

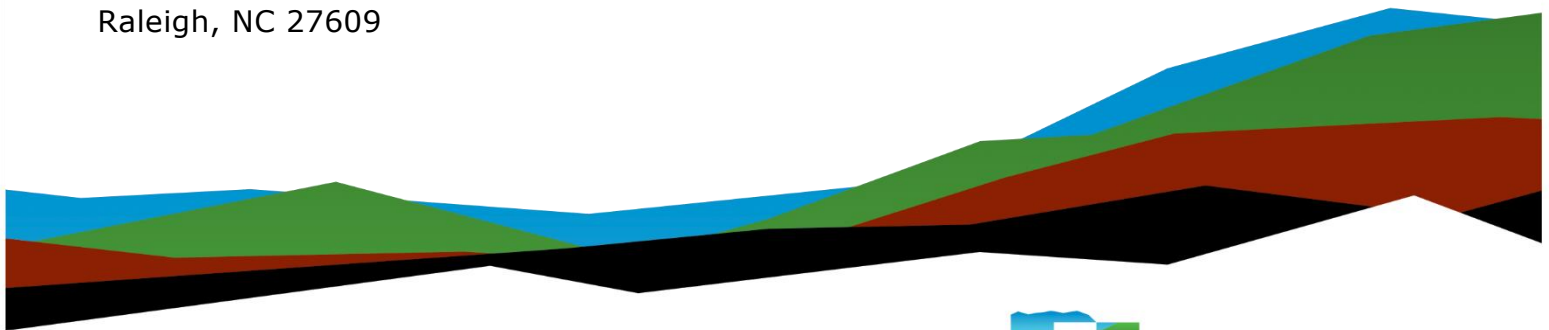
S-13-130 (Rudolph Sikes Road) Bridge Replacement over Clay Creek Chesterfield County, SC

Geotechnical Subsurface Data Report

August 18, 2023 | SCDOT Project ID: P041956
Terracon Project No.: 7323P100

Prepared for:

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





521 Clemson
Columbia, SC 29229
P (803) 741-9000
[Terracon.com](https://www.terracon.com)

August 18, 2023

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 Subsurface Data Report
S-13-130 Bridge Replacement over Clay Creek
Chesterfield County, South Carolina
SCDOT Project ID.: P041956
Terracon Project No.: 7323P100

Dear Mr. Franklin:

Terracon Consultants Inc. (Terracon) has completed the exploration, testing and limited engineering analysis services (contained in the Geotechnical Baseline Report) for the above 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, and laboratory testing for the replacement of the S-13-130 bridge over Clay Creek in Chesterfield County, South Carolina. The proposed bridge intends to replace the existing one. This GSDR was prepared in general accordance with the 2022 SCDOT Geotechnical Design Manual (GDM) and Preconstruction Design Memorandum (PCDM) 11 - Supplemental Design Criteria for Low Volume Bridge Replacement Projects.

Project Description

The project site is located at the S-13-130 (Rudolph Sikes Road) crossing over Clay Creek in Chesterfield County, South Carolina. Site location and exploration plans are presented in Appendix A of this report. Based on the conceptual plans by HNTB dated 6/9/2023, the replacement bridge will be constructed on essentially the same alignment as the current bridge. The existing bridge is a multi-span structure supported by deep foundations. The

conceptual plans show that the replacement bridge will be a single-span structure supported by deep foundations.

Geotechnical Testing

The geotechnical exploration for this project was performed between June 22 and June 23, 2023. The results of our field work 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-13-130-1 and S-13-130-2)
- One (1) offset boring near S-13-130-1 for bulk sample collection

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 Construction Support Services, LLC after completion.

Laboratory Testing

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

- Eight (8) Natural Moisture Content Tests
- Five (5) Atterberg Limits Tests
- Five (5) Fines Content 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 Tests (pH, chloride content, sulfate content, and resistivity tests)

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.

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.

Phillip A. Morrison, P.E.
Senior Engineer
SC Registration No. 17275

Abdul Q. Fekrat, PhD, P.E.
Project Engineer
SC Registration No. 38531

Reviewed by Terracon's Authorized Project Reviewer: David J. Corley, P.E.

Appendix A

Field Exploration

- Exhibit A-1 – Site Location Map
- Exhibit A-2 – Exploration Plan
- Exhibit A-3 – Summary of Boring Data
- Exhibit A-4 – GeoScoping Form (2 Pages)
- Exhibit A-5 – Field Exploration Description (2 Pages)
- Exhibit A-6 – Soil Description Terms
- Exhibit A-7 – Soil/Rock Symbols
- Exhibit A-8 – Boring Logs (4 Pages)
- Exhibit A-9 – Grout Logs (3 Pages)

Note: All exhibits are one page unless noted above.

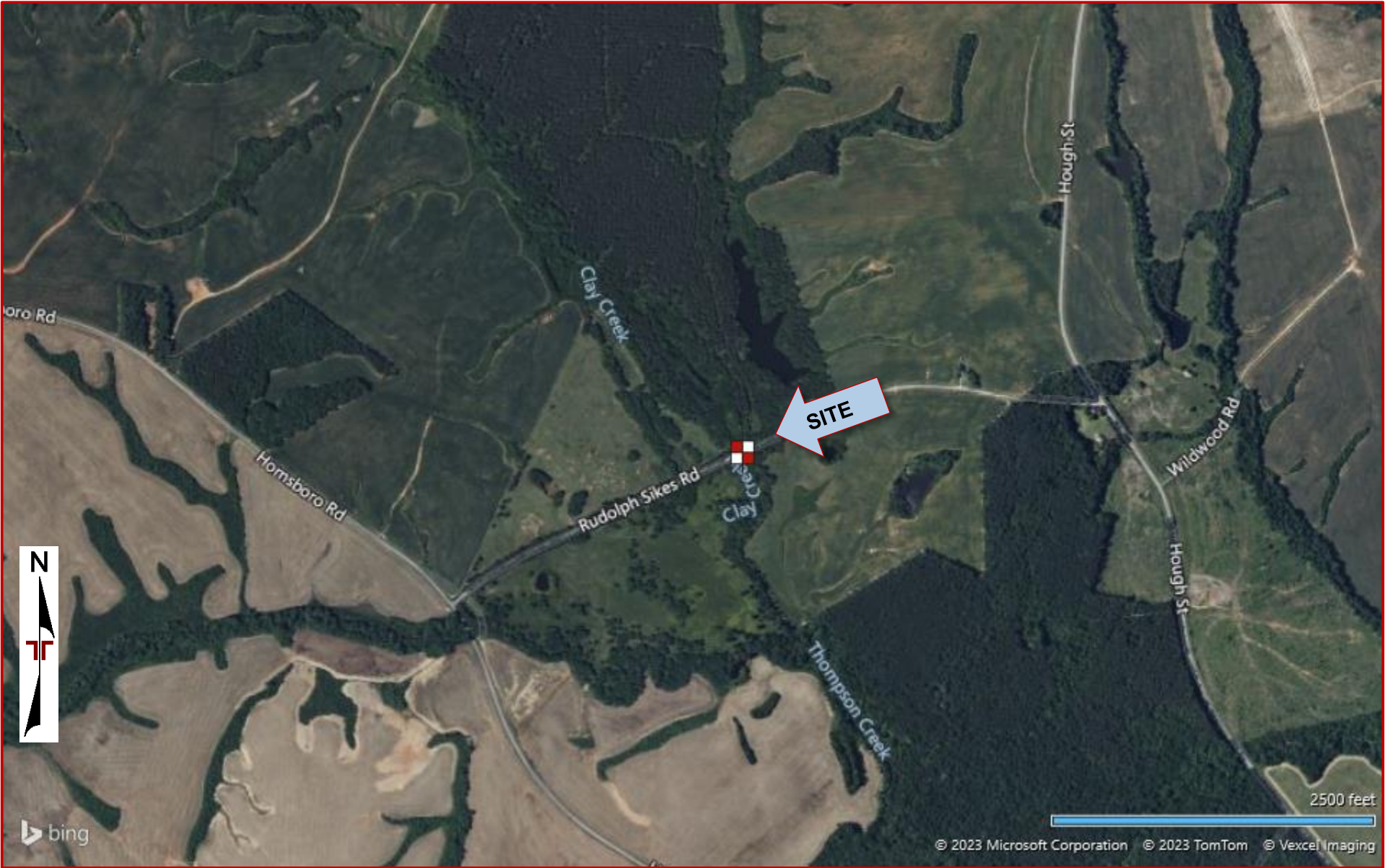


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT
 INTENDED FOR CONSTRUCTION PURPOSES

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
 QUADRANGLES INCLUDE: HORNSBORO, SC (1/1/1983) and MT CROGHAN, NC
 (1/1/1983).

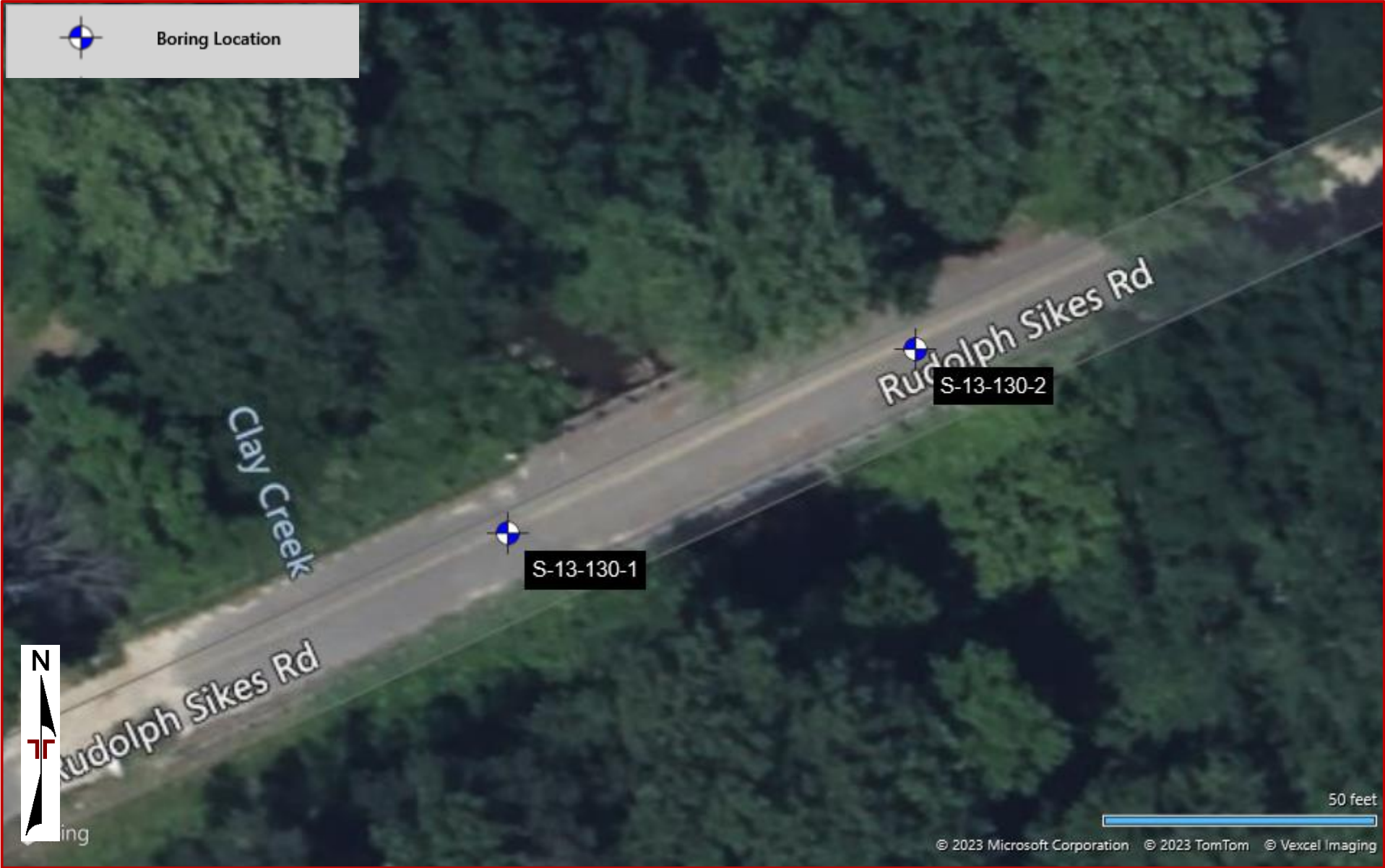


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT
INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY
MICROSOFT BING MAPS

Summary of Boring Data – Exhibit A-3

S-13-130 BRO Clay Creek | Chesterfield County, SC

Terracon Project No. 7323P100 | SCDOT Project ID: P041956



Summary of Boring Data

Boring No.	Ground Elevation ft.	Test Depth ft.	Northing	Easting	Latitude	Longitude	Station	Offset
S-13-130-1	313.2	65.0	1078206.17	2222600.99	34.794461	80.258595	29+36.62	1.25R
S-13-130-2	313.3	65.0	1078240.39	2222675.71	34.794554	80.258346	28+54.44	0.47R

Note: A bulk sample was collected near S-13-130-1.

