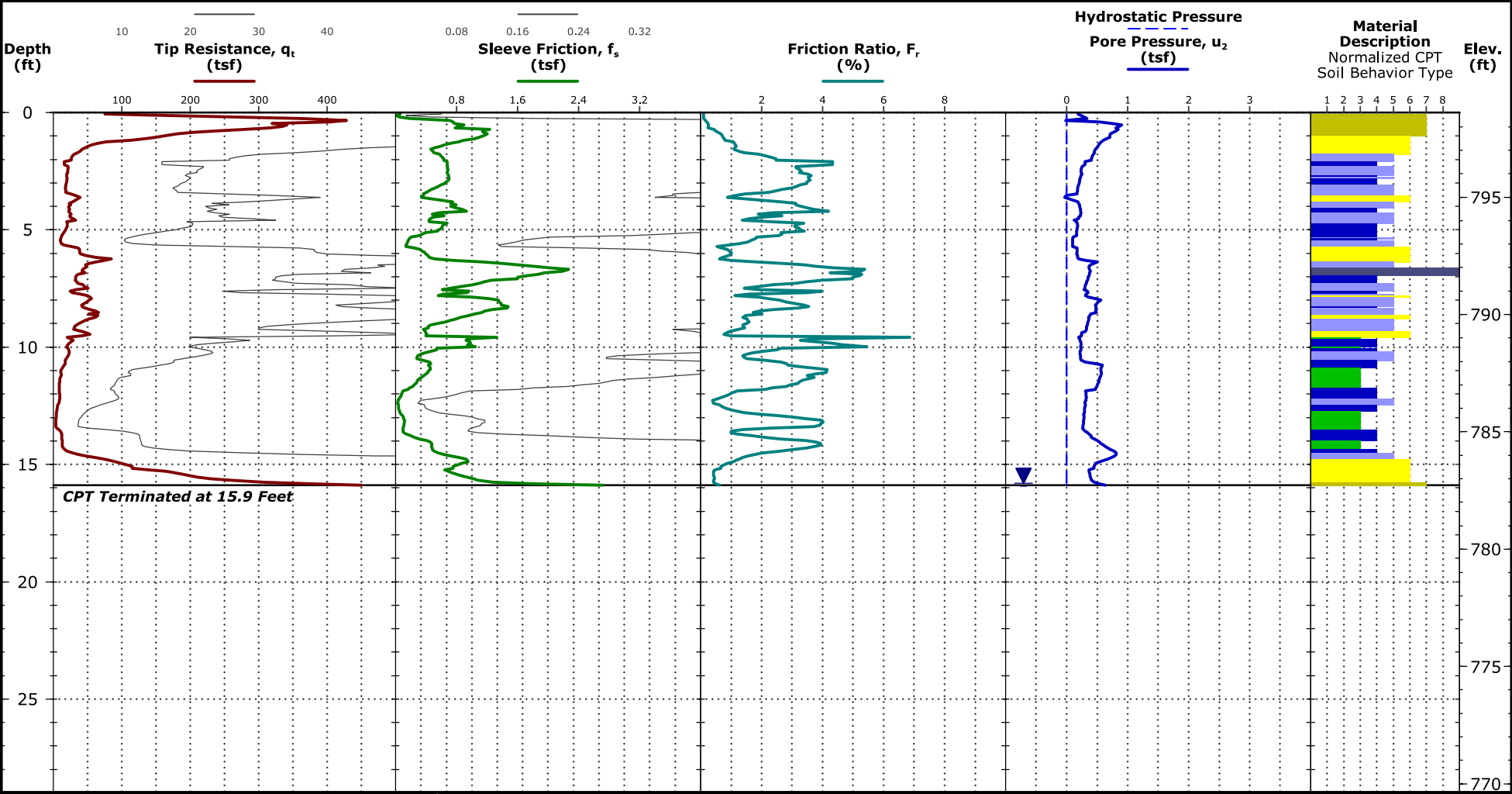
**TEST NO.  
S-37-51-1  
(DHT-1)**

**EXHIBIT  
A-12**

CPT Sounding ID S-37-51-1C

Elevation: 798.6 (ft)  
Elevation Reference: Elevations were surveyed by Thomas & Hutton.

Latitude: 34.623810° Longitude: -82.994386°  
North: 1021089.28 East: 1400034.85  
Station: 111+97 Offset: 3.8L



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

**Notes**

Test Location: See [Exploration Plan](#)

**CPT Equipment**

CPT Rig: CR#CPT03  
Operator: AM/LB  
CPT sensor calibration reports available upon request  
Probe No. 5851 with net area ratio of .86  
 $u_2$  pore pressure transducer location  
Manufactured by Geoprobe Systems- Calibrated 2/16/2024  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 2 in

**Water Level Observation**

▼ 15.8 ft estimated water depth  
(used in normalizations and correlations)

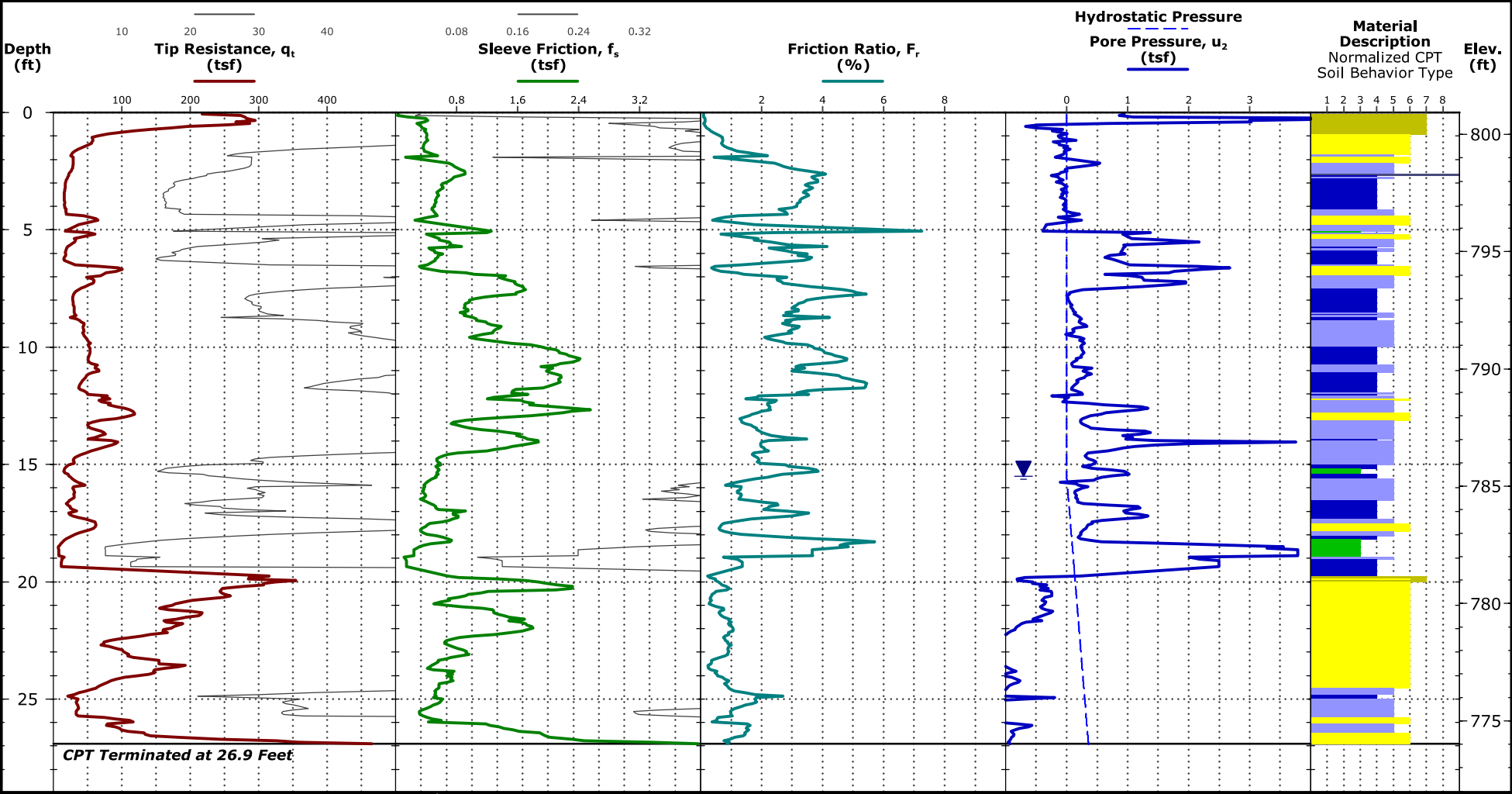
**Normalized Soil Behavior Type**  
(Robertson 1990)

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

CPT Sounding ID S-37-51-2C

Elevation: 800.9 (ft)  
Elevation Reference: Elevations were surveyed by Thomas & Hutton.

Latitude: 34.623584° Longitude: -82.994587°  
North: 1021007.99 East: 1399972.64  
Station: 110+80 Offset: 4.4L



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

**Notes**

Test Location: See [Exploration Plan](#)

**CPT Equipment**

CPT Rig: CR#CPT03  
Operator: AM/LB  
CPT sensor calibration reports available upon request  
Probe No. 5851 with net area ratio of .86  
 $u_2$  pore pressure transducer location  
Manufactured by Geoprobe Systems- Calibrated 2/16/2024  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 2 in

**Water Level Observation**

▼ 15.5 ft estimated water depth  
(used in normalizations and correlations)

**Normalized Soil Behavior Type**  
(Robertson 1990)

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

## **Appendix B – Laboratory Testing**

S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek | Oconee County, SC  
Terracon Project No. 8623P180 | SCDOT Project ID: P041166



# **Appendix B**

## **Laboratory Testing**

Exhibit B-1 – Laboratory Testing Description  
Summary of Laboratory Results  
Laboratory Data Sheets (20 Pages)

Note: All exhibits are one page unless noted above.

## Exhibit B-1 – Laboratory Testing Description

S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek | Oconee County, SC  
Terracon Project No. 8623P180 | SCDOT Project ID: P041166



### Laboratory Testing Description

The samples collected during the field exploration were taken to our laboratory for additional testing. The laboratory testing scope was developed by the SCDOT and laboratory assignment was performed by Terracon. The laboratory tests were conducted on selected soil samples from the borings and the bulk sample locations. The test results are presented in this appendix.

The laboratory test results were used to confirm the soil descriptions presented on the boring logs in Appendix A. Laboratory tests were performed in general accordance with the applicable ASTM, AASHTO, SCDOT or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

■	Moisture Content	AASHTO T265/(ASTM D2216)
■	Atterberg Limits	AASHTO T89/T90(ASTM D4318)
■	Wash 200	AASHTO T11/(ASTM D1140)
■	Proctor (Standard effort)	AASHTO T99/ (ASTM D698)
■	Triaxial Shear CU w/ PP	AASHTO T297/(ASTM D4767)
■	Grain Size Distribution	ASTM D6913
■	Hydrometer	ASTM D7928
■	Compressive Strength of Rock Cores	ASTM D7012
■	Corrosion Series	AASHTO D422
		AASHTO T289/ASTM G51
		AASHTO T290/ASTM C1580
		AASHTO T291



Summary of Laboratory Results

Boring ID	Depth (Ft.)	Soil Classification USCS & AASHTO	Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines	% Silt	% Clay	Water Content (%)	Proctor Dry Density (pcf)/Opt. Moisture (%)
S-37-51-1	2-4	SANDY LEAN CLAY(CL) / A-6 **				7.7	37.0	55.3			23.8	
S-37-51-1	4-6	CLAYEY SAND(SC) / A-4 (2)	33	23	10	0.0	54.3	45.7			18.4	
S-37-51-1	6-8	CLAYEY SAND(SC) / A-6 **									19.4	
S-37-51-1	8-10	CLAYEY SAND(SC) / A-6 (1)	33	22	11	3.8	59.5	36.6	11.5	25.1	13.7	
S-37-51-1	13.5-15	SANDY LEAN CLAY(CL) / A-7-6 (9)	45	26	19	0.0	42.4	57.6	21.3	36.3	26.5	
S-37-51-1	18.5-20	SILTY SAND(SM) / A-2-4 **						16.3			23.6	
S-37-51-1	28.5-30	SILTY SAND(SM) / A-2-4 **						22.9			22.1	
S-37-51-2	2-4	CLAYEY SAND(SC) / A-6 **				2.4	50.3	47.3			19.9	
S-37-51-2	4-6	SANDY LEAN CLAY(CL) / A-6 (4)	34	21	13	1.2	48.2	50.6			17.6	
S-37-51-2	6-8	SANDY LEAN CLAY(CL) / A-6 **									17.3	
S-37-51-2	8-10	SANDY LEAN CLAY(CL) / A-6 **				3.9	26.7	69.4			20.3	
S-37-51-2	12-14	SILTY, CLAYEY SAND(SC-SM) / A-4 (0)	26	20	6	6.4	48.8	44.8	20.5	24.3	17.3	
S-37-51-2	14-16	CLAYEY SAND(SC) / A-2-4 (0)	28	20	8	10.1	57.8	32.1	13.9	18.2	19.8	
S-37-51-2	20-22	SILTY SAND(SM) / A-2-4 **						13.9			21.3	
S-37-51-2	24-26	SILTY SAND(SM) / A-2-4 **						15.3			23.0	
S-37-51-1/2 Bulk	1-5	CLAYEY SAND(SC) / A-2-6 (1)	37	21	16	1.2	65.8	33.0			19.6	103.0 / 18.8