GeoScoping Form

PROJECT INFORMATION	
Project ID: P041956	Date of Trip: 6/22/23
County: Chesterfield	Location: Pageland
Rd/Route: S-13-130	Local Name: Rudolph Sikes
Attendees: A. Beaty	

EXISTING BRIDGE INFORMATION	
Bridge Length: 75 feet	Bridge Width: 26 Feet
Superstructure Type: Concrete framing and decking	Substructure Type: Concrete Piles
Begin Bridge Sta.: 28+54	End Bridge Sta.: 29+29
Begin Bridge Embankment Sta. ¹ 27+54	End Bridge Embankment Sta. ¹ : 30+29
Structure Number: 03620	Posted Weight Limit: N/A
Crossing: Clay Creek	Skew: 30 degrees
Latitude: 34.794512° N	Longitude: 80.258477° W
Existing Fill Height: 12 feet	Approximate Existing Slope Angle: 2H:1V

¹Begin and End Bridge Embankment 100 feet down station or up station from bridge, respectively

EXISTING ROADWAY EMBANKMENT INFORMATION	
Begin Project Sta.: 23+00	Begin Bridge Embankment Sta. ¹ : 33+50
Accessibility Issues: None	
Ground Cover: Asphalt Pavement	
Existing Fill Height: 12	Approximate Existing Slope Angle: 2H:1V
Local Development (undeveloped, developed residential, developed commercial, developed industrial, etc.): Undeveloped	
Topography (level, flat, rolling, steep, hillside, valley, swamp, gully, etc.): Rolling	
Traffic Control Necessary (Y/N):	
No	
Surface Soil: Clay	Muck (Y/N): No
Exposed Rock (Y/N): No	In Stream Bed (Y/N): No
	In Banks (Y/N): No
Wetlands On-Site (Y/N): Yes (Stream)	Wetlands Adjacent (Y/N): Yes (Stream)
Depth FG to Water: 5 feet	Water Depth: 8 feet
Depth to Existing Ground: 13 feet	
Scour Condition at EB: None observed	Scour Condition at IB: None Observed
End Bridge Embankment Sta. ¹ : 29+29	End Project Sta.: 33+50
Accessibility Issues: None Bridge Closed	
Ground Cover: Asphalt Pavement	
Existing Fill Height: 12 feet	Approximate Existing Slope Angle: 2H:1V
Local Development (undeveloped, developed residential, developed commercial, developed industrial, etc.): Undeveloped	
Topography (level, flat, rolling, steep, hillside, valley, swamp, gully, etc.): Rolling	
Traffic Control Necessary (Y/N): No	
Surface Soil: Clay	Muck (Y/N): No
Exposed Rock (Y/N): No	In Stream Bed (Y/N): No
	In Banks (Y/N): No
Wetlands On-Site (Y/N): Yes (Stream)	Wetlands Adjacent (Y/N): Yes (Stream)
Depth FG to Water:	Water Depth:
Depth to Existing Ground: 13 feet	
Scour Condition at EB: None	Scour Condition at IB: Not observed due to water depth

GeoScoping Form

UTILITIES INFORMATION	
Attached:	
Above Ground/ Overhead:	None
Underground:	

COMMENTS	

Instructions:

1. Attach boring location plan for bridge and roadway.
2. Attach all photographs taken, photographs to be labeled as to direction looking in and what is being depicted.
3. Fill out GeoScoping Form as completely as possible, using additional sheets as necessary to describe site conditions.
4. If representative of GEC on site during GeoScoping, include GEC representative's name and contact number in Attendees block.

Exhibit A-5

S-13-130 BRO Clay Creek | Chesterfield County, SC

August 18, 2023 | Terracon Project No. 7323P100 | SCDOT Project ID: P041956



Field Exploration Description

Overview

The testing locations were proposed to and approved by SCDOT and located in the field by Terracon using measurements from existing structures shown on the provided drawings. The borings were surveyed by Construction Support Services, LLC after testing and drilling was complete. The locations as shown in the Exploration Plan 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
- Preconstruction Design Memorandum (PCDM) 11 - Supplemental Design Criteria for Low Volume Bridge Replacement Projects
- 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"

Each soil test boring was advanced using rotary wash drilling techniques. The initial sampling program is summarized in the following table:

Test ID	Total Depth	Interval of Continuous Sampling
S-13-130-1	100 feet or 10 feet rock coring	0 to 10 feet
S-13-130-2	100 feet or 10 feet rock coring	0 to 10 feet
S-13-130-1 Bulk	5 feet	Bulk Sample

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

Exhibit A-5

S-13-130 BRO Clay Creek | Chesterfield County, SC

August 18, 2023 | Terracon Project No. 7323P100 | SCDOT Project ID: P041956



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.

As practical, groundwater readings were collected from each of the soil test borings after 24 hours. These water levels are indicated on the boring logs. The borings were advanced using mud rotary drilling techniques. As the drilling method introduces water into the borehole, time-of-drilling water levels may not be reliable.

At the conclusion of the work, the boreholes were backfilled with the drill cuttings and clean sand. The upper 20 feet of the boreholes were grouted with a cement bentonite grout and capped with cold-patch asphalt.

SOIL DESCRIPTION TERMS

Relative Density/Consistency Terms

<u>Relative Density</u> ¹			<u>Consistency</u> ²		
Descriptive Term	Relative Density	SPT Blow Count	Descriptive Term	Unconfined Compression Strength (q _u) (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.