\*\* Soil is classified per ASTM D2488 - Visual-Manual Procedure



# INDEX PROPERTIES VERSUS DEPTH

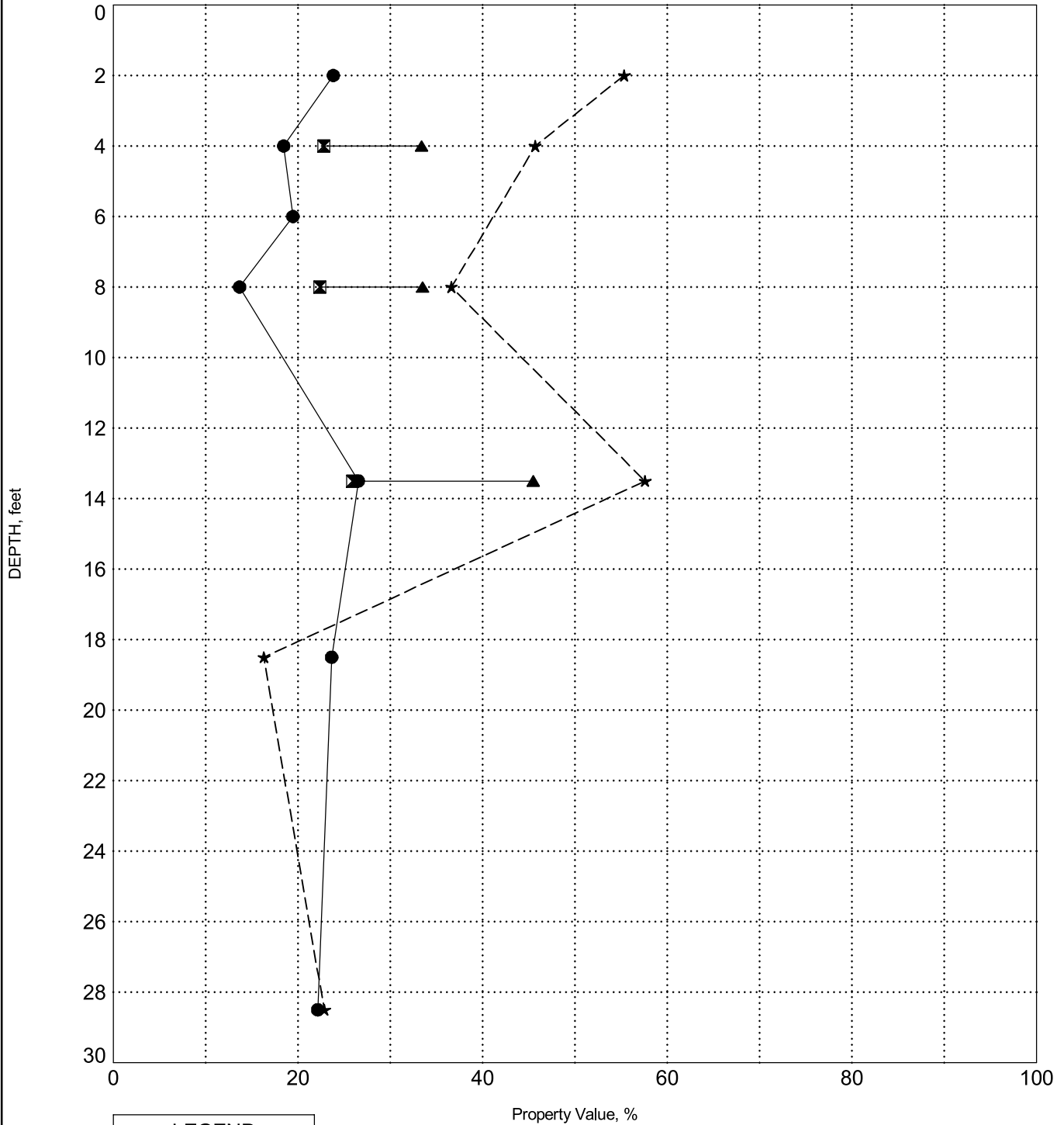
PROJECT ID P041166

PROJECT NAME S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek

PROJECT COUNTY Oconee

SURFACE ELEVATION: 798.7

## BORING S-37-51-1



LEGEND	
●	Water Content
⊠	Plastic Limit
▲	Liquid Limit
★	Fines



# INDEX PROPERTIES VERSUS DEPTH

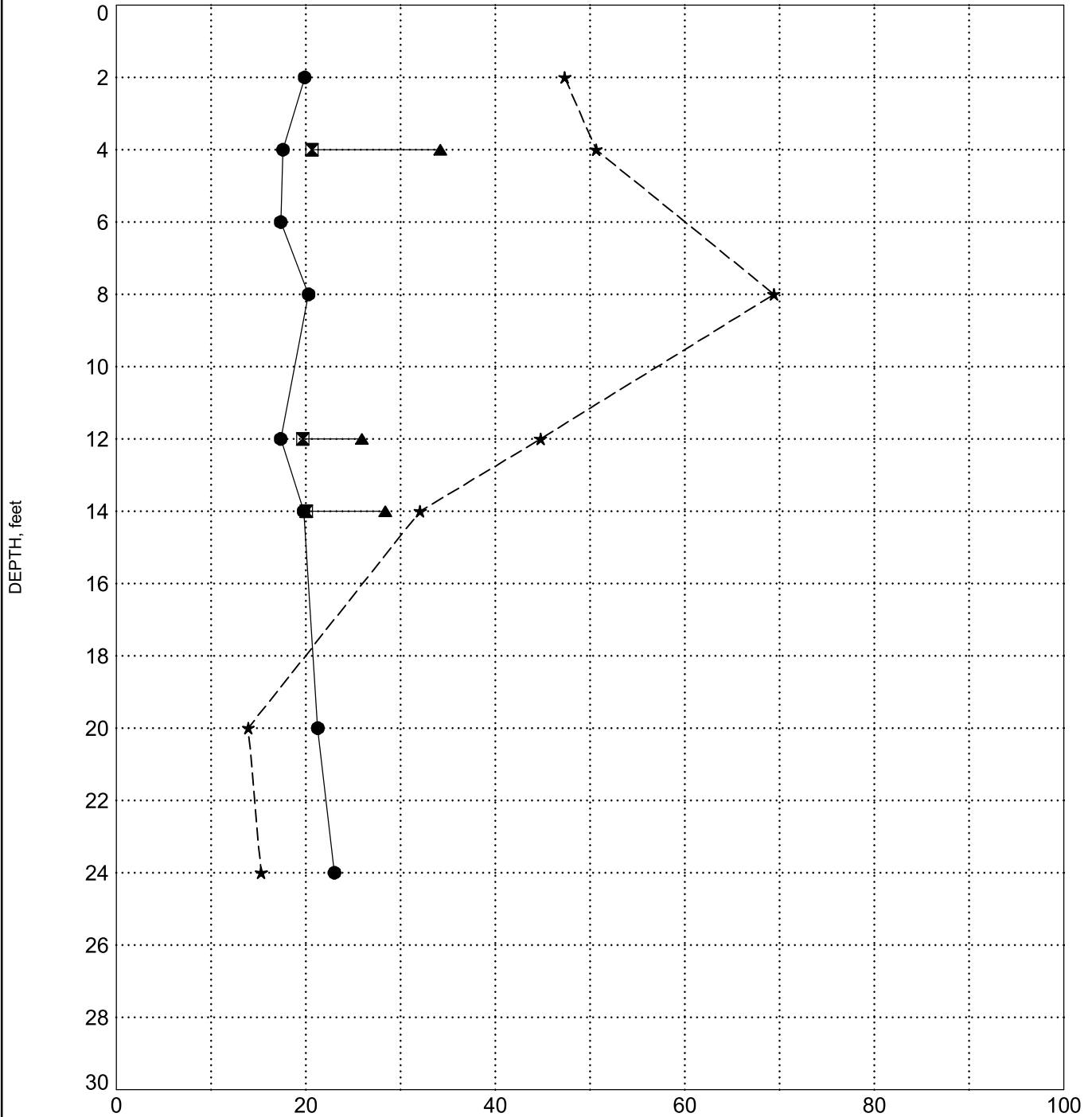
PROJECT ID P041166

PROJECT NAME S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek

PROJECT COUNTY Oconee

SURFACE ELEVATION: 800.9

## BORING S-37-51-2



LEGEND	
●	Water Content
⊠	Plastic Limit
▲	Liquid Limit
★	Fines



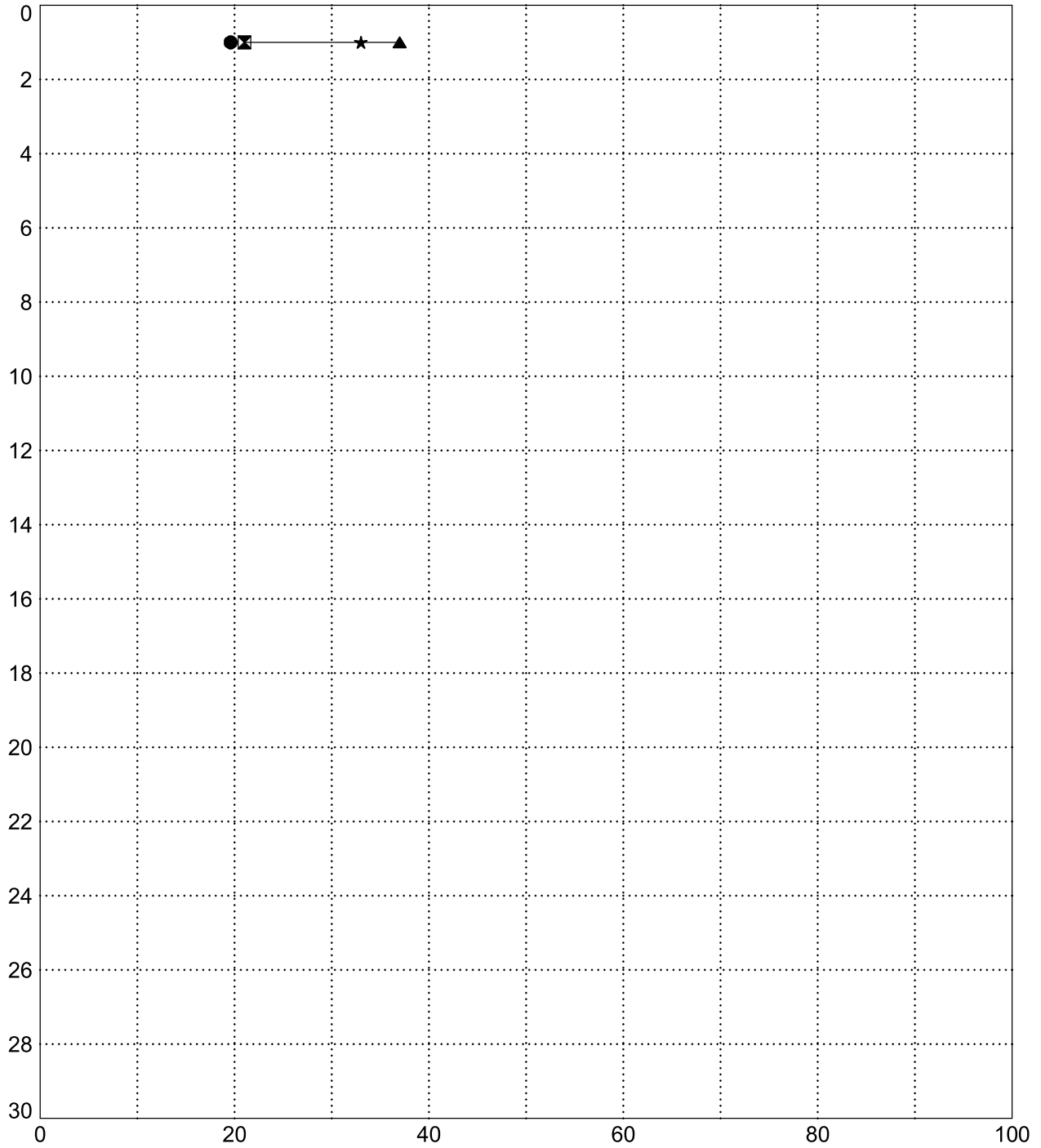
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PROJECT ID P041166

PROJECT NAME S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek

PROJECT COUNTY Oconee

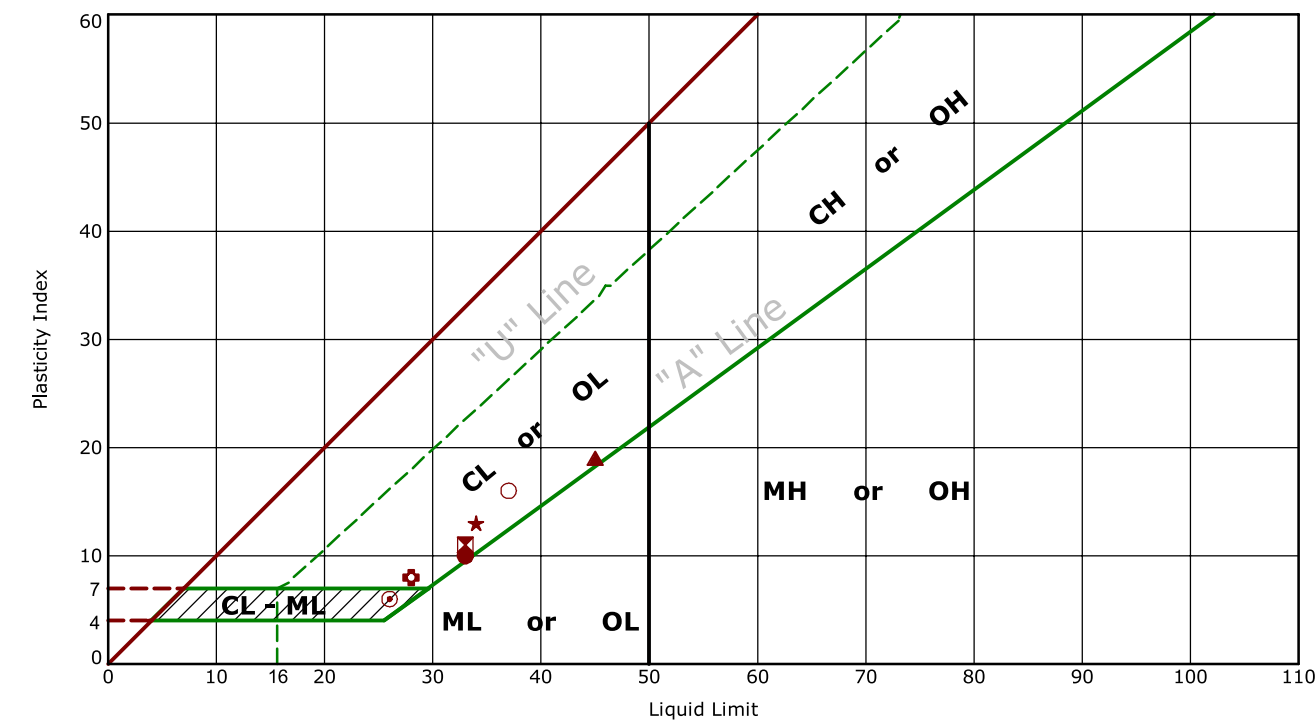
## BORING S-37-51-1/2 Bulk



LEGEND	
●	Water Content
⊠	Plastic Limit
▲	Liquid Limit
★	Fines

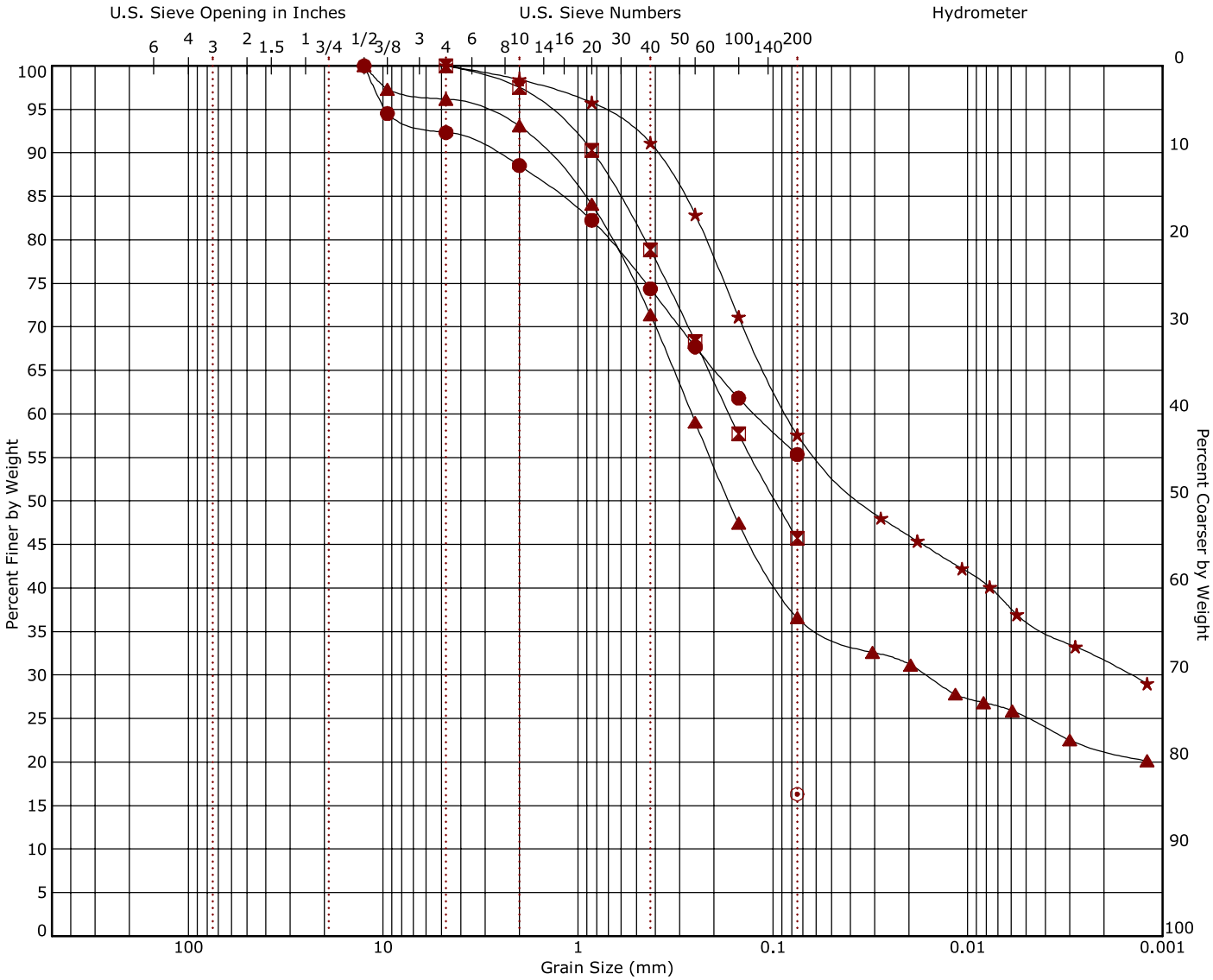
# Atterberg Limit Results

ASTM D4318



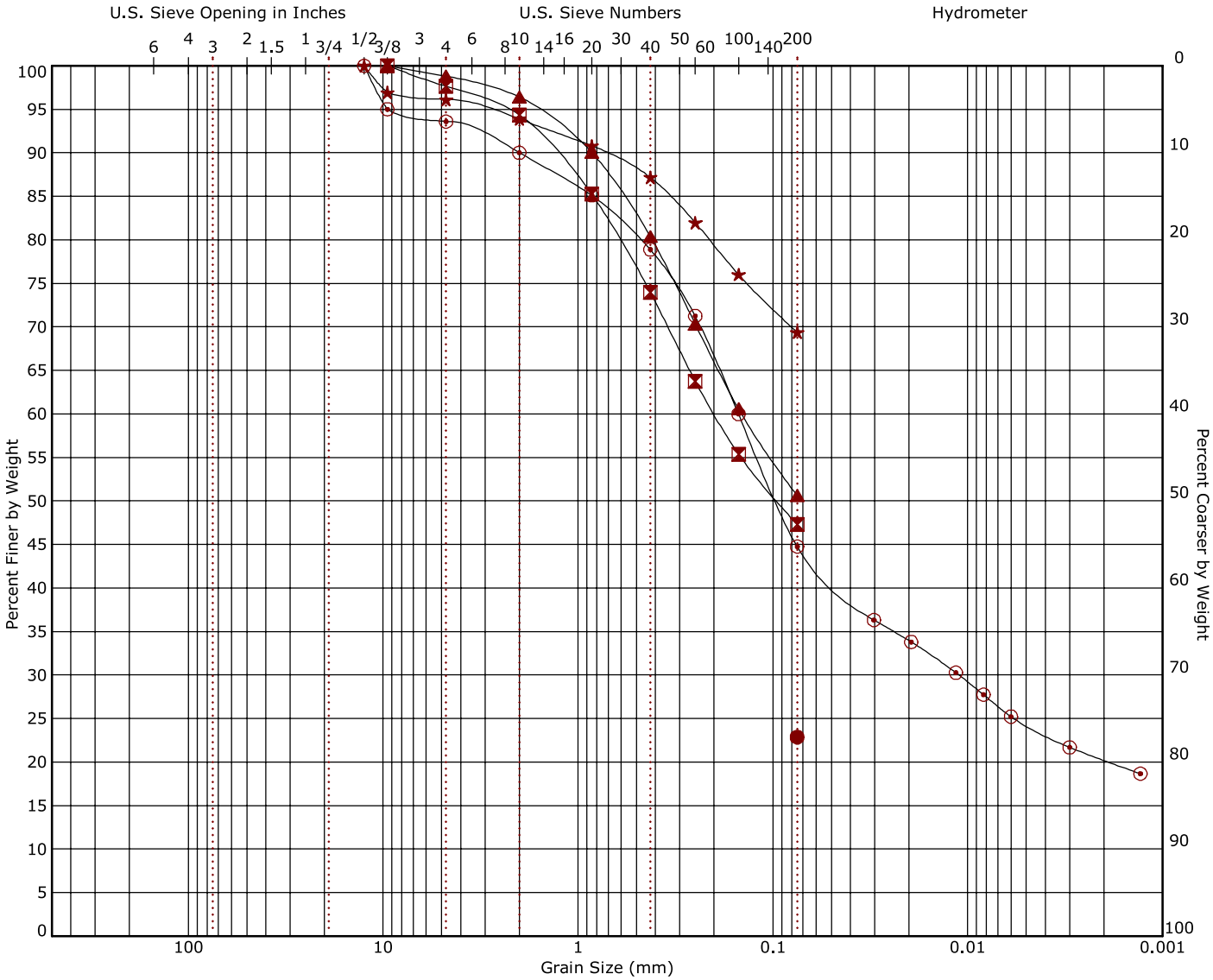
	Boring ID	Depth (Ft)	LL	PL	PI	Fines	AASHTO	Description
●	S-37-51-1	4 - 6	33	23	10	45.7	A-4 (2)	CLAYEY SAND
⊠	S-37-51-1	8 - 10	33	22	11	36.6	A-6 (1)	CLAYEY SAND
▲	S-37-51-1	13.5 - 15	45	26	19	57.6	A-7-6 (9)	SANDY LEAN CLAY
★	S-37-51-2	4 - 6	34	21	13	50.6	A-6 (4)	SANDY LEAN CLAY
⊙	S-37-51-2	12 - 14	26	20	6	44.8	A-4 (0)	SILTY, CLAYEY SAND
⊕	S-37-51-2	14 - 16	28	20	8	32.1	A-2-4 (0)	CLAYEY SAND
○	S-37-51-1/2 Bulk	1 - 5	37	21	16	33.0	A-2-6 (1)	CLAYEY SAND


Grain Size Distribution  
ASTM D422 / ASTM C136



	Cobbles	Gravel		Sand			Silt or Clay				
		coarse	fine	coarse	medium	fine					
Boring ID	Depth (Ft)	USCS Classification			USCS	AASHTO	LL	PL	PI	Cc	Cu
● S-37-51-1	2 - 4	SANDY LEAN CLAY			CL	A-6					
☒ S-37-51-1	4 - 6	CLAYEY SAND			SC	A-4 (2)	33	23	10		
▲ S-37-51-1	8 - 10	CLAYEY SAND			SC	A-6 (1)	33	22	11		
★ S-37-51-1	13.5 - 15	SANDY LEAN CLAY			CL	A-7-6 (9)	45	26	19		
⊙ S-37-51-1	18.5 - 20	SILTY SAND			SM	A-2-4					
Boring ID	Depth (Ft)	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
● S-37-51-1	2 - 4	12.5	0.124			0.0	7.7	37.0	55.3		
☒ S-37-51-1	4 - 6	4.75	0.167			0.0	0.0	54.3	45.7		
▲ S-37-51-1	8 - 10	12.5	0.26	0.016		0.0	3.8	59.5		11.5	25.1
★ S-37-51-1	13.5 - 15	4.75	0.085	0.001		0.0	0.0	42.4		21.3	36.3
⊙ S-37-51-1	18.5 - 20	0.075							16.3		

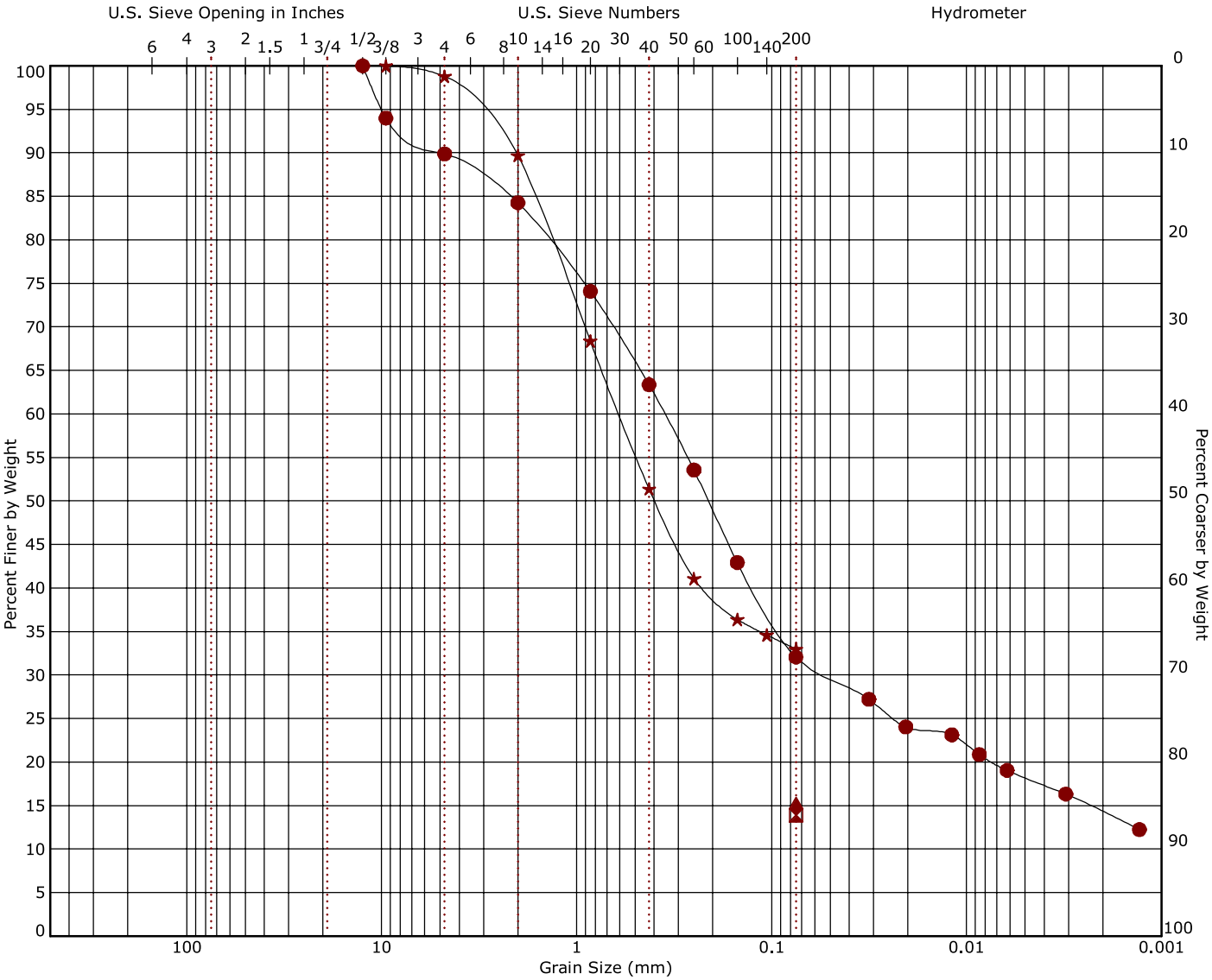
Grain Size Distribution  
ASTM D422 / ASTM C136



	Cobbles	Gravel		Sand			Silt or Clay					
		coarse	fine	coarse	medium	fine						
Boring ID	Depth (Ft)	USCS Classification				USCS	AASHTO	LL	PL	PI	Cc	Cu
● S-37-51-1	28.5 - 30	SILTY SAND				SM	A-2-4					
☒ S-37-51-2	2 - 4	CLAYEY SAND				SC	A-6					
▲ S-37-51-2	4 - 6	SANDY LEAN CLAY				CL	A-6 (4)	34	21	13		
★ S-37-51-2	8 - 10	SANDY LEAN CLAY				CL	A-6					
⊙ S-37-51-2	12 - 14	SILTY, CLAYEY SAND				SC-SM	A-4 (0)	26	20	6		
Boring ID	Depth (Ft)	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay	
● S-37-51-1	28.5 - 30	0.075							22.9			
☒ S-37-51-2	2 - 4	9.5	0.199			0.0	2.4	50.3	47.3			
▲ S-37-51-2	4 - 6	9.5	0.144			0.0	1.2	48.2	50.6			
★ S-37-51-2	8 - 10	12.5				0.0	3.9	26.7	69.4			
⊙ S-37-51-2	12 - 14	12.5	0.15	0.011		0.0	6.4	48.8		20.5	24.3	