Angularity¹

<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 Reaction³

<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

Cementation³

<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 Range¹

<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^{1, 2}

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

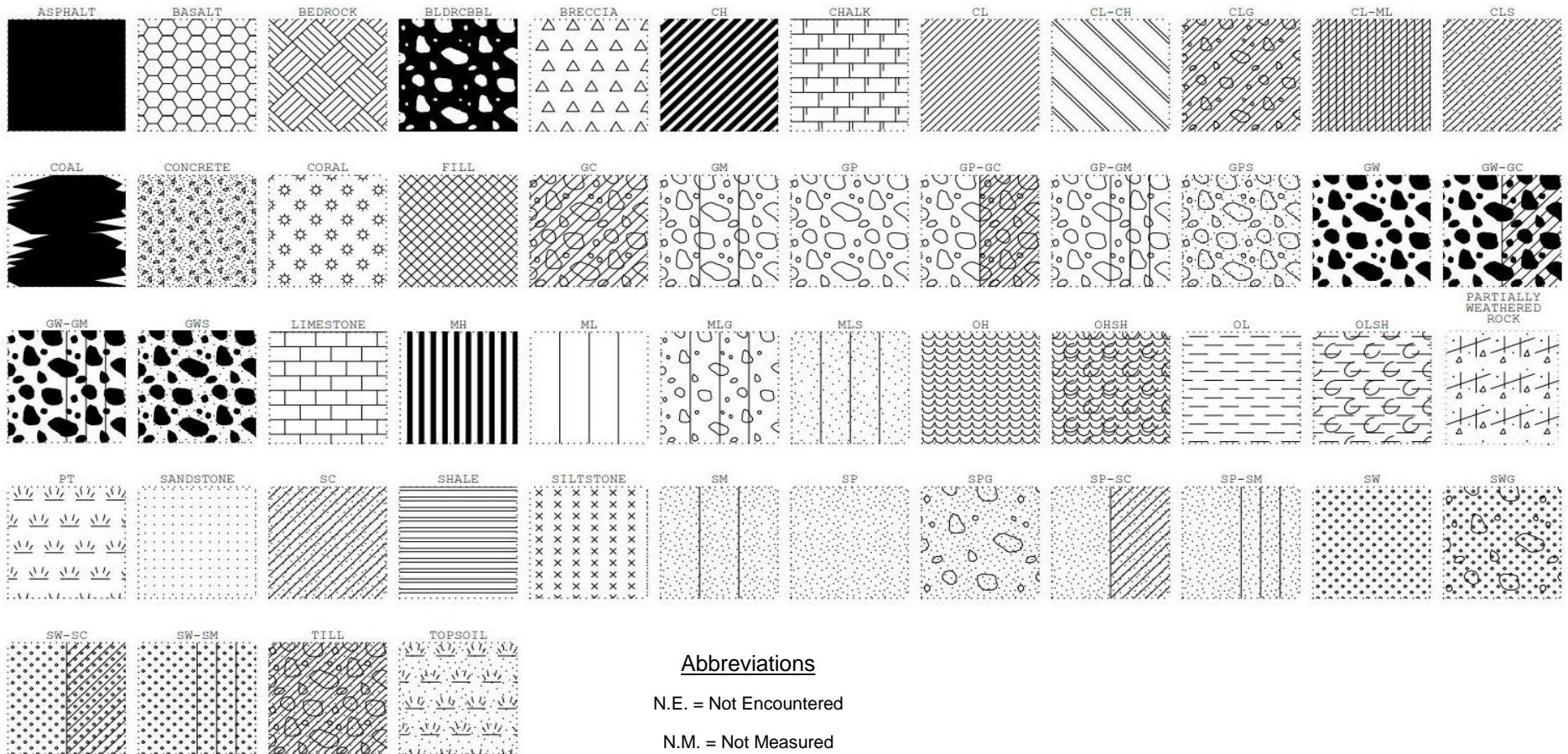
AASHTO Soil Designation

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

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

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

³Use as required



Project Manager:	PAM
Drawn by:	KJZ
Checked by:	PAM
Approved by:	DJC

Project No.	7323P100
Scale:	N.T.S.
File Name:	Soil – Rock – Log
Date:	Jul 2023



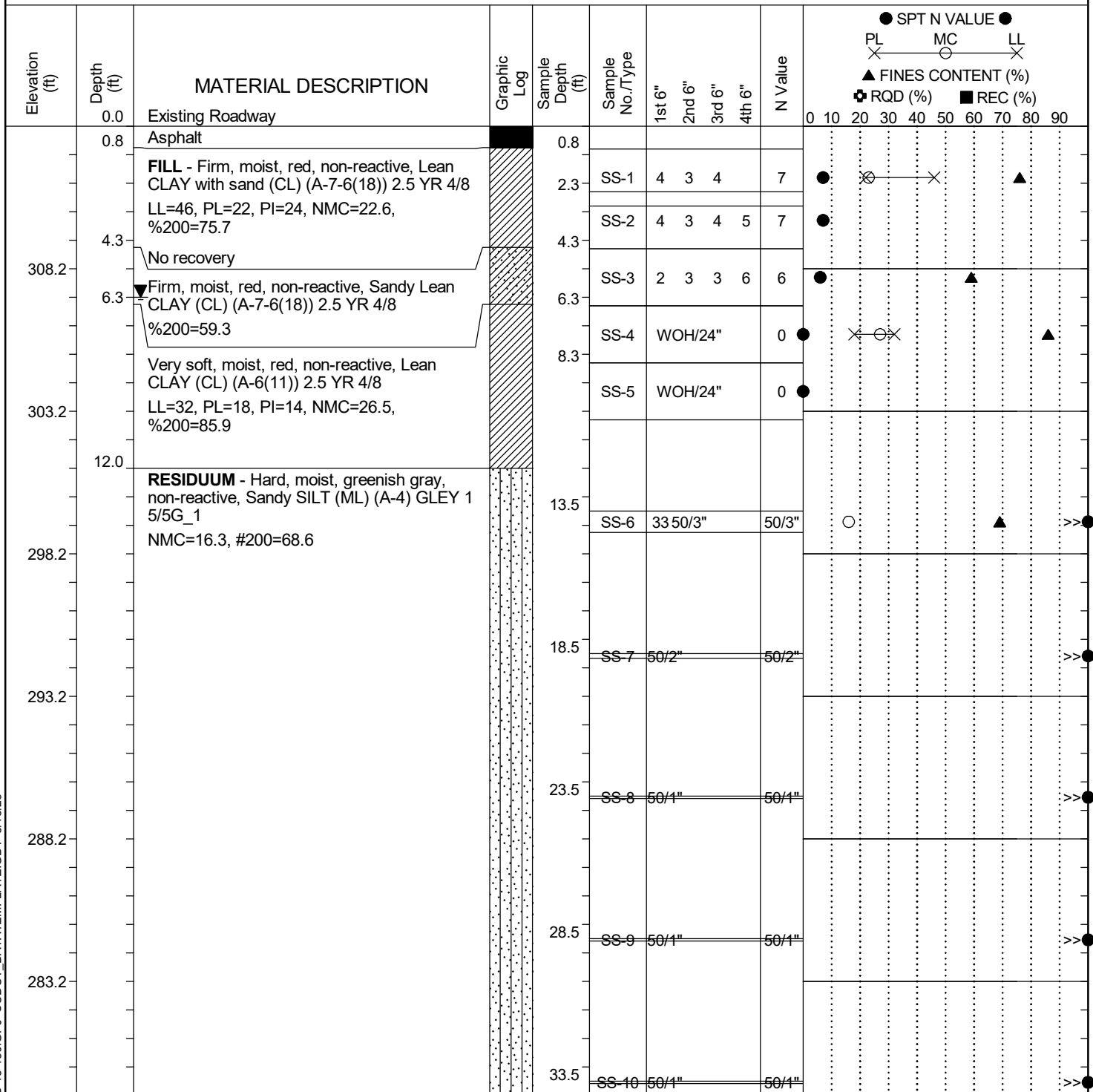
521 Clemson Road
PH. (803) 741-9000
Columbia, SC 29229
FAX. (803) 741-9900

SOIL AND ROCK SYMBOLS

Exhibit A-7

SCDOT Soil Test Log

Project ID:	P041956	County:	Chesterfield	Boring No.:	S-13-130-1
Site Description:	S-13-130 BRO Clay Creek			Route:	S-13-130
Eng./Geo.:	A. Beaty	Boring Location:	29+36.62	Offset:	1.25 R
Elev.:	313.2 ft	Latitude:	34.794461	Longitude:	-80.258595
Date Started:	6/22/2023				
Total Depth:	65 ft	Soil Depth:	65 ft	Core Depth:	0 ft
Date Completed:	6/23/2023				
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	DR1109	Drill Method:	RW	Hammer Type:	Automatic
Energy Ratio:	93.9%				
Core Size:		Driller:	S. Truesdale	Groundwater:	TOB N.M.
24HR	6 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

Project ID:	P041956	County:	Chesterfield	Boring No.:	S-13-130-1
Site Description:	S-13-130 BRO Clay Creek	Route:	S-13-130		
Eng./Geo.:	A. Beaty	Boring Location:	29+36.62	Offset:	1.25 R
Elev.:	313.2 ft	Latitude:	34.794461	Longitude:	-80.258595
Date Started:	6/22/2023	Date Completed:	6/23/2023		
Total Depth:	65 ft	Soil Depth:	65 ft	Core Depth:	0 ft
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	DR1109	Drill Method:	RW	Hammer Type:	Automatic
Energy Ratio:	93.9%				
Core Size:		Driller:	S. Truesdale	Groundwater:	TOB N.M.
24HR	6 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 X LL X </div> <div> ▲ FINES CONTENT (%) </div> <div> ⊕ RQD (%) ■ REC (%) </div> </div>
278.2											
		No recovery		38.5	SS-11	50/0"			50/0"		>>●
273.2											
				43.5	SS-12	50/1"			50/1"		>>●
268.2											
		No recovery		48.5	S-13	50/1"			50/1"		>>●
263.2											
		No recovery		53.5	SS-14	50/0"			50/0"		>>●
258.2											
		No recovery		58.5	SS-15	50/0"			50/0"		>>●
253.2											
				63.5	SS-16	50/1"			50/1"		>>●
248.2	65.0	BORING TERMINATED AT 65 FEET									

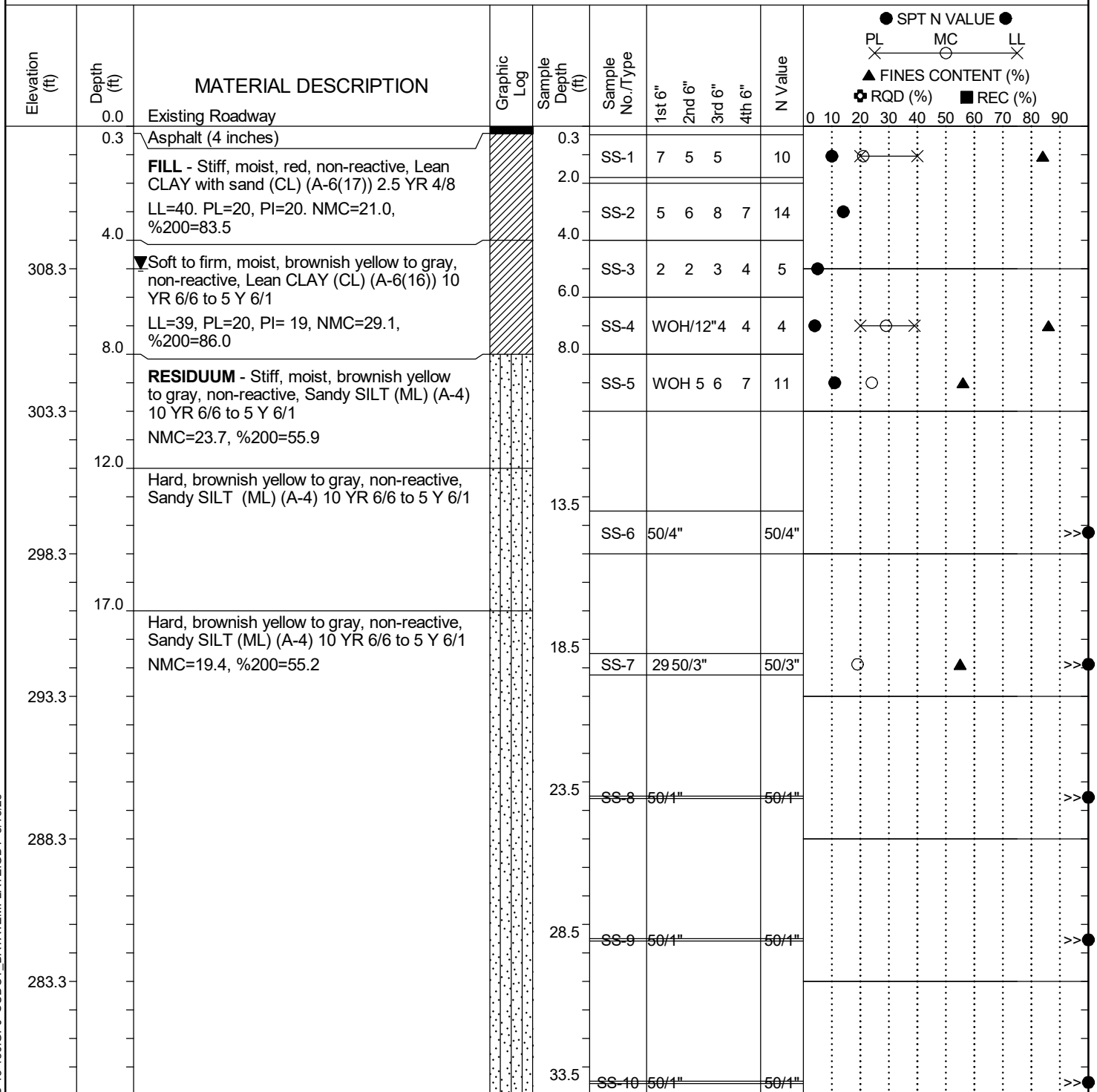
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SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving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

SC.DOT SCDOT S-13-130.GPJ SCDOT_DATATEMPLATE.GDT 8/18/23

SCDOT Soil Test Log

Project ID:	P041956	County:	Chesterfield	Boring No.:	S-13-130-2
Site Description:	S-13-130 BRO Clay Creek			Route:	S-13-130
Eng./Geo.:	A. Beaty	Boring Location:	28+54.44	Offset:	0.47 R
Elev.:	313.3 ft	Latitude:	34.794554	Longitude:	-80.258347
Total Depth:	65 ft	Soil Depth:	65 ft	Date Started:	6/22/2023
Core Depth:	0 ft	Date Completed:	6/23/2023		
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Drill Machine:	DR1109	Drill Method:	RW	Liner Used:	Y (N)
Hammer Type:	Automatic	Energy Ratio:	93.9%		
Core Size:		Driller:	S. Truesdale	Groundwater:	TOB N.M.
24HR	5 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

Project ID:	P041956	County:	Chesterfield	Boring No.:	S-13-130-2
Site Description:	S-13-130 BRO Clay Creek	Route:	S-13-130		
Eng./Geo.:	A. Beaty	Boring Location:	28+54.44	Offset:	0.47 R
Elev.:	313.3 ft	Latitude:	34.794554	Longitude:	-80.258347
Date Started:	6/22/2023	Date Completed:	6/23/2023		
Total Depth:	65 ft	Soil Depth:	65 ft	Core Depth:	0 ft
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	DR1109	Drill Method:	RW	Hammer Type:	Automatic
Energy Ratio:	93.9%				
Core Size:		Driller:	S. Truesdale	Groundwater:	TOB N.M.
24HR	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 X LL X </div> <div> ▲ FINES CONTENT (%) </div> <div> ⊕ RQD (%) ■ REC (%) </div> </div>
278.3											
				38.5	SS-11	50/3"			50/3"		>>●
273.3											
		No recovery		43.5	SS-12	50/1"			50/1"		>>●
268.3											
		No recovery		48.5	SS-13	50/1"			50/1"		>>●
263.3											
				53.5	SS-14	50/0"			50/0"		>>●
258.3											
				58.5	SS-15	50/1"			50/1"		>>●
253.3											
				63.5	SS-16	50/2"			50/2"		>>●
248.3	65.0	BORING TERMINATED AT 65 FEET									

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	

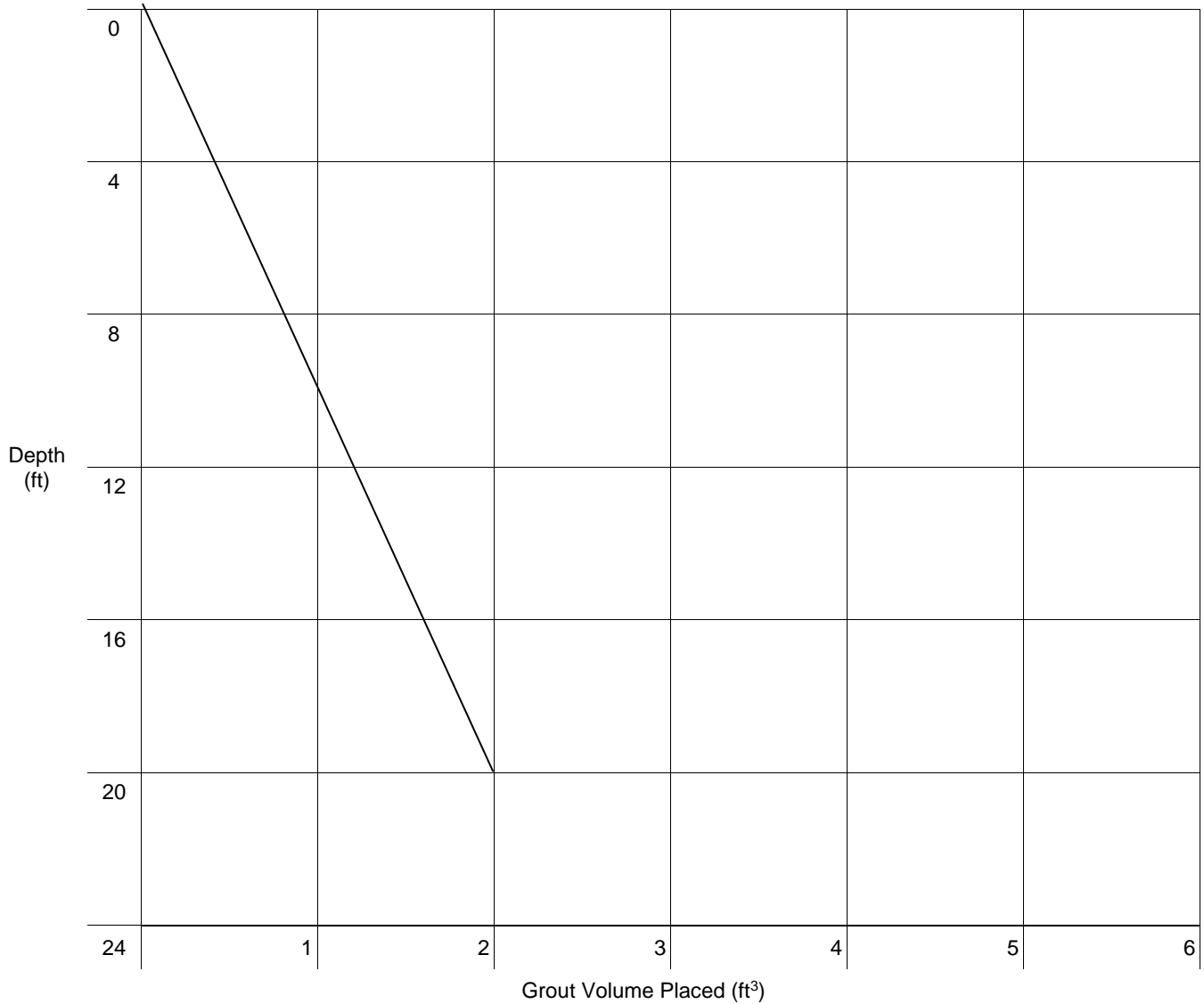
SC.DOT SCDOT S-13-130.GPJ SCDOT_DATATEMPLATE.GDT 8/18/23



GROUT LOG OF TEST HOLES FOR GEOTECHNICAL ON-CALL

Project Name:	S-13-130 BRO Clay Creek		Test Hole No.:	S-13-130-1
Project ID:	P041956		Station:	29+36.62
Consultant Firm:	Terracon Consultants, Inc.		Offset:	1.25 R
Grouted By (Driller's Name):	Truesdale	Date	6/23/23	
Notes:	Mix design: 1 pound cement, 1 pound bentonite, 6 pounds water			

Grout Curve



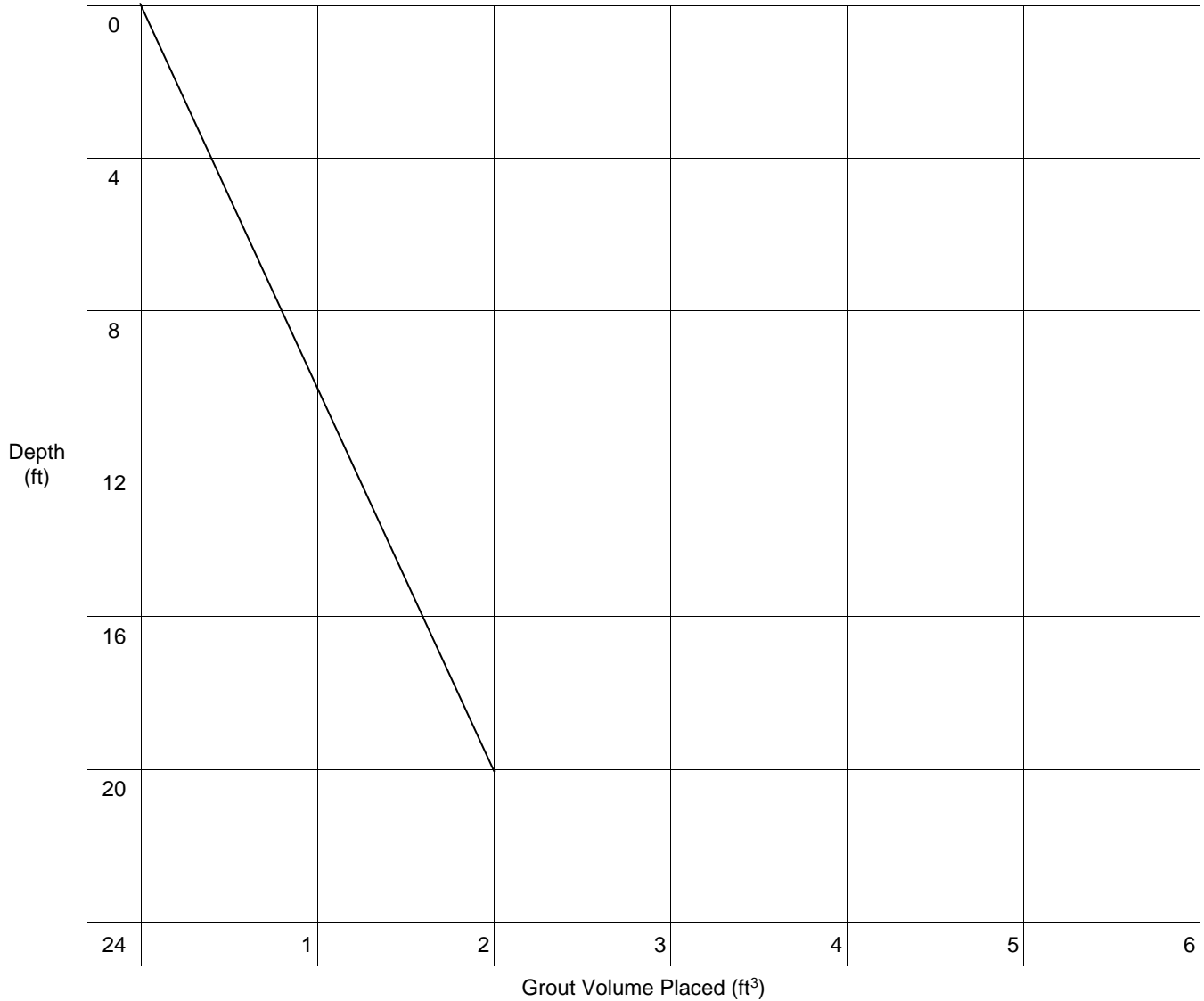
Number of Bags On-Site	20	ea.
Depth of Test Hole Grouted	20	ft.
Diameter of Test Hole	0.33	ft.
Area of Test Hole	0.09	ft²
Volume of Test Hole	1.74	ft³
Volume of Casing (If applicable)	-	ft³
Theoretical Volume of Test Hole	1.74	ft³
Number of Bags Used	2.5	ea.
Volume Placed	2	ft³



GROUT LOG OF TEST HOLES FOR GEOTECHNICAL ON-CALL

Project Name:	S-13-130 BRO Clay Creek		Test Hole No.:	S-13-130-2
Project ID:	P041956		Station:	28+54.44
Consultant Firm:	Terracon Consultants, Inc.		Offset:	0.47R
Grouted By (Driller's Name):	Truesdale	Date	6/23/23	
Notes:	Mix design: 1 pound cement, 1 pound bentonite, 6 pounds water			

Grout Curve

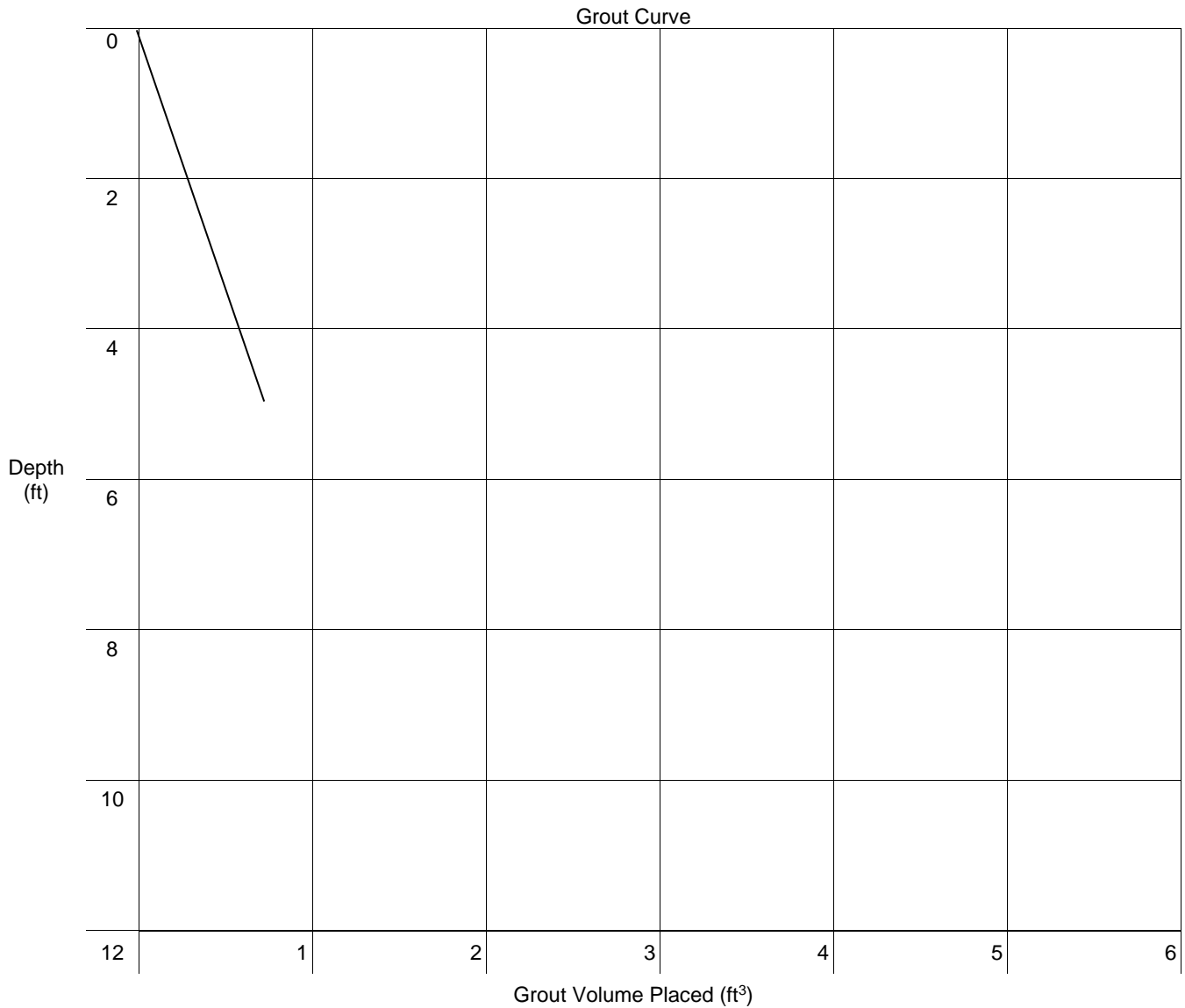


Number of Bags On-Site	20	ea.
Depth of Test Hole Grouted	20	ft.
Diameter of Test Hole	0.33	ft.
Area of Test Hole	0.09	ft²
Volume of Test Hole	1.74	ft³
Volume of Casing (If applicable)	-	ft³
Theoretical Volume of Test Hole	1.74	ft³
Number of Bags Used	2.5	ea.
Volume Placed	2	ft³