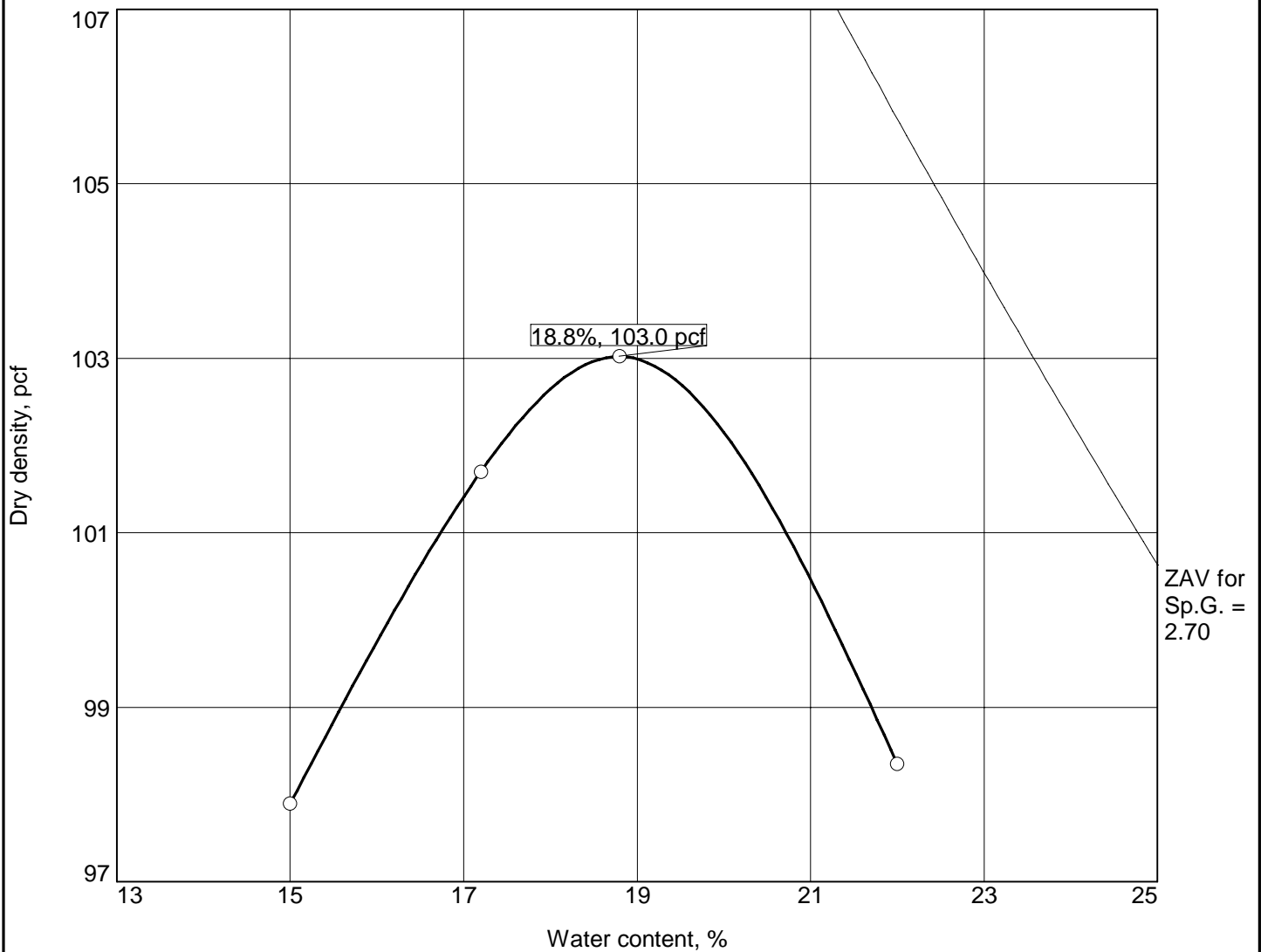


Grain Size Distribution  
ASTM D422 / ASTM C136



Cobbles		Gravel		Sand			Silt or Clay				
		coarse	fine	coarse	medium	fine					
Boring ID	Depth (Ft)	USCS Classification			USCS	AASHTO	LL	PL	PI	Cc	Cu
● S-37-51-2	14 - 16	CLAYEY SAND			SC	A-2-4 (0)	28	20	8		
☒ S-37-51-2	20 - 22	SILTY SAND			SM	A-2-4					
▲ S-37-51-2	24 - 26	SILTY SAND			SM	A-2-4					
★ S-37-51-1/2 Bulk	1 - 5	CLAYEY SAND			SC	A-2-6 (1)	37	21	16		
Boring ID	Depth (Ft)	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
● S-37-51-2	14 - 16	12.5	0.354	0.052		0.0	10.1	57.8		13.9	18.2
☒ S-37-51-2	20 - 22	0.075							13.9		
▲ S-37-51-2	24 - 26	0.075							15.3		
★ S-37-51-1/2 Bulk	1 - 5	9.5	0.603			0.0	1.2	65.8	33.0		

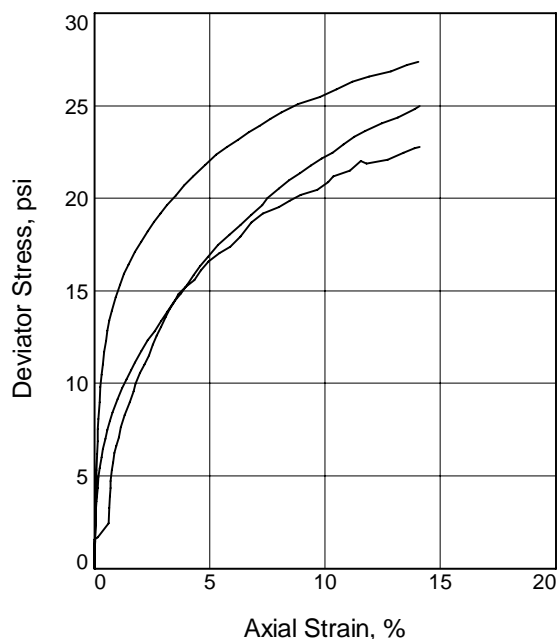
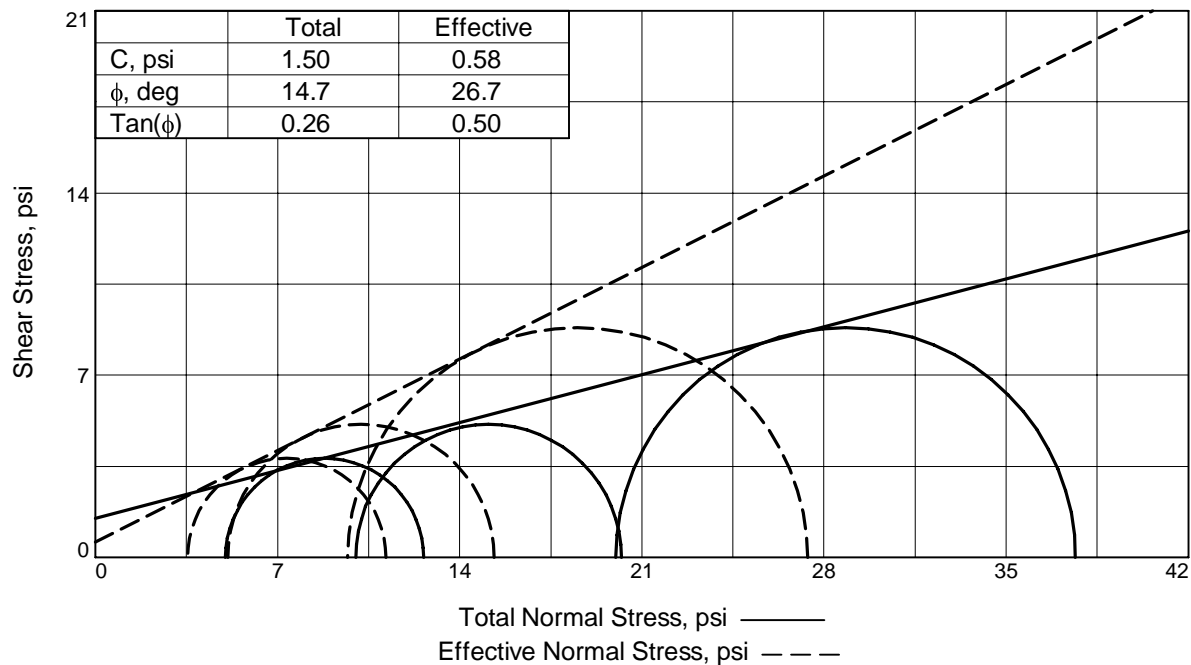
# PROCTOR TEST



Test specification: ASTM D 698-12 Method B Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
1.0-5.0 ft	SC	A-2-6(1)	19.6	2.7	37	16	0.0	33.0

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 103.0 pcf Optimum moisture = 18.8 %	clayey sand
<b>Project No.</b> 8623P180 <b>Client:</b> HNTB North Carolina PC <b>Project:</b> S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek <b>Source of Sample:</b> S-37-51 <b>Sample Number:</b> 1 & 2 Composite <b>Terracon Consultants, Inc.</b>	Remarks:



Sample No.		1	2	3
Initial	Water Content, %	18.8	18.8	18.8
	Dry Density, pcf	97.9	97.9	97.9
	Saturation, %	70.3	70.3	70.3
	Void Ratio	0.7216	0.7216	0.7216
	Diameter, in.	2.80	2.80	2.80
	Height, in.	6.00	6.00	6.00
At Test	Water Content, %	26.3	25.8	24.9
	Dry Density, pcf	98.3	98.9	99.6
	Saturation, %	99.4	98.9	97.2
	Void Ratio	0.7147	0.7045	0.6919
	Diameter, in.	2.80	2.79	2.78
	Height, in.	5.99	5.97	5.98
Strain rate, in./min.		0.001	0.001	0.001
Back Pressure, psi		50.0	50.0	50.0
Cell Pressure, psi		55.0	60.0	70.0
Fail. Stress, psi		7.6	10.2	17.7
Excess Pore Pr., psi		1.5	4.9	10.3
Ult. Stress, psi				
Excess Pore Pr., psi				
$\bar{\sigma}_1$ Failure, psi		11.2	15.3	27.4
$\bar{\sigma}_3$ Failure, psi		3.5	5.1	9.7

#### Type of Test:

CU with Pore Pressures

**Sample Type:** Remolded

**Description:** clayey sand

**LL=** 37      **PL=** 21      **PI=** 16

**Assumed Specific Gravity=** 2.7

**Remarks:** Three Specimen Series

**Client:** HNTB North Carolina PC

**Project:** S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek

**Source of Sample:** S-37-51      **Depth:** 1.0-5.0 ft

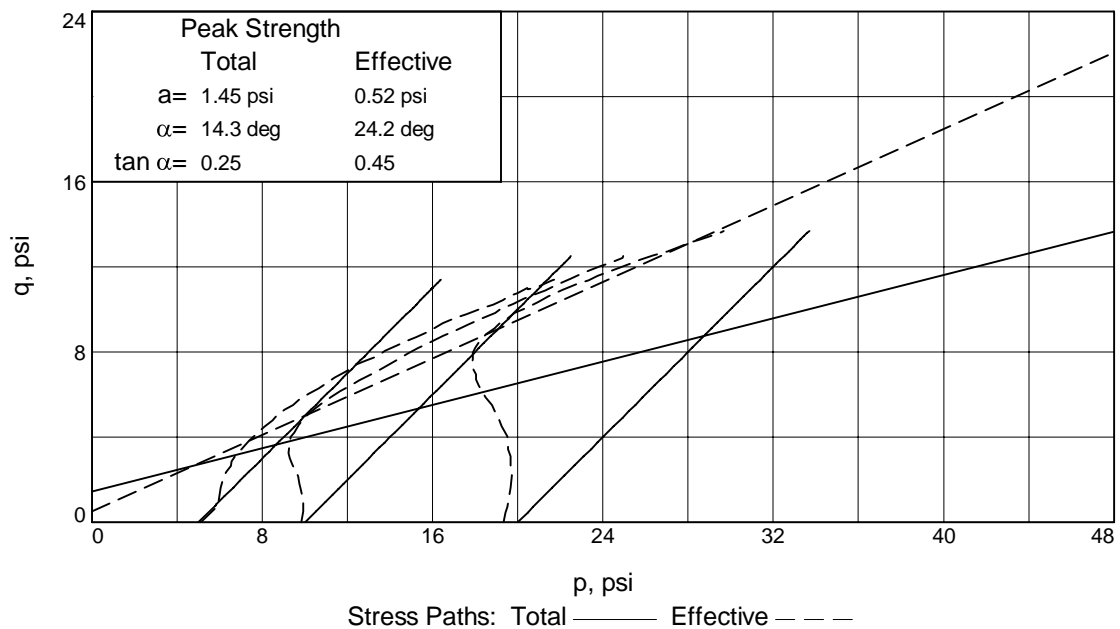
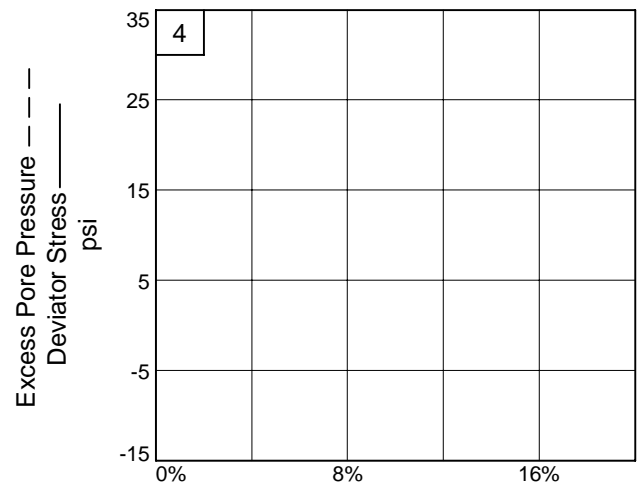
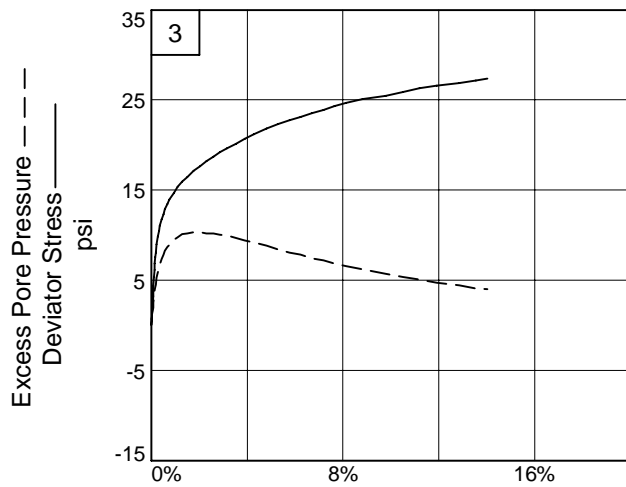
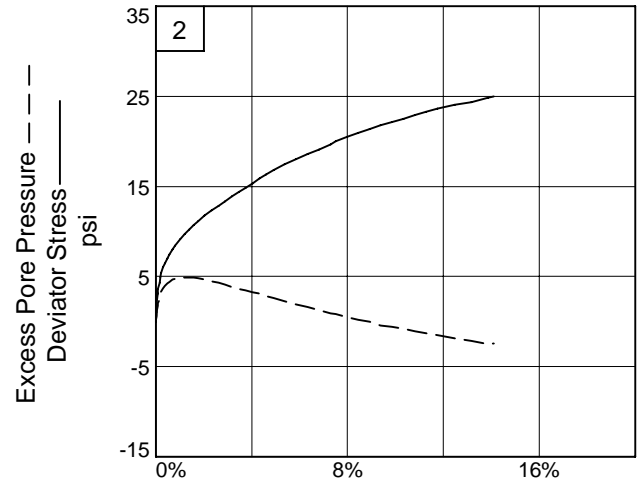
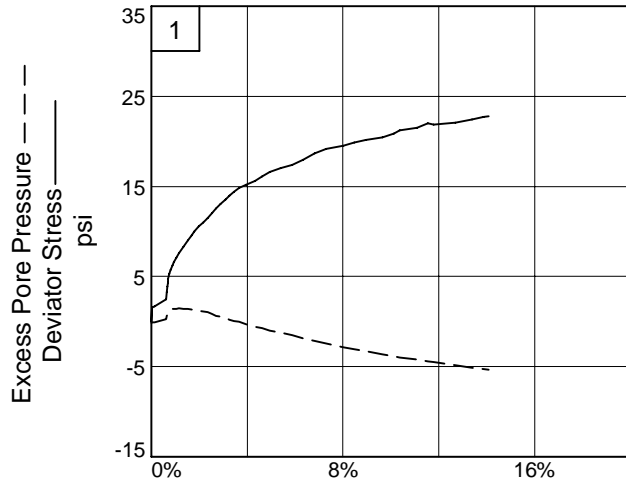
**Sample Number:** 1 & 2 Composite