GROUT LOG OF TEST HOLES FOR GEOTECHNICAL ON-CALL

Project Name:	S-13-130 BRO Clay Creek	Test Hole No.:	S-13-130-1
Project ID:	P041956	Station:	(BULK)
Consultant Firm:	Terracon Consultants, Inc.	Offset:	29+36.62
Grouted By (Driller's Name):	Truesdale	Date	6/22/23
Notes:	Mix design: 1 pound cement, 1 pound bentonite, 6 pounds water		1.25 R



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	0.2	ft ²
Volume of Test Hole	1.0	ft ³
Volume of Casing (If applicable)	-	ft ³
Theoretical Volume of Test Hole	1.0	ft ³
Number of Bags Used	1.5	ea.
Volume Placed	0.7	ft ³

Appendix B

Laboratory Testing

Exhibit B-1 – Laboratory Testing Description
Summary of Laboratory Data
Laboratory Data Sheets (14 Pages)

Note: All exhibits are one page unless noted above.

Exhibit B-1

S-13-130 BRO Clay Creek | Chesterfield County, SC

August 10, 2023 | Terracon Project No. 7323P100 | SCDOT Project ID: P041956



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 samples 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)
■ Triaxial Shear CU w/ PP	AASHTO T297/(ASTM D4767)
■ Grain Size Distribution	ASTM D6913
■ Hydrometer	ASTM D7928
■ Corrosion Series	AASHTO D422
	AASHTO T289/ASTM G51
	AASHTO T290/ASTM C1580
	AASHTO T291

SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 1

BORING ID	Depth (Ft.)	Soil Classification USCS & AASHTO	Liquid Limit	Plastic Limit	Plasticity Index	% Fines	% Gravel	% Sand	% Silt	% Clay	Water Content (%)
S-13-130-1 Bulk	0-5	LEAN CLAY with SAND(CL) / A-6 (12)	38	19	19	70.9					18.3
S-13-130-1	0.8-2.8	LEAN CLAY with SAND(CL) / A-7-6 (18)	46	22	24	75.7					22.6
S-13-130-1	4.3-6.3					59.3	2.0	38.7	35.1	24.2	
S-13-130-1	6.3-8.3	LEAN CLAY(CL) / A-6 (11)	32	18	14	85.9	0.0	14.1	52.1	33.8	26.5
S-13-130-1	13.5-14.3					68.6					16.3
S-13-130-2	0.3-1.8	LEAN CLAY with SAND(CL) / A-6 (17)	40	20	20	83.5					21.0
S-13-130-2	6-8	LEAN CLAY(CL) / A-6 (16)	39	20	19	86.0	0.0	14.0	49.7	36.3	29.1
S-13-130-2	8-10					55.9	0.3	43.9	35.0	20.8	23.7
S-13-130-2	18.5-20					55.2					19.4
PROJECT: S-13-130 BRO Clay Creek			<div>Terracon</div> <div>521 Clemson Rd Columbia, SC</div>					PROJECT NUMBER: 7323P100			
SITE: Chesterfield County, SC								CLIENT: HNTB			
			PH. 803-741-9000 FAX. 803-741-9900								



INDEX PROPERTIES VERSUS DEPTH

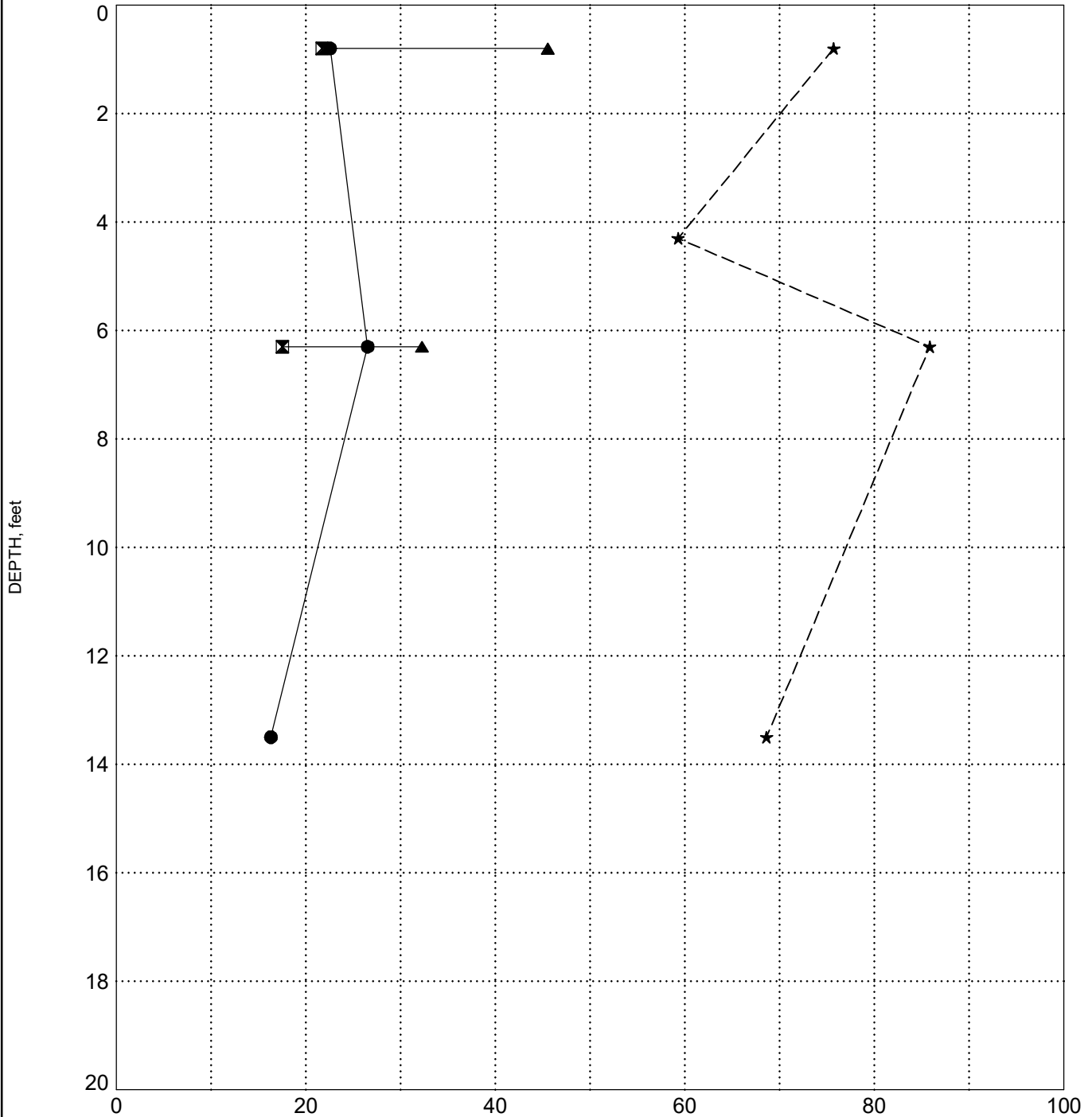
PROJECT ID P041956

PROJECT NAME S-13-130 BRO Clay Creek

PROJECT COUNTY Chesterfield

SURFACE ELEVATION: 313.2

BORING S-13-130-1



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



INDEX PROPERTIES VERSUS DEPTH

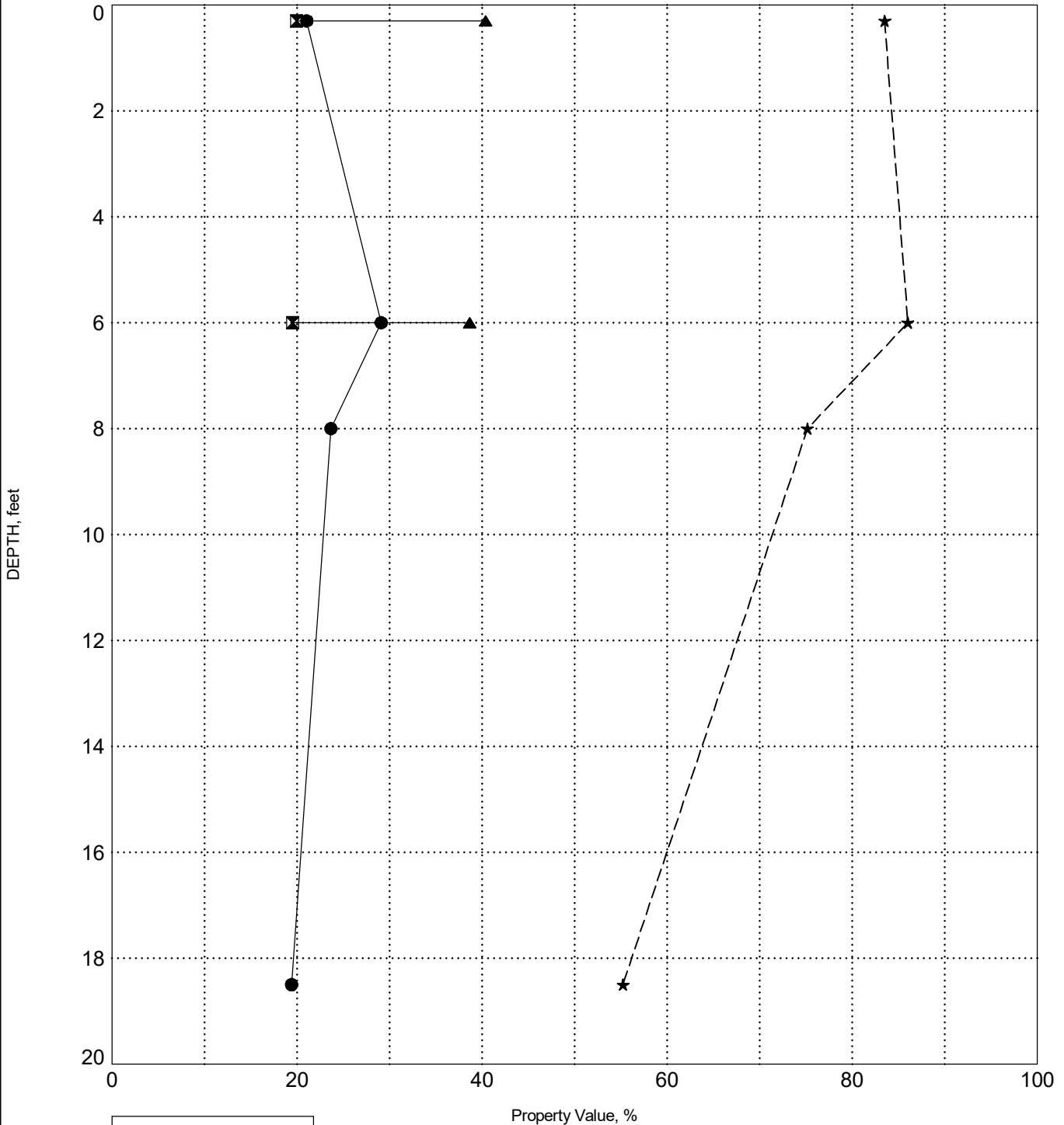
PROJECT ID P041956

PROJECT NAME S-13-130 BRO Clay Creek

PROJECT COUNTY Chesterfield

SURFACE ELEVATION: 313.3

BORING S-13-130-2



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

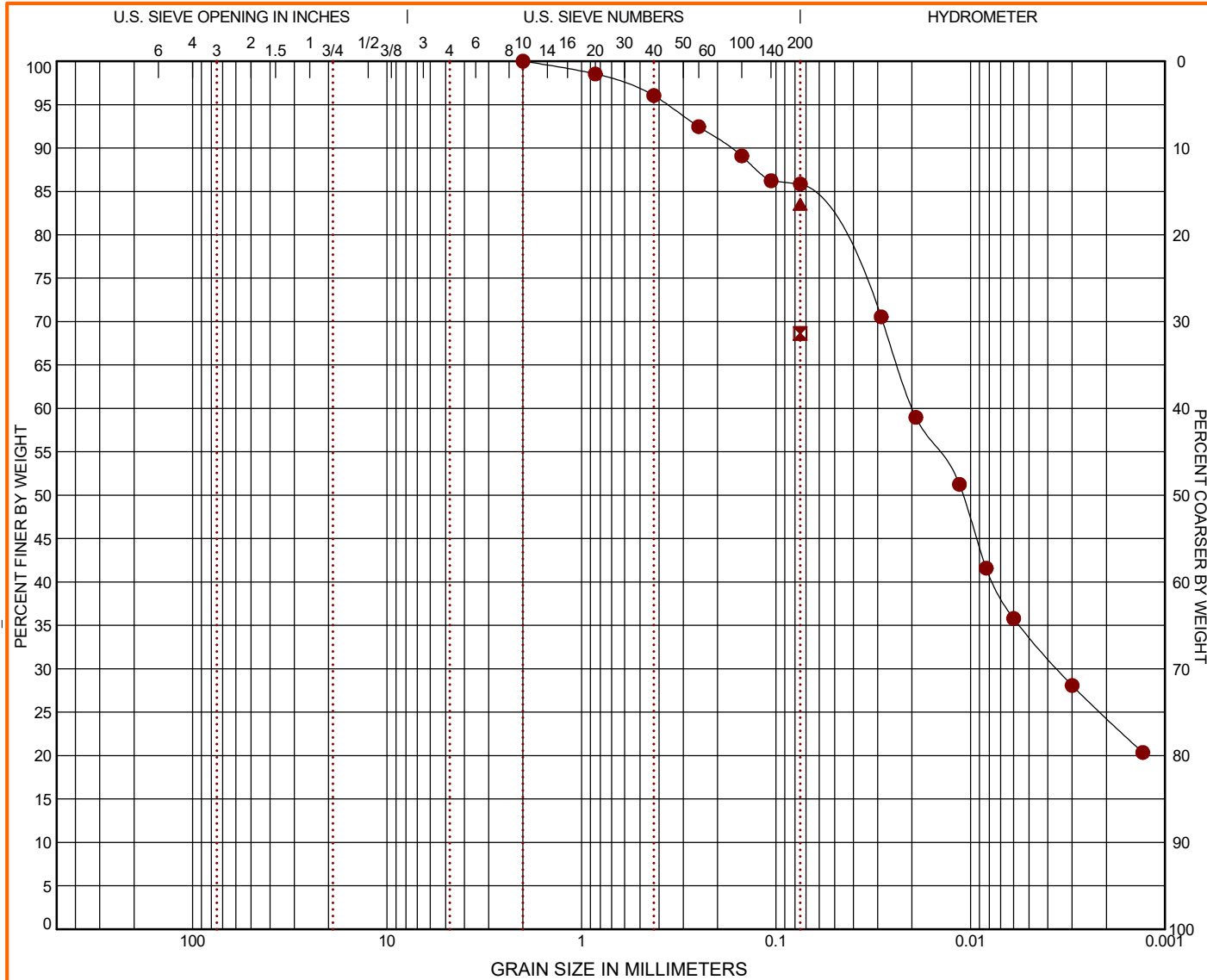
ASTM D422 / ASTM C136

PROJECT: S-13-130 BRO Clay Creek	 521 Clemson Rd Columbia, SC	PROJECT NUMBER: 7323P100
SITE: Chesterfield County, SC		CLIENT: HNTB

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: AASHTO DESC-1 S-13-130 THOMSON CREEK.GPJ TERRACON_DATATEMPLATE.GDT 8/16/23



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
● S-13-130-1	6.3 - 8.3	0.0	0.0	14.1	52.1		33.8	CL
✕ S-13-130-1	13.5 - 14.3					68.6		
▲ S-13-130-2	0.3 - 1.8					83.5		CL

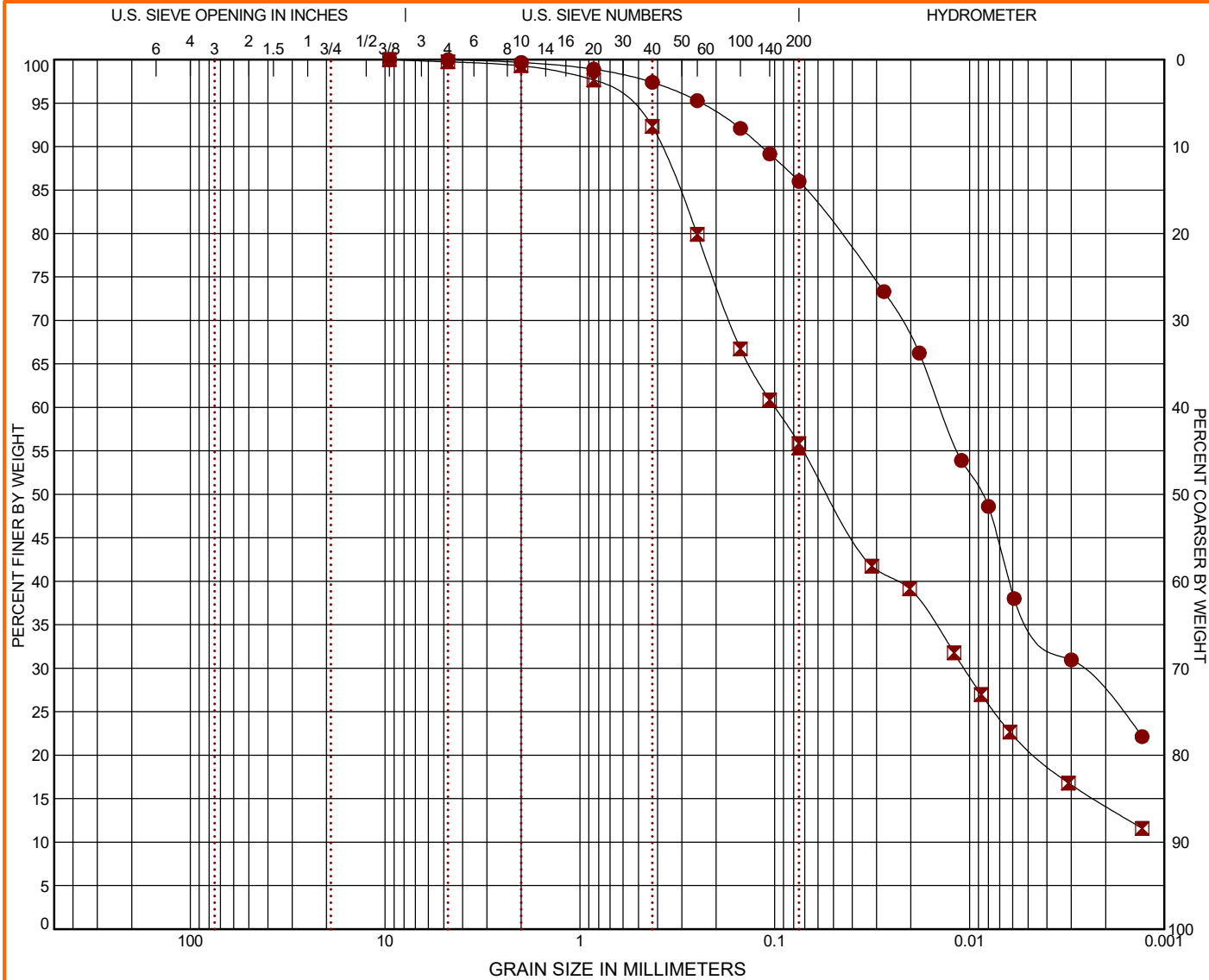
GRAIN SIZE				SOIL DESCRIPTION			
	●	✕	▲	Sieve	% Finer	Sieve	% Finer
D ₆₀	0.02			#10	100.0	#200	68.62
D ₃₀	0.004			#20	98.53	#200	83.52
D ₁₀				#40	96.04		
				#60	92.46		
				#100	89.09		
				#140	86.23		
				#200	85.85		
COEFFICIENTS				REMARKS			
	●	✕	▲				
C _c							
C _u							

PROJECT: S-13-130 BRO Clay Creek	<p>521 Clemson Rd Columbia, SC</p>	PROJECT NUMBER: 7323P100
SITE: Chesterfield County, SC		CLIENT: HNTB

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: AASHTO DESC-1 S-13-130 THOMSON CREEK.GPJ TERRACON_DATATEMPLATE.GDT 8/16/23



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
● S-13-130-2	6 - 8	0.0	0.0	14.0	49.7		36.3	CL
✕ S-13-130-2	8 - 10	0.0	0.3	43.9	35.0		20.8	
▲ S-13-130-2	18.5 - 20					55.2		

GRAIN SIZE			
	●	✕	▲
D ₆₀	0.014	0.1	
D ₃₀	0.003	0.011	
D ₁₀			

COEFFICIENTS			
	●	✕	▲
C _c			
C _u			

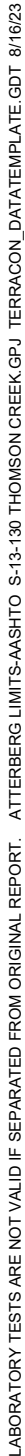
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/8"	100.0	3/8"	100.0	#200	55.22
#4	99.97	#4	99.73		
#10	99.66	#10	99.29		
#20	98.89	#20	97.66		
#40	97.39	#40	92.31		
#60	95.27	#60	79.91		
#100	92.09	#100	66.74		
#140	89.15	#140	60.86		
#200	86.0	#200	55.85		

SOIL DESCRIPTION	
●	A-6 (16)
✕	
▲	

REMARKS	
●	
✕	
▲	

PROJECT: S-13-130 BRO Clay Creek	<p>521 Clemson Rd Columbia, SC</p>	PROJECT NUMBER: 7323P100
SITE: Chesterfield County, SC		CLIENT: HNTB