**Proj. No.:** 8623P180

**Date Sampled:** N/A

TRIAXIAL SHEAR TEST REPORT

Terracon Consultants, Inc.



**Client:** HNTB North Carolina PC

**Project:** S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek

**Source of Sample:** S-37-51

**Depth:** 1.0-5.0 ft

**Sample Number:** 1 & 2 Composite

**Project No.:** 8623P180

**Terracon Consultants, Inc.**

750 Pilot Road, Suite F  
Las Vegas, Nevada 89119  
(702) 597-9393



**Client**

HNTB North Carolina PC

**Project**

S-37-51 (Snow Creek Road) Bridge  
Replacement over Snow Creek

**Sample Submitted By:** Terracon (86)

**Date Received:** 2/8/2024

**Lab No.:** 24-0064

**Results of Corrosion Analysis**

<b>Sample Number</b>	S-37-S1-2
<b>Sample Location</b>	--
<b>Sample Depth (ft.)</b>	2-14
pH Analysis, AASHTO T289	6.43
Water Soluble Sulfate (SO4), AASHTO T290 (mg/kg)	54
Chlorides, AASHTO T291, (mg/kg)	93
Saturated Minimum Resistivity, AASHTO T288, (ohm-cm)	8243

A handwritten signature in black ink, appearing to read 'N. Campo'.

**Analyzed By** \_\_\_\_\_  
Nathan Campo  
Laboratory Coordinator

The tests were performed in general accordance with applicable ASTM and AWWA test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.



PROJECT ID P041166 PROJECT NAME S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek  
PROJECT COUNTY Oconee

Borehole	Core Run Number	Core Run Top Depth	REC (%)	RQD (%)	q <sub>u</sub> (psi)	Poisson's Ratio	Secant Modulus (ksi)	Unit Weight (pcf)	RMR	GSI
S-37-51-1	NQ-1	48.6	98	98	10136	0.10	596	168	72	85
S-37-51-1	NQ-2	53.6	100	100					72	85
S-37-51-1	NQ-3	58.6	97	95	16210	0.21	843	173	77	85
S-37-51-2	NQ-1	28.0	100	87	13408	0.18	759	172	59	75
S-37-51-2	NQ-2	33.0	99	99	11560	0.18	650	168	72	85



Compressive Strength and Elastic Moduli of Intact Rock Core  
Specimens under Varying Stress and Temperatures

ASTM D 7012

Method D

Laboratory Services Group

192 Exchange Boulevard

Glendale Heights, IL 60139

Phone: (630) 717-4263

Fax: (630) 357-9489

Project No.: 8623P180  
Project Name: S-37-51 (Snow Creek Road) Bridge  
Replacement over Snow Creek

Tested By: EB Date: 3/11/2025  
Calculated By: EB Date: 3/11/2025  
Checked By: WPQ Date: 3/14/2025

Sample No. S-37-51-1 Run/Sam No.: NQ-1  
Depth (ft): 51.4'-52.2'  
Description: Light Brownish Gray Gneiss Core

Rock Sample Moisture Condition at Time of Test: As Received

ASTM D4543 TOLERANCE CHECK

Side Straightness		Maximum Gap ≤ 0.020 in.					Tolerance Met	Yes	
End Flatness: Max.	Diameter 1a	0.0008	in	Diameter 1b	0.0006	in	≤ 0.0010	Tolerance Met	Yes
End Flatness: Max.	Diameter 2a	0.0008	in	Diameter 2b	0.0007	in	≤ 0.0010	Tolerance Met	Yes
Perpendicularity Slope	Diameter 1a	0.00040		Diameter 1b	0.00040		≤ 0.0043	Tolerance Met	Yes
Perpendicularity Slope	Diameter 2a	0.00030		Diameter 2b	0.00035		≤ 0.0043	Tolerance Met	Yes

Length (in): 1) 4.214 2) 4.213 3) 4.214 Avg. 4.213 in

Diameter (in): 1) 1.977 2) 1.976 3) 1.976 Avg. 1.976 in

Uniaxial Compressive Strength: 10,136 psi Mass: 570.3 g

Load: 31,089 lbs. Wet Unit Weight: 168.1 pcf

L/D: 2.1 Dry Unit Weight: 167.3 pcf

Water Content: 0.5 %

Time to Failure: 2.20 min

Load Rate: 236 lbs/sec

Young's Modulus

Et (50% Co) 5.96E+05

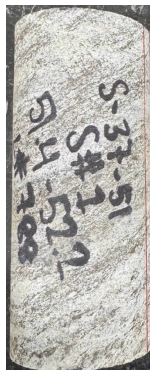
Poisson's Ratio

ut (50% Co) 0.102

REMARKS:

- 
- 
- 
- 
- 
- 
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- 
- 

Before



After





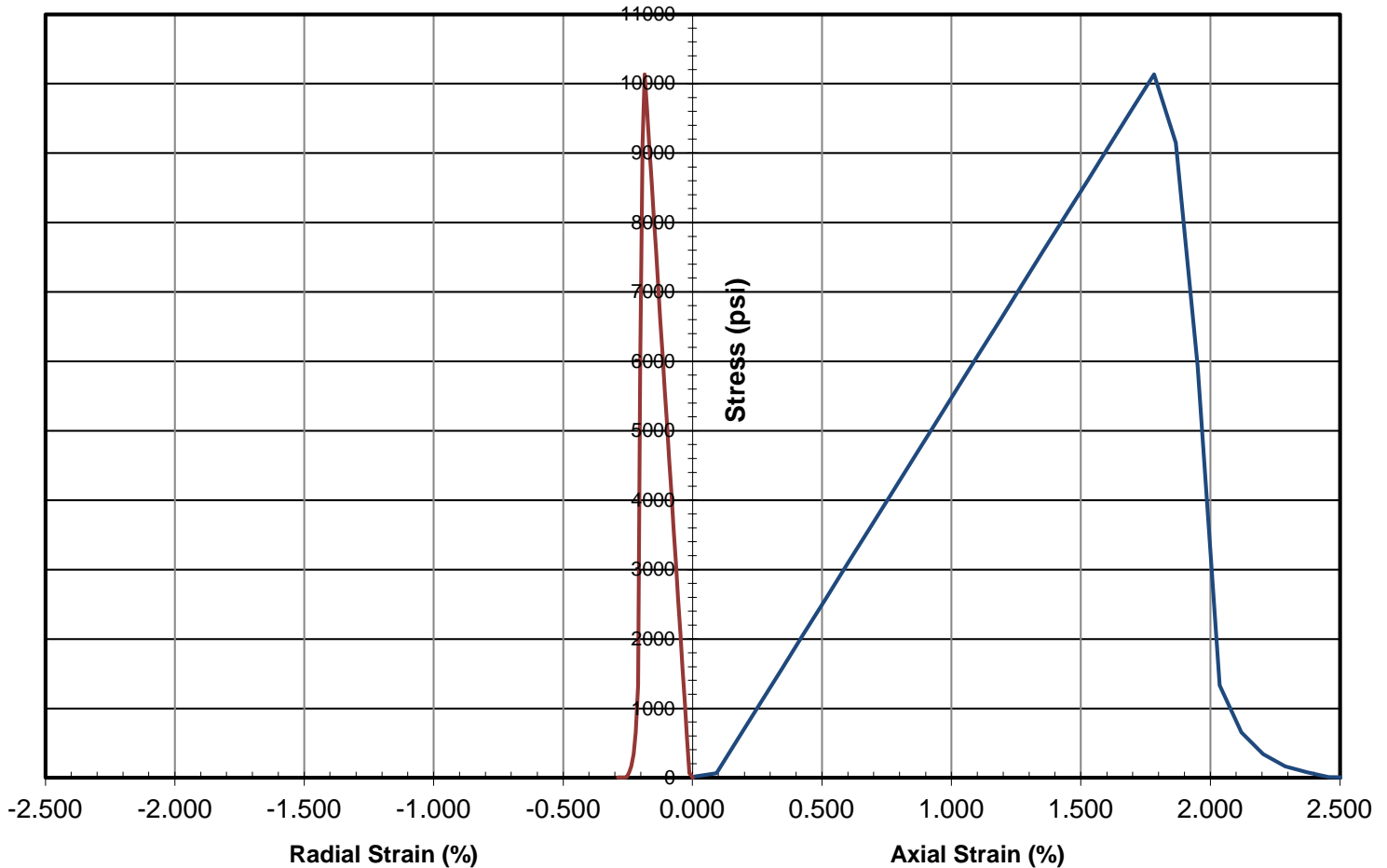


Compressive Strength and Elastic Moduli of Intact Rock Core  
Specimens under Varying Stress and Temperatures  
ASTM D 7012  
Method D

Laboratory Services Group	192 Exchange Boulevard	Glendale Heights, IL 60139	Phone: (630) 717-4263	Fax: (630) 357-9489
Project No.:	8623P180	Tested By:	EB	Date: 03/11/25
Project Name:	S-37-51 (Snow Creek Road) Bridge	Calculated By:	EB	Date: 03/11/25
	Replacement over Snow Creek	Checked By:	WPQ	Date: 03/14/25
Boring No.	S-37-51-1	Run No.:	NQ-1	
Depth (ft):	51.4'-52.2'			

Stress vs Radial Strain

Stress vs Axial Strain



Young's Modulus

$C_0$  Max = 10,136 psi    50%  $C_0$  Max 5,068 psi  
10%  $C_0$  Max 1,014 psi

$E_t$  (50%)  $C_0$  = 5.96E+05 psi

Poisson's Ratio

$C_0$  Max = 10,136 psi    50%  $C_0$  Max 5,068 psi  
10%  $C_0$  Max 1,014 psi

$\nu_t$  (50%)  $C_0$  = 0.102



**Compressive Strength and Elastic Moduli of Intact Rock Core  
Specimens under Varying Stress and Temperatures  
ASTM D 7012  
Method D**

Laboratory Services Group 192 Exchange Boulevard Glendale Heights, IL 60139 Phone: (630) 717-4263 Fax: (630) 357-9489

Project No.: 8623P180 Tested By: EB Date: 3/11/2025  
Project Name: S-37-51 (Snow Creek Road) Bridge Calculated By: EB Date: 3/11/2025  
Replacement over Snow Creek Checked By: WPQ Date: 3/14/2025

Sample No. S-37-51-1 Run/Sam No.: NQ-3  
Depth (ft): 61.4'-62.1'  
Description: Light Gray /Reddish Gray Gneiss Core

Rock Sample Moisture Condition at Time of Test: As Received

**ASTM D4543 TOLERANCE CHECK**

Side Straightness	Maximum Gap $\leq$ 0.020 in.						Tolerance Met	Yes
End Flatness: Max.	Diameter 1a	0.0007	in	Diameter 1b	0.0007	in	$\leq$ 0.0010	Tolerance Met Yes
End Flatness: Max.	Diameter 2a	0.0008	in	Diameter 2b	0.0008	in	$\leq$ 0.0010	Tolerance Met Yes
Perpendicularity Slope	Diameter 1a	0.00035		Diameter 1b	0.00040		$\leq$ 0.0043	Tolerance Met Yes
Perpendicularity Slope	Diameter 2a	0.00035		Diameter 2b	0.00040		$\leq$ 0.0043	Tolerance Met Yes

Length (in): 1) 4.294 2) 4.294 3) 4.294 Avg. 4.294 in

Diameter (in): 1) 1.980 2) 1.980 3) 1.981 Avg. 1.980 in

Uniaxial Compressive Strength: 16,210 psi Mass: 598.8 g

Load: 49,921 lbs. Wet Unit Weight: 172.5 pcf

L/D: 2.2 Dry Unit Weight: 172.1 pcf

Water Content: 0.3 %

Time to Failure: 3.40 min

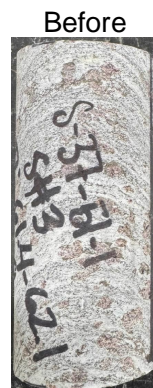
Load Rate: 245 lbs/sec

Young's Modulus	
Et (50% Co)	8.43E+05

Poisson's Ratio	
ut (50% Co)	0.206

REMARKS:

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9



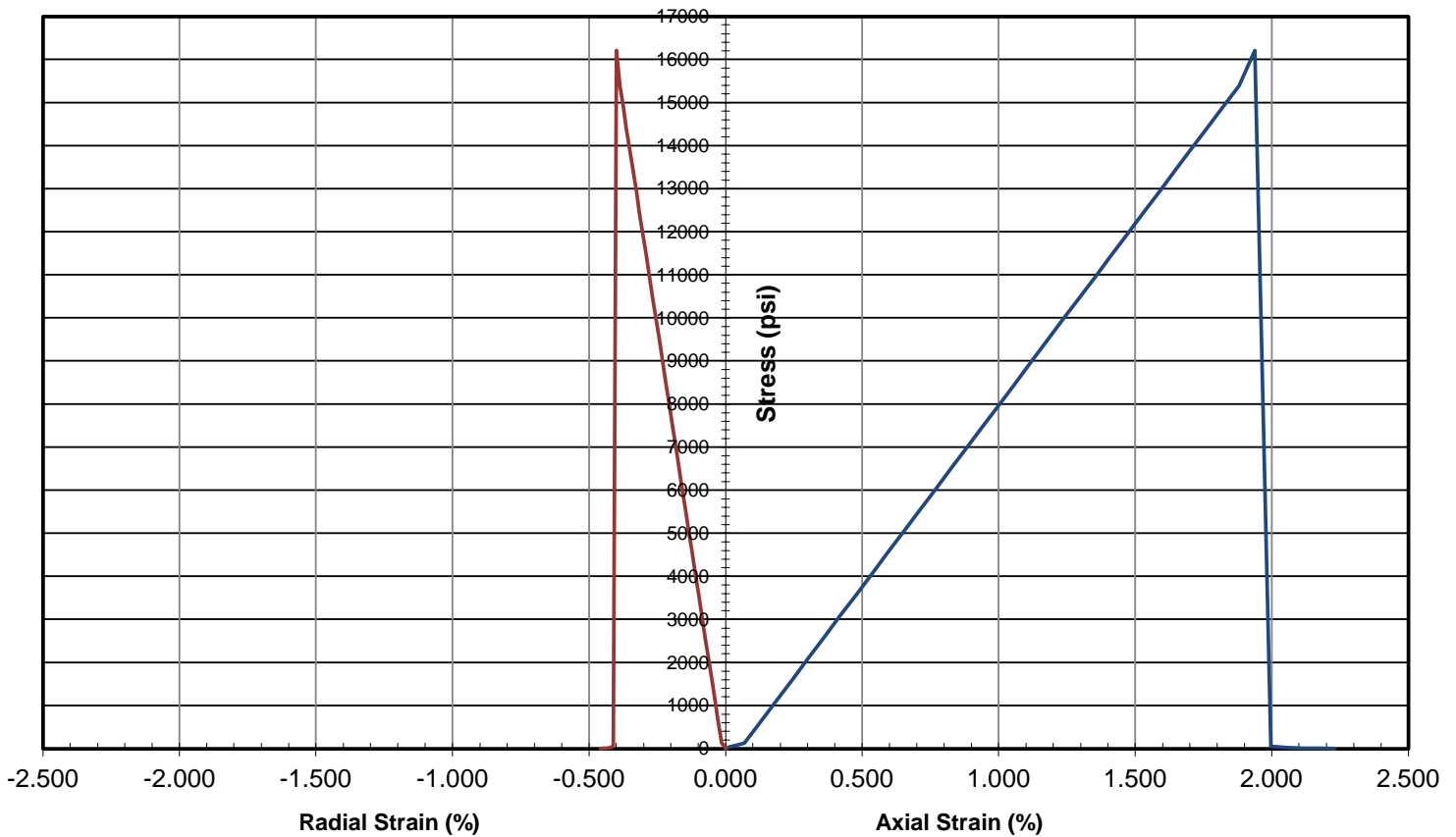


Compressive Strength and Elastic Moduli of Intact Rock Core  
Specimens under Varying Stress and Temperatures  
ASTM D 7012  
Method D

Laboratory Services Group	192 Exchange Boulevard	Glendale Heights, IL 60139	Phone: (630) 717-4263	Fax: (630) 357-9489
Project No.:	8623P180	Tested By:	EB	Date: 03/11/25
Project Name:	S-37-51 (Snow Creek Road) Bridge	Calculated By:	EB	Date: 03/11/25
	Replacement over Snow Creek	Checked By:	WPQ	Date: 03/14/25
Boring No.	S-37-51-1	Run No.:	NQ-3	
Depth (ft):	61.4'-62.1'			

Stress vs Radial Strain

Stress vs Axial Strain



Young's Modulus

$C_0$  Max = 16,210 psi      50%  $C_0$  Max 8,105 psi       $E_t$  (50%)  $C_0$  = 8.43E+05 psi  
10%  $C_0$  Max 1,621 psi

Poisson's Ratio

$C_0$  Max = 16,210  $\nu_0$  Max. psi      50%  $C_0$  Max 8,105 psi       $\nu_t$  (50%)  $C_0$  = 0.206  
10%  $C_0$  Max 1,621 psi



Compressive Strength and Elastic Moduli of Intact Rock Core  
Specimens under Varying Stress and Temperatures

ASTM D 7012

Method D

Laboratory Services Group

192 Exchange Boulevard

Glendale Heights, IL 60139

Phone: (630) 717-4263

Fax: (630) 357-9489

Project No.: 8623P180  
Project Name: S-37-51 (Snow Creek Road) Bridge  
Replacement over Snow Creek

Tested By: EB Date: 3/11/2025  
Calculated By: EB Date: 3/11/2025  
Checked By: WPQ Date: 3/14/2025

Sample No. S-37-51-2 Run/Sam No.: NQ-1  
Depth (ft): 30.0'-30.9'  
Description: Light Brownish Gray Gneiss Core

Rock Sample Moisture Condition at Time of Test: As Received

ASTM D4543 TOLERANCE CHECK

Side Straightness		Maximum Gap ≤ 0.020 in.						Tolerance Met	Yes
End Flatness: Max.	Diameter 1a	0.0008	in	Diameter 1b	0.0008	in	≤ 0.0010	Tolerance Met	Yes
End Flatness: Max.	Diameter 2a	0.0008	in	Diameter 2b	0.0008	in	≤ 0.0010	Tolerance Met	Yes
Perpendicularity Slope	Diameter 1a	0.00041		Diameter 1b	0.00041		≤ 0.0043	Tolerance Met	Yes
Perpendicularity Slope	Diameter 2a	0.00041		Diameter 2b	0.00041		≤ 0.0043	Tolerance Met	Yes

Length (in): 1) 4.181 2) 4.182 3) 4.182 Avg. 4.181 in

Diameter (in): 1) 1.973 2) 1.973 3) 1.973 Avg. 1.973 in

Uniaxial Compressive Strength: 13,408 psi Mass: 575.4 g

Load: 40,987 lbs. Wet Unit Weight: 171.5 pcf

L/D: 2.1 Dry Unit Weight: 170.7 pcf

Water Content: 0.4 %

Time to Failure: 2.50 min

Load Rate: 273 lbs/sec

Young's Modulus

Et (50% Co) 7.59E+05

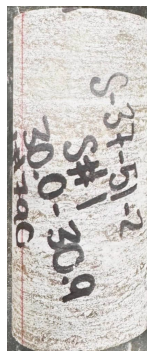
Poisson's Ratio

ut (50% Co) 0.180

REMARKS:

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Before



After





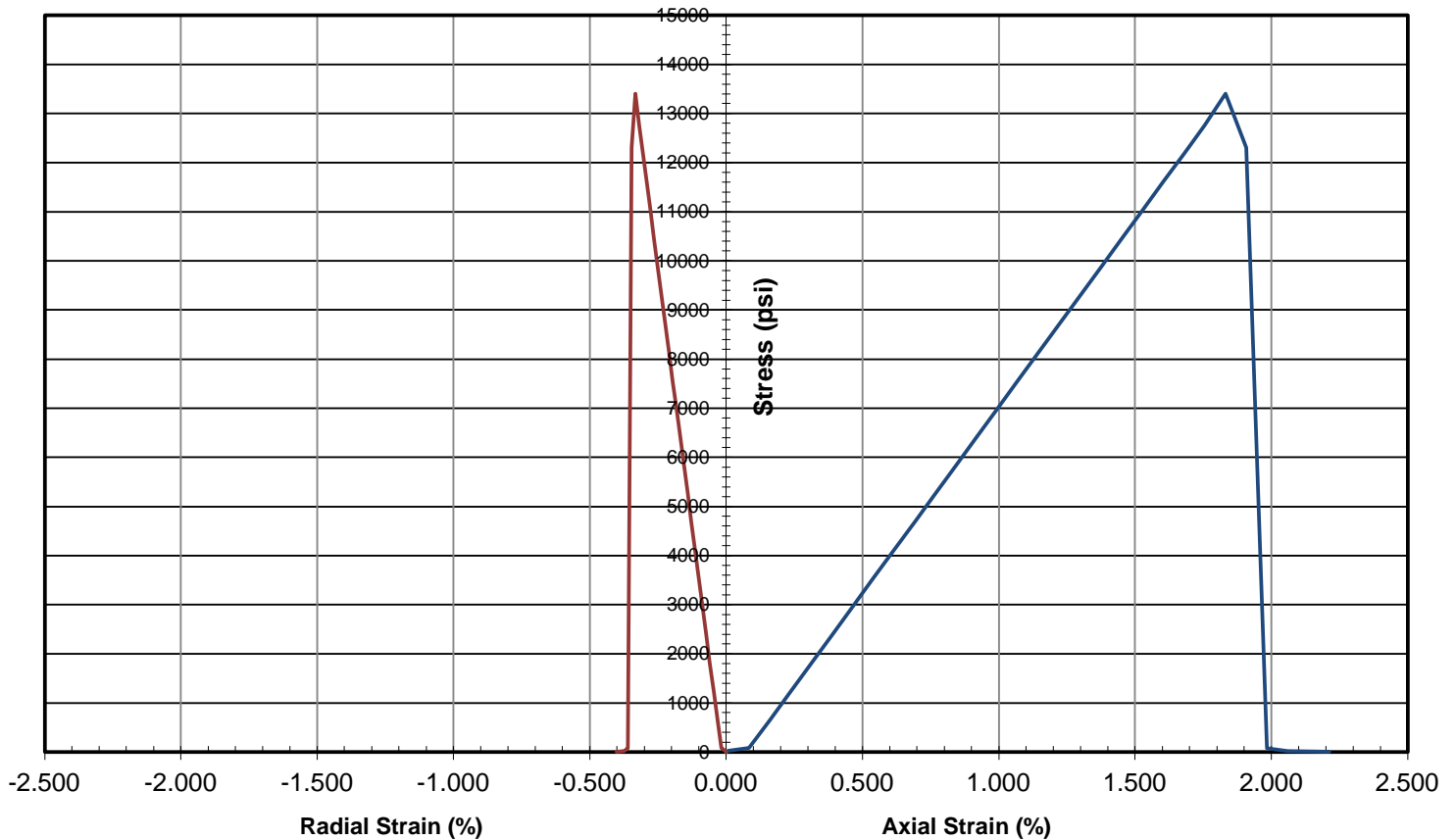
Compressive Strength and Elastic Moduli of Intact Rock Core  
Specimens under Varying Stress and Temperatures  
ASTM D 7012  
Method D

Laboratory Services Group 192 Exchange Boulevard Glendale Heights, IL 60139 Phone: (630) 717-4263 Fax: (630) 357-9489

Project No.: 8623P180 Tested By: EB Date: 03/11/25  
Project Name: S-37-51 (Snow Creek Road) Bridge Calculated By: EB Date: 03/11/25  
Replacement over Snow Creek Checked By: WPQ Date: 03/14/25  
Boring No. S-37-51-2 Run No.: NQ-1  
Depth (ft): 30.0'-30.9'

Stress vs Radial Strain

Stress vs Axial Strain



Young's Modulus

$C_0$  Max = 13,408 psi 50%  $C_0$  Max 6,704 psi  $E_t$  (50%)  $C_0$  = 7.59E+05 psi  
10%  $C_0$  Max 1,341 psi

Poisson's Ratio

$C_0$  Max = 13,408 0%  $C_0$  Max. psi 50%  $C_0$  Max 6,704 psi  $\nu_t$  (50%)  $C_0$  = 0.180  
10%  $C_0$  Max 1,341 psi



Compressive Strength and Elastic Moduli of Intact Rock Core  
Specimens under Varying Stress and Temperatures  
ASTM D 7012  
Method D

Laboratory Services Group 192 Exchange Boulevard Glendale Heights, IL 60139 Phone: (630) 717-4263 Fax: (630) 357-9489

Project No.: 8623P180 Tested By: EB Date: 3/11/2025  
Project Name: S-37-51 (Snow Creek Road) Bridge Calculated By: EB Date: 3/11/2025  
Replacement over Snow Creek Checked By: WPQ Date: 3/14/2025

Sample No. S-37-51-2 Run/Sam No.: NQ-2  
Depth (ft): 36.3'-37.2'  
Description: Light Gray / Brownish Gray Gneiss Core

Rock Sample Moisture Condition at Time of Test: As Received

ASTM D4543 TOLERANCE CHECK

Side Straightness	Maximum Gap $\leq 0.020$ in.					Tolerance Met	
End Flatness: Max.	Diameter 1a	in	Diameter 1b	in	$\leq 0.0010$	Tolerance Met	
End Flatness: Max.	Diameter 2a	in	Diameter 2b	in	$\leq 0.0010$	Tolerance Met	
Perpendicularity Slope	Diameter 1a		Diameter 1b		$\leq 0.0043$	Tolerance Met	
Perpendicularity Slope	Diameter 2a		Diameter 2b		$\leq 0.0043$	Tolerance Met	

Length (in): 1) 4.371 2) 4.371 3) 4.372 Avg. 4.371 in

Diameter (in): 1) 1.977 2) 1.977 3) 1.977 Avg. 1.977 in

Uniaxial Compressive Strength: 11,560 psi Mass: 592.4 g

Load: 35,474 lbs. Wet Unit Weight: 168.2 pcf

L/D: 2.2 Dry Unit Weight: 167.4 pcf

Water Content: 0.5 %

Time to Failure: 2.20 min

Load Rate: 269 lbs/sec

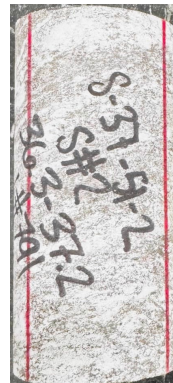
Young's Modulus	
Et (50% Co)	6.50E+05

Poisson's Ratio	
ut (50% Co)	0.178

REMARKS:

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- ASTM Practice D4543 was not performed
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- 