ASTM D4318

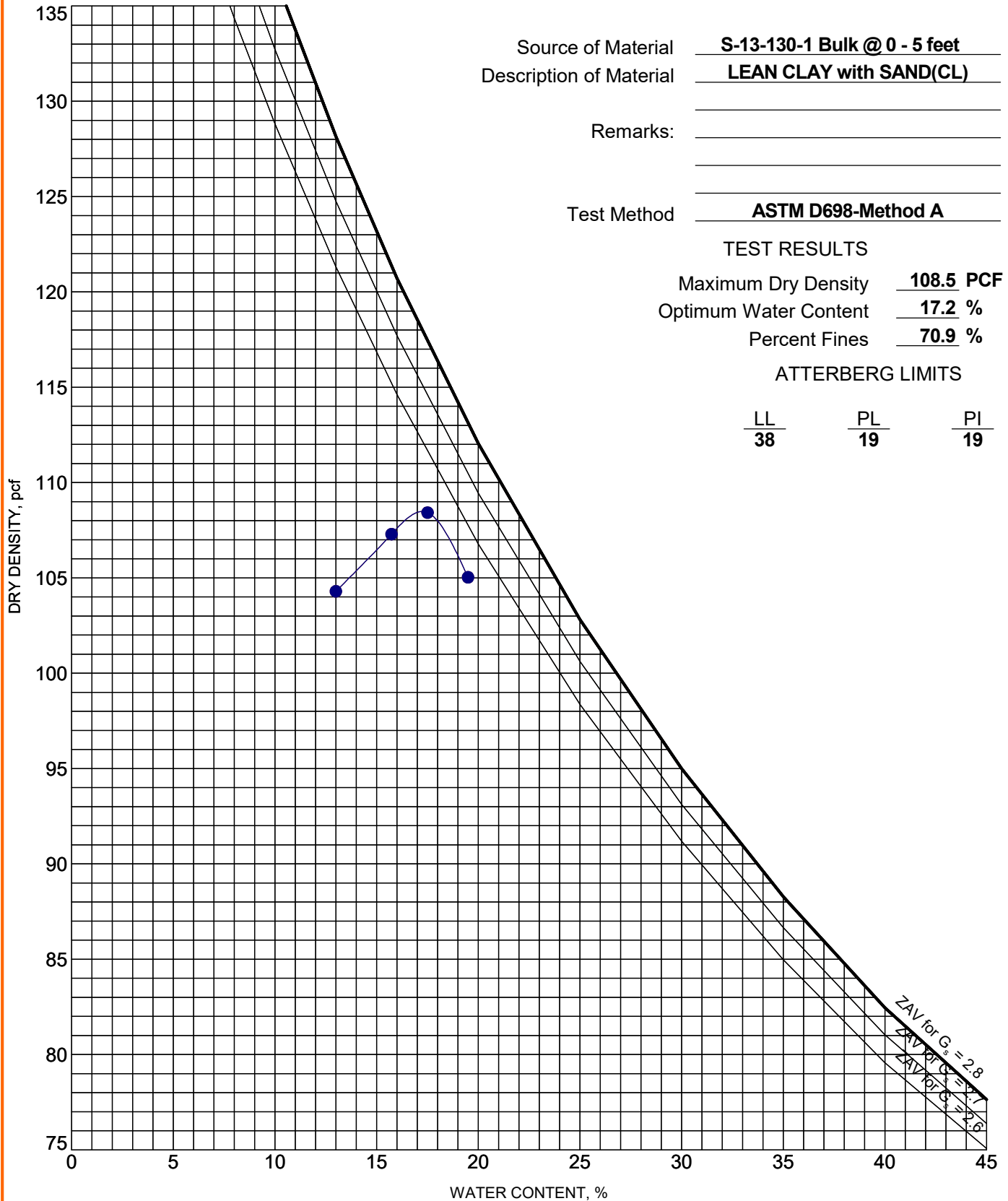


CLIENT: HNTB

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V2 S-13-130 THOMSON CREEK.GPJ TERRACON_DATATEMPLATE.GDT 8/16/23



PROJECT: S-13-130 BRO Clay Creek

SITE: Chesterfield County, SC

Terracon
521 Clemson Rd
Columbia, SC

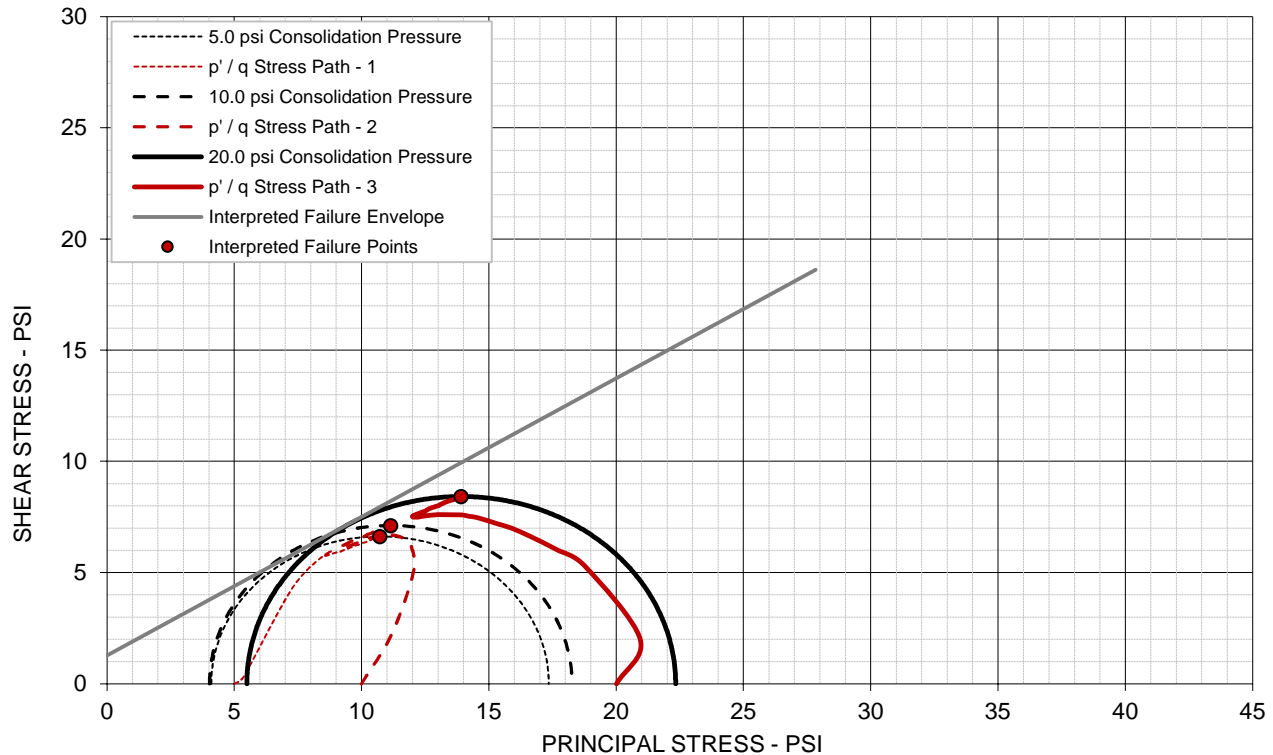
PROJECT NUMBER: 7323P100

CLIENT: HNTB

ICU TRIAXIAL COMPRESSION TEST

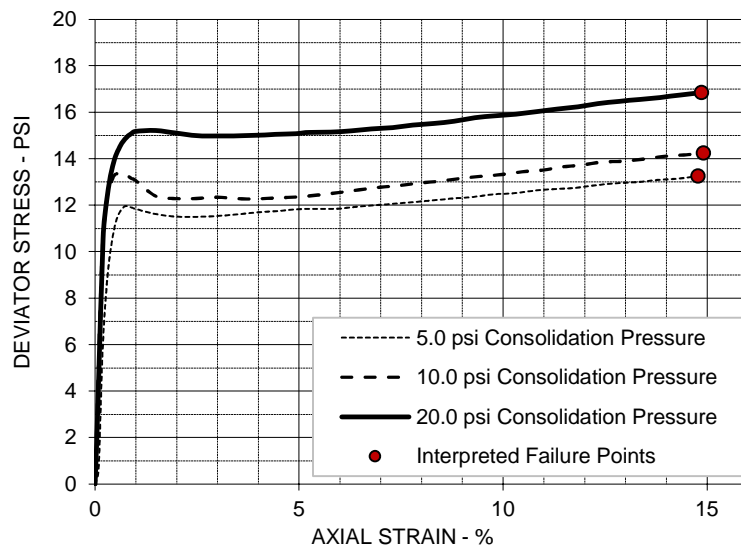
ASTM D4767 / AASHTO T297

Failure Criteria: Max Deviator Stress



EFFECTIVE STRESS PARAMETERS

$\phi' = 31.9$ deg $c' = 1.3$ psi



SPECIMEN NO.	1	2	3
INITIAL			
Moisture Content - %	17.1	17.1	17.1
Dry Density - pcf	103.1	103.2	103.2
Diameter - inches	2.86	2.86	2.86
Height - inches	6.00	6.00	6.00
AT TEST			
Final Moisture - %	21.7	21.1	20.5
Dry Density - pcf	103.2	103.6	104.3
Calculated Diameter (in.)	2.84	2.85	2.83
Height - inches	5.97	5.98	5.94
Effect. Consol. Stress - psi	5.0	10.0	20.0
Failure Stress - psi	13.26	14.24	16.84
Total Pore Pressure - psi	80.9	86.0	94.5
Strain Rate - %/min.	0.0334	0.0331	0.0336
Failure Strain - %	14.8	14.9	14.9
σ_1' Failure - psi	17.35	18.26	22.33
σ_3' Failure - psi	4.09	4.03	5.49

TEST DESCRIPTION

ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION

SAMPLE TYPE: Remolded

DESCRIPTION: Lean Clay with Sand (CL) / A-6 (12)

SAMPLE ID: S-13-130-1 Bulk 0-5'