Before



After





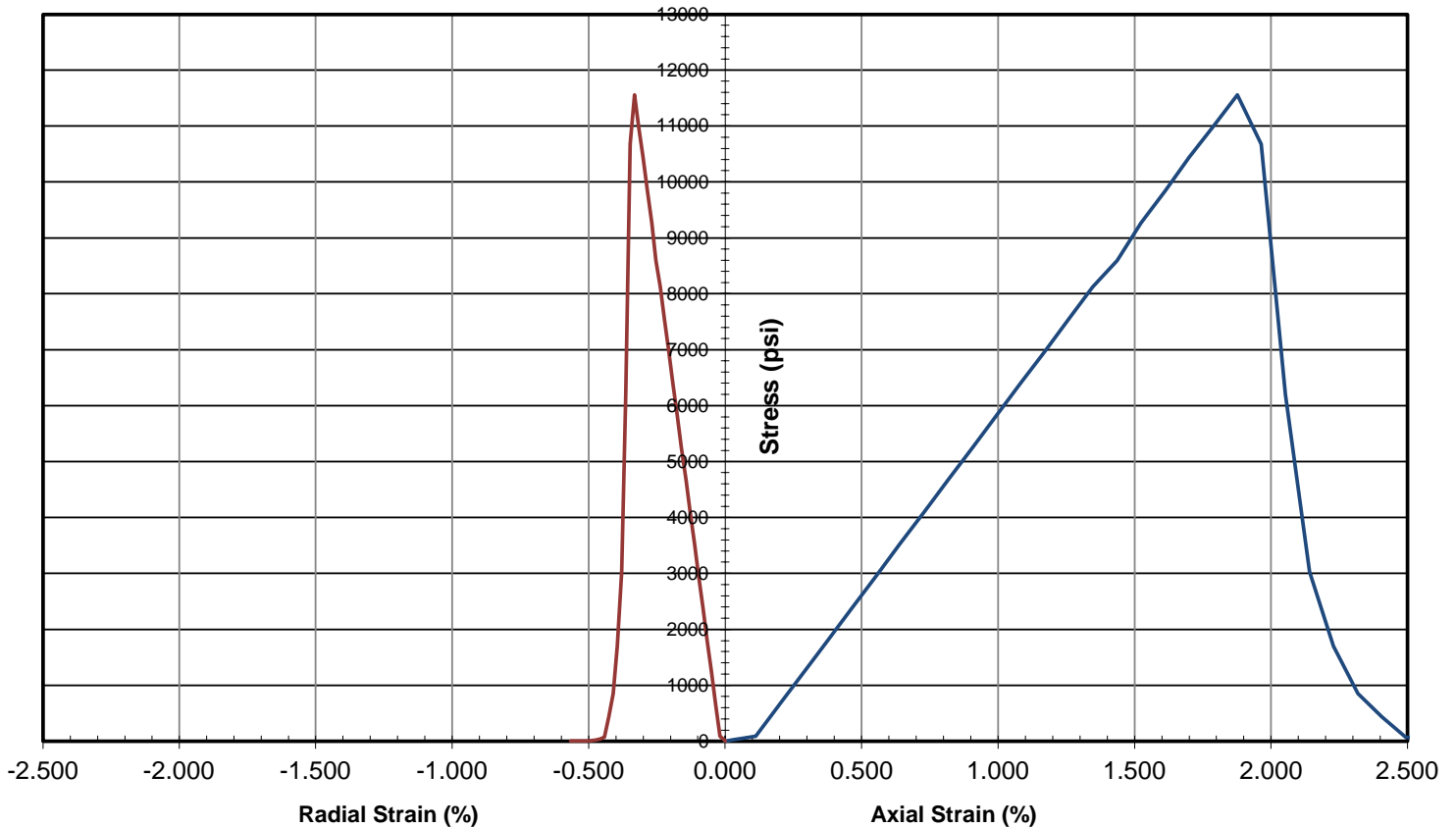
Compressive Strength and Elastic Moduli of Intact Rock Core  
Specimens under Varying Stress and Temperatures  
ASTM D 7012  
Method D

Laboratory Services Group 192 Exchange Boulevard Glendale Heights, IL 60139 Phone: (630) 717-4263 Fax: (630) 357-9489

Project No.: 8623P180 Tested By: EB Date: 03/11/25  
Project Name: S-37-51 (Snow Creek Road) Bridge Calculated By: EB Date: 03/11/25  
Replacement over Snow Creek Checked By: WPQ Date: 03/14/25  
Boring No. S-37-51-2 Run No.: NQ-2  
Depth (ft): 36.3'-37.2'

Stress vs Radial Strain

Stress vs Axial Strain



Young's Modulus

$C_o$  Max = 11,560 psi 50%  $C_o$  Max 5,780 psi  $E_t$  (50%)  $C_o$  = 6.50E+05 psi  
10%  $C_o$  Max 1,156 psi

Poisson's Ratio

$C_o$  Max = 11,560 50%  $C_o$  Max. psi 50%  $C_o$  Max 5,780 psi  $\nu_t$  (50%)  $C_o$  = 0.178  
10%  $C_o$  Max 1,156 psi



## **Appendix C – Supporting Documents**

S-37-51 (Snow Creek Road) Bridge Replacement over Snow Creek | Oconee County, SC  
Terracon Project No. 8623P180 | SCDOT Project ID: P041166



# **Appendix C**

## **Supporting Documents**

3-Point Acceleration Design Response Spectrum by SCDOT  
Rig Calibration Report – DR#554 (5 Pages)

Note: All exhibits are one page unless noted above.

### 3-Point Acceleration Design Response Spectrum

SCDOT v3.2 - 06/01/2023

Project ID:	P041166			Latitude:	34.6237
Route:	S-37-51	County:	37 - Oconee	Longitude:	82.9945
Project:	Snow creek Road over Snow Creek				

Designer:	D. Sapkota - Support
Date:	03/05/2024

Design EQ	PGA	S <sub>DS</sub>	S <sub>D1</sub>	M <sub>W</sub>	R	PGV	D <sub>as-95</sub>	T' <sub>o</sub>
	g	g	g	-	km	inches/sec	sec	sec
FEE	0.03	0.08	0.01	6.47	225.33	0.29	43.69	0.17
SEE	0.07	0.15	0.02	5.63	113.07	0.63	22.43	0.13

Fundamental Period of Structure, T <sub>o</sub>	Range of Interest		V* <sub>s,H</sub>	H	T <sub>NH</sub>	
	0.5*T <sub>o</sub>	2.0*T <sub>o</sub>			(4*H)/V* <sub>s,H</sub>	(6*H)/V* <sub>s,H</sub>
sec	sec	sec	ft/sec	ft	sec	sec
0.00	0.00	0.00	1307.34	67.00	0.11	0.31
0.00	0.00	0.00				

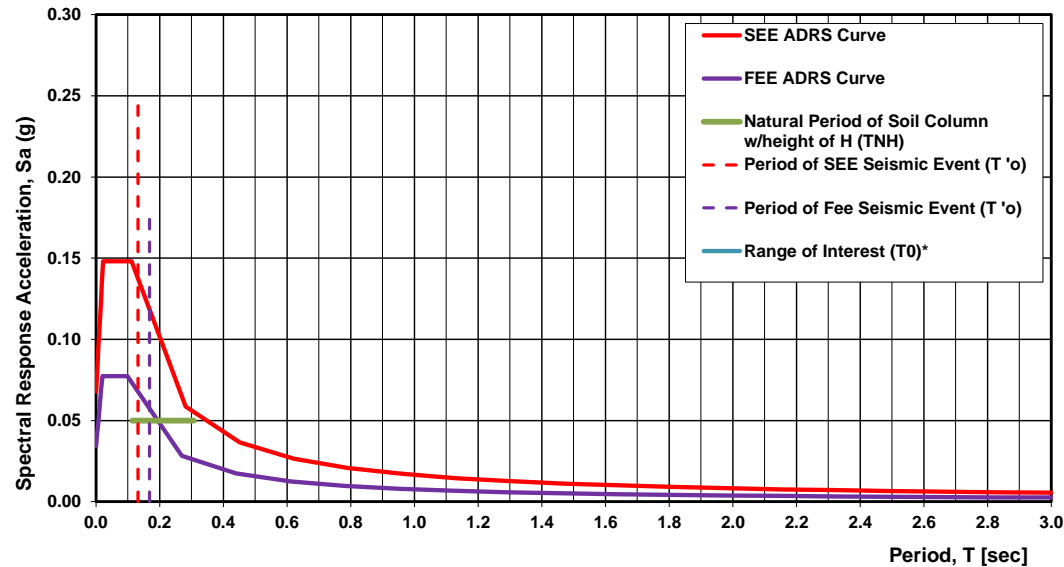
H = B-C Boundary

Damping:	5%
Geologic Condition:	Geologically Realistic (Q = 100)*
ADRS Location within Soil Column:	SCP
	At Ground Surface

South Carolina Piedmont

\*Same Geologic Condition as used in SCENARIO\_PC (2006)

### SC Seismic ADRS Curve



#### FEE Data

T	S <sub>a</sub>
0.00	0.034
0.00	0.041
0.01	0.049
0.01	0.056
0.01	0.063
0.02	0.070
0.02	0.077
0.03	0.077
0.03	0.077
0.04	0.077
0.05	0.077
0.05	0.077
0.06	0.077
0.07	0.077
0.07	0.077
0.08	0.077
0.09	0.077
0.09	0.077
0.10	0.077
0.27	0.028
0.44	0.017
0.61	0.013
0.78	0.010
0.95	0.008
1.12	0.007
1.29	0.006
1.46	0.005
1.63	0.005
1.81	0.004
1.98	0.004
2.15	0.004
2.32	0.003
2.49	0.003
2.66	0.003
2.83	0.003
3.00	0.003

#### SEE Data

T	S <sub>a</sub>
0.00	0.068
0.00	0.081
0.01	0.095
0.01	0.108
0.01	0.121
0.02	0.135
0.02	0.148
0.03	0.148
0.04	0.148
0.04	0.148
0.05	0.148
0.06	0.148
0.07	0.148
0.07	0.148
0.08	0.148
0.09	0.148
0.10	0.148
0.10	0.148
0.11	0.148
0.28	0.059
0.45	0.037
0.62	0.027
0.79	0.021
0.96	0.017
1.13	0.015
1.30	0.013
1.47	0.011
1.64	0.010
1.81	0.009
1.98	0.008
2.15	0.008
2.32	0.007
2.49	0.007
2.66	0.006
2.83	0.006
3.00	0.005

# SPT Automatic Hammer Energy Measurement Report

Drill Rig Model: GeoProbe 3126

Drill Rig Serial Number: 3126TTS52010006

Asset Number: DR#554

August 21, 2023

July 19, 2023

Terracon  
72 Pointe Circle  
Greenville, South Carolina 29607

Attn: Maggie McKenney  
E: m.mckenney@terracon.com

**Re:** SPT Automatic Hammer Energy Measurement Report  
Rig Serial Number: 3126TTS52010006  
Terracon Project Number: DYXX0500

Dear Ms. McKenney:

This report provides the Energy Transfer Ratio (ETR) for the Standard Penetration Testing (SPT) automatic hammer as summarized below:

**Table 1: Hammer Efficiency Summary**

Drill Rig Make/Model	Drill Rig Serial Number	Drill Rig Year	Asset Number	Energy Transfer Ratio (ETR)	Hammer Efficiency Correction (Ce)
GeoProbe 3126	3126TTS52010006	2021	GP#554	88.5% ± 4.2%	1.48

If you have any questions concerning this summary, or if we may be of further service, please contact us.

*Jim Smith*

James P. Smith  
National Manager of Equipment & Training

*Rob Kramer*

Rob Kramer  
Group Manager Geophysics

Attachments:

Exhibit A: PDA SPT Analyzer Results  
Exhibit B: PDA Equipment Calibration

Facilities | Environmental | **Geotechnical** | Materials |

Prepared for:

Terracon  
Greenville-Spartanburg, South Carolina



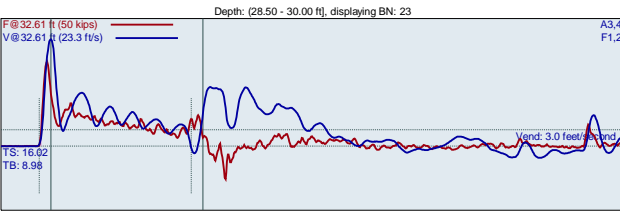
## MEASUREMENT SUMMARY

ITEM	DESCRIPTION
Drill Rig Owner	Terracon Greenville-Spartanburg - Greenville, SC
Drill Rig Operator	Brett Burnett; Terracon Exploration Services
Testing Date	08/21/2023
Testing Location	Spartanburg, SC
Boring Identification	B-1
Hammer Type	140 pounds (automatic)
Boring Method	Hollow Stem Auger
Drill Rods	<ul style="list-style-type: none"> <li>AWJ</li> <li>1-3/4" outside diameter</li> <li>3/16" wall thickness</li> </ul>
Calibration Testing Equipment	<ul style="list-style-type: none"> <li>2-foot AWJ rod instrumented w/ two strain gauges and two accelerometers</li> <li>Model SPT Analyzer™ (PDA)</li> </ul>
ASTM Methods Used	<p><b>ASTM D1586</b>, Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils</p> <p><b>ASTM D4633-16</b>, Standard Method for Energy Measurement for Dynamic Penetrometers</p>
SPT Calibration Personnel	Jim Smith, National Manager of Equipment and Training

## Exhibit A

### PDA SPT Analyzer Results

GP554-3126  
JIM SMITH  
TB-1  
AR: 1.20 in/2  
LE: 32.61 ft  
WS: 16807.9 fts  
28.5-30  
Interval start: 8/21/2023  
SP: 0.492 k/ft3  
EM: 30000 ksi



F1 : [648AWJ1] 226.21 PDICAL (1) FF1  
F2 : [648AWJ2] 225.58 PDICAL (1) FF1  
A3 (PR): [K4483] 410.187 mv/6.4v/5000g (1) VF1  
A4 (PR): [K10491] 421.907 mv/6.4v/5000g (1) VF1

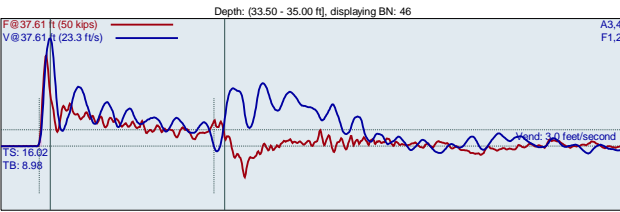
FMX: Maximum Force  
VMX: Maximum Velocity  
BPM: Blows/Minute  
EFV: Maximum Energy  
ETR: Energy Transfer Ratio - Rated

BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR %
1	6	40	19.4	1.9	234	84.1
2	6	39	19.2	51.9	292	83.4
3	6	25	16.9	52.7	274	78.2
4	6	28	17.9	52.4	273	77.9
5	6	32	19.6	52.6	294	83.9
6	6	27	17.3	53.1	268	79.5
7	8	38	19.0	52.7	289	82.5
8	8	39	19.6	52.4	305	87.2
9	8	36	19.2	52.7	290	82.8
10	8	28	18.2	52.5	292	83.4
11	8	38	19.0	53.0	293	83.8
12	8	35	19.4	52.6	282	80.4
13	8	36	19.1	52.9	299	85.3
14	8	34	19.8	52.8	307	87.7
15	11	34	19.5	52.7	307	87.6
16	11	33	19.5	52.9	299	85.6
17	11	36	19.4	52.7	308	88.1
18	11	37	18.5	52.8	320	91.4
19	11	32	19.6	52.9	301	86.1
20	11	39	18.7	52.9	301	85.9
21	11	26	17.5	52.8	277	79.1
22	11	30	19.1	52.6	306	87.4
23	11	33	19.5	52.7	298	85.1
24	11	35	19.9	52.4	303	86.5
25	11	36	19.4	53.1	313	89.6

Average	34	19.2	52.8	299	85.6
Std Dev	3	0.6	0.2	10	3.0
Maximum	39	19.9	53.1	320	91.4
Minimum	26	17.5	52.4	277	79.1
N-value: 19					

Sample Interval Time: 27.36 seconds.

GP554-3126  
JIM SMITH  
TB-1  
AR: 1.20 in/2  
LE: 37.61 ft  
WS: 16807.9 fts  
28.5-30  
Interval start: 8/21/2023  
SP: 0.492 k/ft3  
EM: 30000 ksi

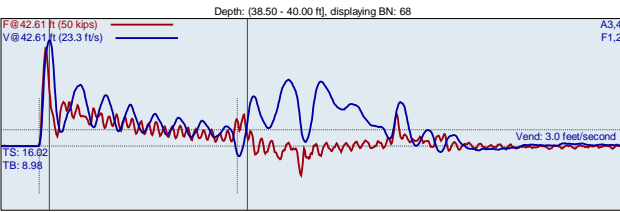


F1 : [648AWJ1] 226.21 PDICAL (1) FF1  
F2 : [648AWJ2] 225.58 PDICAL (1) FF1  
A3 (PR): [K4483] 410.187 mv/6.4v/5000g (1) VF1  
A4 (PR): [K10491] 421.907 mv/6.4v/5000g (1) VF1

BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR %
26	5	38	19.1	1.9	302	86.4
27	5	35	18.9	52.0	301	86.1
28	5	29	18.8	52.0	299	85.5
29	5	35	19.2	52.7	299	85.5
30	5	37	19.4	52.5	297	84.8
31	8	37	19.5	52.4	307	87.7
32	8	26	16.4	52.7	282	80.5
33	8	34	19.5	52.4	307	87.6
34	8	40	19.1	52.2	307	87.6
35	8	37	19.4	52.6	299	85.5
36	8	40	20.6	52.4	321	91.7
37	8	41	19.6	52.8	308	87.9
38	8	40	19.8	52.7	313	89.5
39	10	34	20.2	52.2	323	92.2
40	10	32	19.4	52.8	297	84.9
41	10	36	19.8	52.6	311	88.8
42	10	37	19.7	52.5	317	90.7
43	10	35	20.0	52.6	324	92.6
44	10	38	19.5	52.7	308	88.1
45	10	34	20.1	52.4	322	92.0
46	10	35	19.7	52.4	322	92.0
47	10	37	19.9	52.6	314	89.7
48	10	37	19.8	52.7	332	94.8
Average		36	19.6	52.6	312	89.1
Std Dev		3	0.8	0.2	12	3.3
Maximum		41	20.6	52.8	332	94.8
Minimum		26	16.4	52.2	282	80.5
N-value: 18						

Sample Interval Time: 25.16 seconds.

GP554-3126  
JIM SMITH  
TB-1  
AR: 1.20 in/2  
LE: 42.61 ft  
WS: 16807.9 ft/s  
28.5-30  
Interval start: 8/21/2023  
SP: 0.492 kftG  
EM: 30000 ksi



F1 : [648AWJ1] 226.21 PDICAL (1) FF1			A3 (PR): [K4483] 410.187 mm/6.4w/5000g (1) VF1			
F2 : [648AWJ2] 225.58 PDICAL (1) FF1			A4 (PR): [K10491] 421.907 mm/6.4w/5000g (1) VF1			
BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR %
49	5	34	19.6	1.9	307	87.6
50	5	34	19.3	52.0	301	86.1
51	5	27	16.5	52.7	278	79.4
52	5	33	19.9	52.5	310	88.6
53	5	29	17.7	52.7	288	82.2
54	8	29	18.6	52.5	295	84.2
55	8	23	15.6	52.9	287	82.0
56	8	34	20.1	52.6	323	92.2
57	8	28	18.1	52.8	295	84.3
58	8	38	18.8	53.1	312	89.1
59	8	35	19.2	52.6	329	94.0
60	8	36	19.3	52.9	327	93.3
61	8	40	19.7	52.8	323	92.4
62	9	35	18.8	53.0	320	91.3
63	9	37	19.1	52.7	320	91.3
64	9	35	19.9	52.9	327	93.4
65	9	29	18.8	52.7	314	89.7
66	9	35	19.7	53.0	342	97.8
67	9	36	19.9	52.8	331	94.5
68	9	38	19.3	52.8	335	95.8
69	9	36	19.9	52.5	325	92.9
70	9	39	19.5	52.9	329	94.0
Average		34	19.1	52.8	320	91.3
Std Dev		4	1.0	0.2	15	4.1
Maximum		40	20.1	53.1	342	97.8
Minimum		23	15.6	52.5	287	82.0
N-value: 17						

Sample Interval Time: 23.91 seconds.

Summary of SPT Test Results

Project: GP554-3126, Test Date: 8/21/2023		EFV: Maximum Energy	
FMX: Maximum Force		ETR: Energy Transfer Ratio - Rated	
VMX: Maximum Velocity			
BPM: Blows/Minute			
in/in	Blows	N	N60
Length	Applied	Value	Value
ft	/6"		
		Average	Average
		FMX	VMX
		kips	ft/s
		Average	Average
		BPM	ETR
		bpm	%
32.61	6-8-11	19	28
37.61	5-8-10	18	26
42.61	5-8-9	17	25
Overall Average Values:		35	19.3
Standard Deviation:		4	0.8
Overall Maximum Value:		41	20.6
Overall Minimum Value:		23	15.6
		52.7	310
		0.2	15
		53.1	342
		52.2	277
			88.5
			4.2
			97.8
			79.1



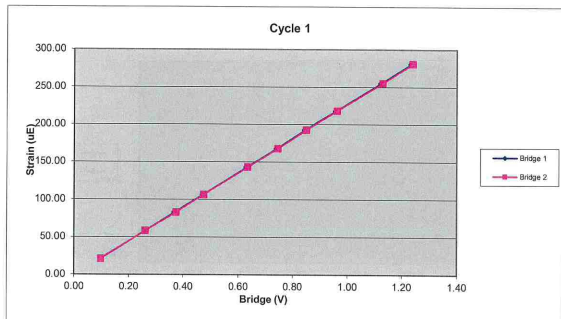
Exhibit B

PDA Equipment Calibration

648AWJ		Cycle 1		
Sample	Force (lb)	Strain (µE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	799.99	21.12	0.10	0.10
3	2111.63	58.22	0.26	0.26
4	2997.39	82.70	0.37	0.37
5	3848.07	106.26	0.47	0.47
6	5131.83	143.07	0.63	0.63
7	6017.79	167.81	0.74	0.75
8	6872.07	192.74	0.85	0.85
9	7783.57	218.15	0.96	0.96
10	9136.93	255.02	1.12	1.13
11	10026.70	280.73	1.24	1.24

Bridge 1		Bridge 2	
Force Calibration (lb/V)	8120.30	Force Calibration (lb/V)	8089.75
Offset	-4.24	Offset	-2.24
Correlation	0.999998	Correlation	0.999995
Strain Calibration (µE/V)	228.56	Strain Calibration (µE/V)	227.70
Offset	-1.57	Offset	-1.51
Correlation	0.999991	Correlation	0.999983

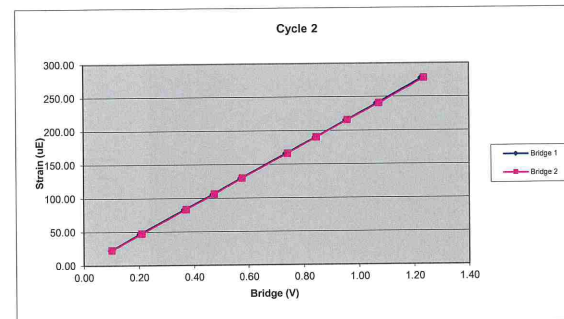
Force Strain Calibration	
EA (Kips)	35527.98
Offset	51.69
Correlation	0.999986



648AWJ		Cycle 2		
Sample	Force (lb)	Strain (µE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	805.54	22.23	0.10	0.10
3	1679.81	47.04	0.20	0.21
4	2989.11	83.03	0.37	0.37
5	3830.62	105.81	0.47	0.47
6	4658.00	129.50	0.57	0.58
7	5984.74	165.81	0.74	0.74
8	6848.87	189.76	0.84	0.84
9	7747.90	215.15	0.95	0.96
10	8674.21	240.08	1.07	1.07
11	9994.82	277.48	1.23	1.24

Bridge 1		Bridge 2	
Force Calibration (lb/V)	8127.14	Force Calibration (lb/V)	8103.79
Offset	10.37	Offset	-14.59
Correlation	0.999997	Correlation	0.999997
Strain Calibration (µE/V)	225.29	Strain Calibration (µE/V)	224.64
Offset	0.36	Offset	-0.33
Correlation	0.999990	Correlation	0.999992

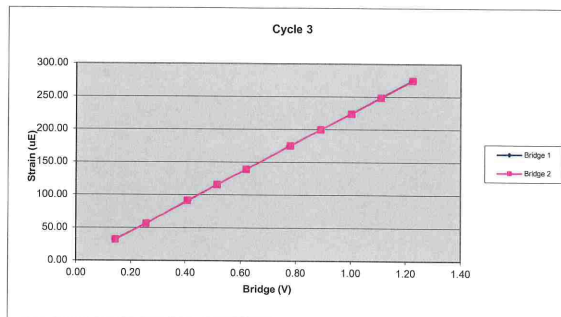
Force Strain Calibration	
EA (Kips)	36073.41
Offset	-2.66
Correlation	0.999993



648AWJ		Cycle 3		
Sample	Force (lb)	Strain (µE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1153.24	31.90	0.14	0.14
3	2056.55	56.28	0.26	0.26
4	3310.19	91.18	0.41	0.41
5	4155.51	115.51	0.51	0.51
6	5035.81	139.16	0.62	0.62
7	6303.78	175.10	0.78	0.78
8	7221.91	199.87	0.89	0.89
9	8120.94	223.92	1.00	1.00
10	9001.15	248.68	1.11	1.11
11	9931.66	274.33	1.22	1.23

Bridge 1		Bridge 2	
Force Calibration (lb/V)	8132.32	Force Calibration (lb/V)	8118.57
Offset	-20.37	Offset	-15.36
Correlation	0.999998	Correlation	0.999997
Strain Calibration (µE/V)	224.79	Strain Calibration (µE/V)	224.41
Offset	-0.57	Offset	-0.43
Correlation	0.999984	Correlation	0.999985

Force Strain Calibration	
EA (Kips)	36175.62
Offset	0.42
Correlation	0.999984



Bridge Excitation (V) 5  
Shunt Resistor (ohm) 60.4k

Calibration Factors		648AWJ	
Bridge 1 (µE/V)	226.21	Bridge 2 (µE/V)	225.58
EA Factor (Kips)	35925.67	Area (in <sup>2</sup> )	1.20

Calibrated by: *Aht*  
Calibrated Date: 3/3/2022

Pile Dynamics Inc  
30725 Aurora Rd  
Solon, OH 44139

Traceable to N.I.S.T.

Accelerometer Calibration Certificate  
Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.  
Calibration performed on 26Oct2021

Serial No: K4483 Temperature: 22.1 °C  
Model: PR Humidity: 45%  
Calibrated on: Channel 3 on 8G 5161 LE

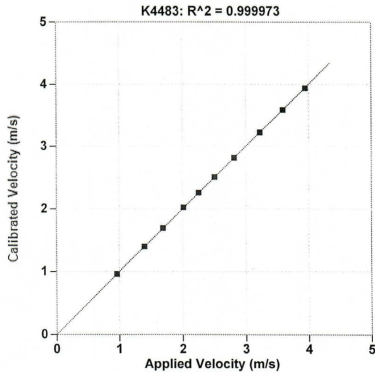
PDA CALIBRATION FACTOR  
410.2 mv/5000g  
(62.0  $\mu$ v/g)  
R<sup>2</sup>: 0.999973 [Chip programmed]

Operator: William Johnson

Signed

Ref Acc 1: 690961 Cal on: 27Jan2021  
978 g's/volt  
Ref Acc 2: 691321 Cal on: 09Feb2021  
960 g's/volt

Reference accelerometer calibrations are traceable to  
the United States National Institute of Standards and  
Technology (NIST).



Date printed: 26Oct2021, version: 2020.30.170 0.57

Accelerometer Calibration Certificate  
Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.  
Calibration performed on 25Jan2022

Serial No: K10491 Temperature: 19.3 °C  
Model: PR Humidity: 30%  
Calibrated on: Channel 3 on 8G 5161 LE

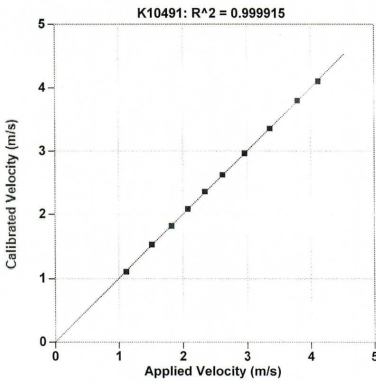
PDA CALIBRATION FACTOR  
421.9 mv/5000g  
(84.4  $\mu$ v/g)  
R<sup>2</sup>: 0.999915 [Chip programmed]

Operator: William Johnson

Signed

Ref Acc 1: 691321 Cal on: 09Feb2021  
960 g's/volt  
Ref Acc 2: 690961 Cal on: 27Jan2021  
978 g's/volt

Reference accelerometer calibrations are traceable to  
the United States National Institute of Standards and  
Technology (NIST).



Date printed: 25Jan2022, version: 2020.30.170 0.05