SPECIFIC GRAVITY: 2.65

LL: 38 PL: 19 PI: 19 Percent -200: 70.9%

Remarks: Remolded to 95% of the Standard Proctor

PROJECT INFORMATION

PROJECT: S-13-130 BRO Clay Creek

LOCATION: Chesterfield County, SC

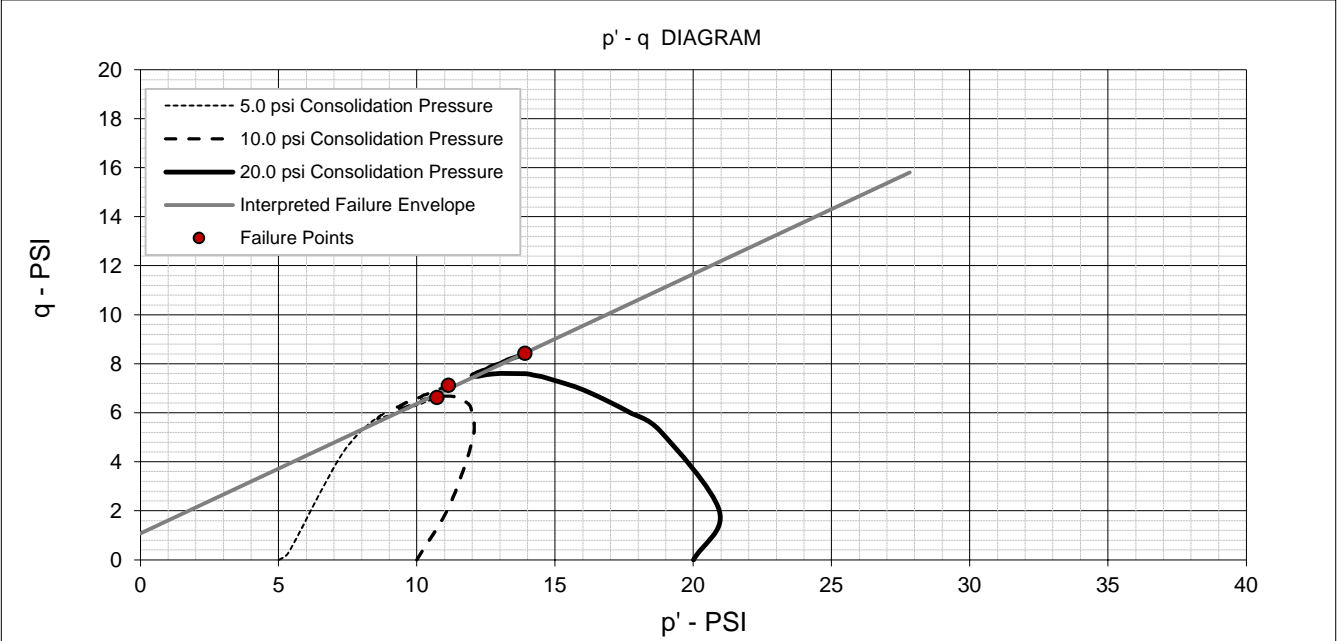
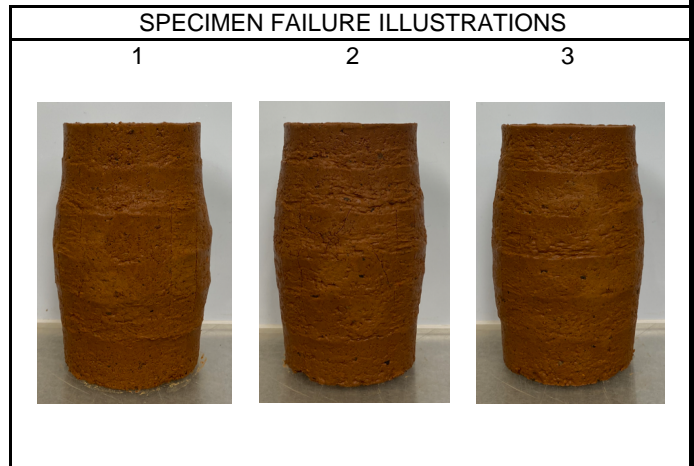
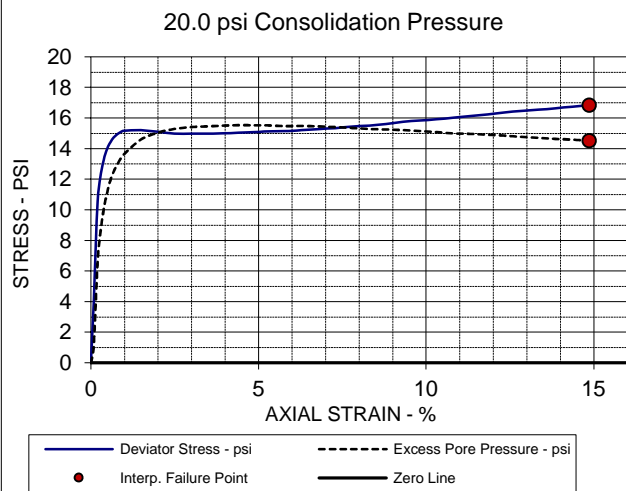
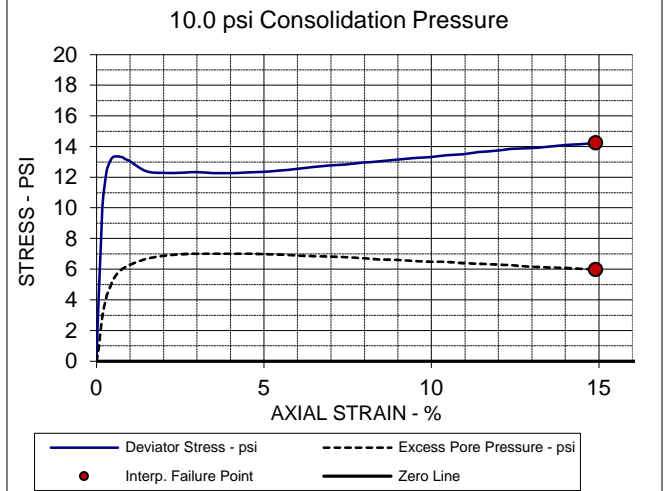
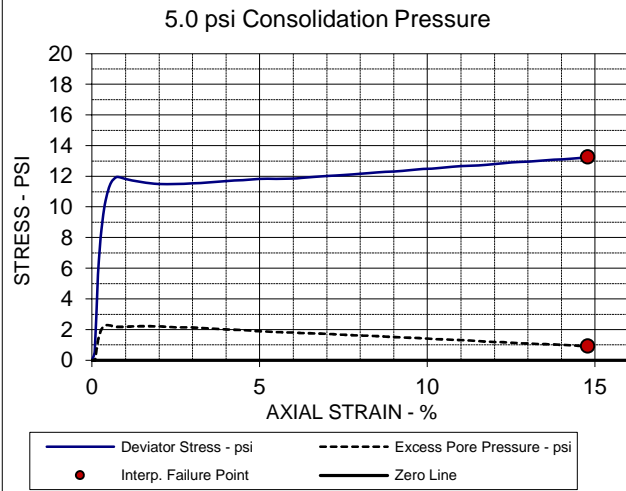
PROJECT #: 7323P100


CLIENT: HNTB

DATE: 07/12/23

521 Clemson Road
Columbia, SC



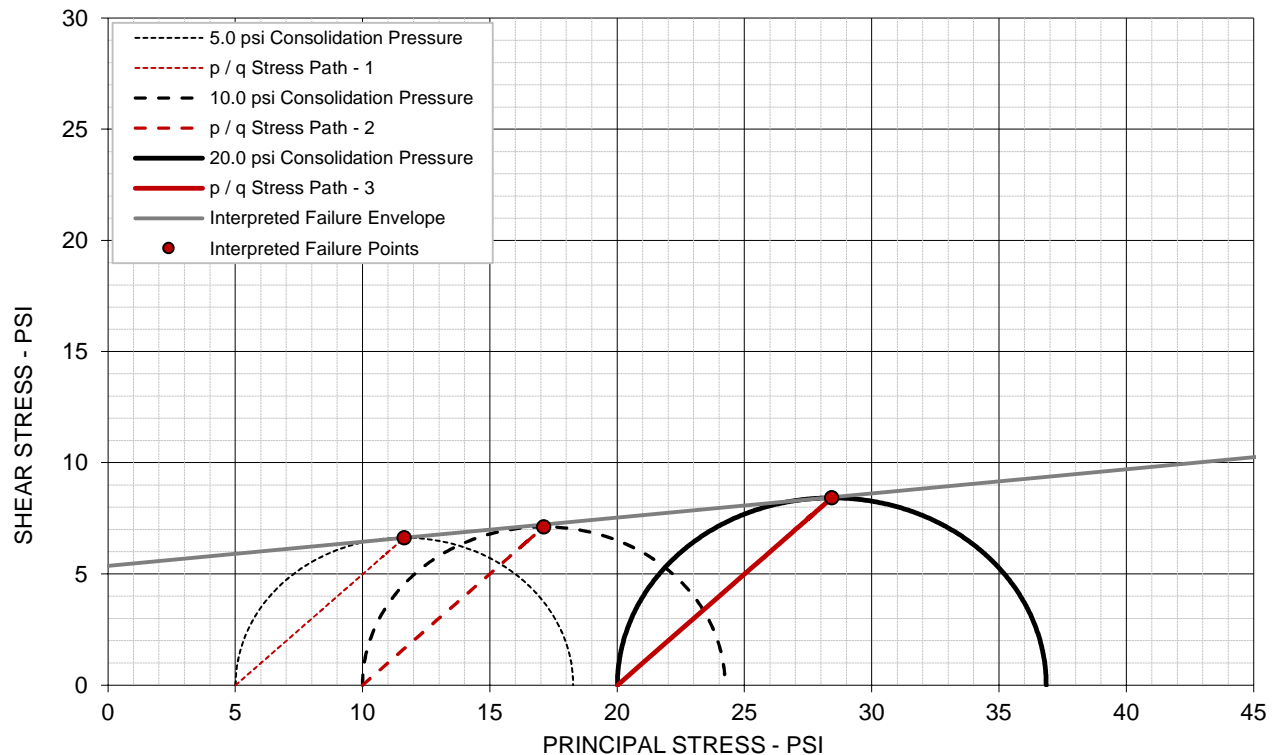


EFFECTIVE STRESS PARAMETERS	R ² = 0.99	α = 27.9 deg	a = 1.1 psi
PROJECT: S-13-130 BRO Clay Creek		ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION TEST	
LOCATION: Chesterfield County, SC		CLIENT: HNTB	
SAMPLE ID: S-13-130-1 Bulk 0-5'		<div>521 Clemson Road Columbia, SC</div> <div></div>	
DESCRIPTION: Lean Clay with Sand (CL) / A-6 (12)			

ICU TRIAXIAL COMPRESSION TEST

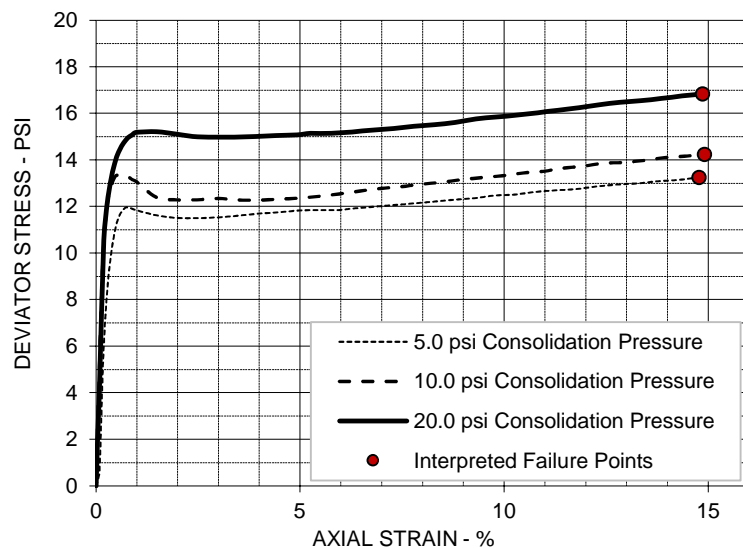
ASTM D4767 / AASHTO T297

Failure Criteria: Max Deviator Stress



TOTAL STRESS PARAMETERS

$\phi = 6.2$ deg $c = 5.4$ psi



SPECIMEN NO.

1 2 3

INITIAL

Moisture Content - %	17.1	17.1	17.1
Dry Density - pcf	103.1	103.2	103.2
Diameter - inches	2.86	2.86	2.86
Height - inches	6.00	6.00	6.00

AT TEST

Final Moisture - %	21.7	21.1	20.5
Dry Density - pcf	103.2	103.6	104.3
Calculated Diameter (in.)	2.84	2.85	2.83
Height - inches	5.97	5.98	5.94
Effect. Consol. Stress - psi	5.0	10.0	20.0
Failure Stress - psi	13.26	14.24	16.84
Total Pore Pressure - psi	80.9	86.0	94.5
Strain Rate - %/min.	0.0334	0.0331	0.0336
Failure Strain - %	14.8	14.9	14.9
σ_1 Failure - psi	18.27	24.23	36.85
σ_3 Failure - psi	5.01	9.99	20.01

TEST DESCRIPTION

ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION
 SAMPLE TYPE: Remolded
 DESCRIPTION: Lean Clay with Sand (CL) / A-6 (12)
 SAMPLE ID: S-13-130-1 Bulk 0-5'
 SPECIFIC GRAVITY: 2.65
 LL: 38 PL: 19 PI: 19 Percent -200: 70.9%
 Remarks: Remolded to 95% of the Standard Proctor

PROJECT INFORMATION

PROJECT: S-13-130 BRO Clay Creek
 LOCATION: Chesterfield County, SC
 PROJECT #: 7323P100
 CLIENT: HNTB
 DATE: 07/12/23

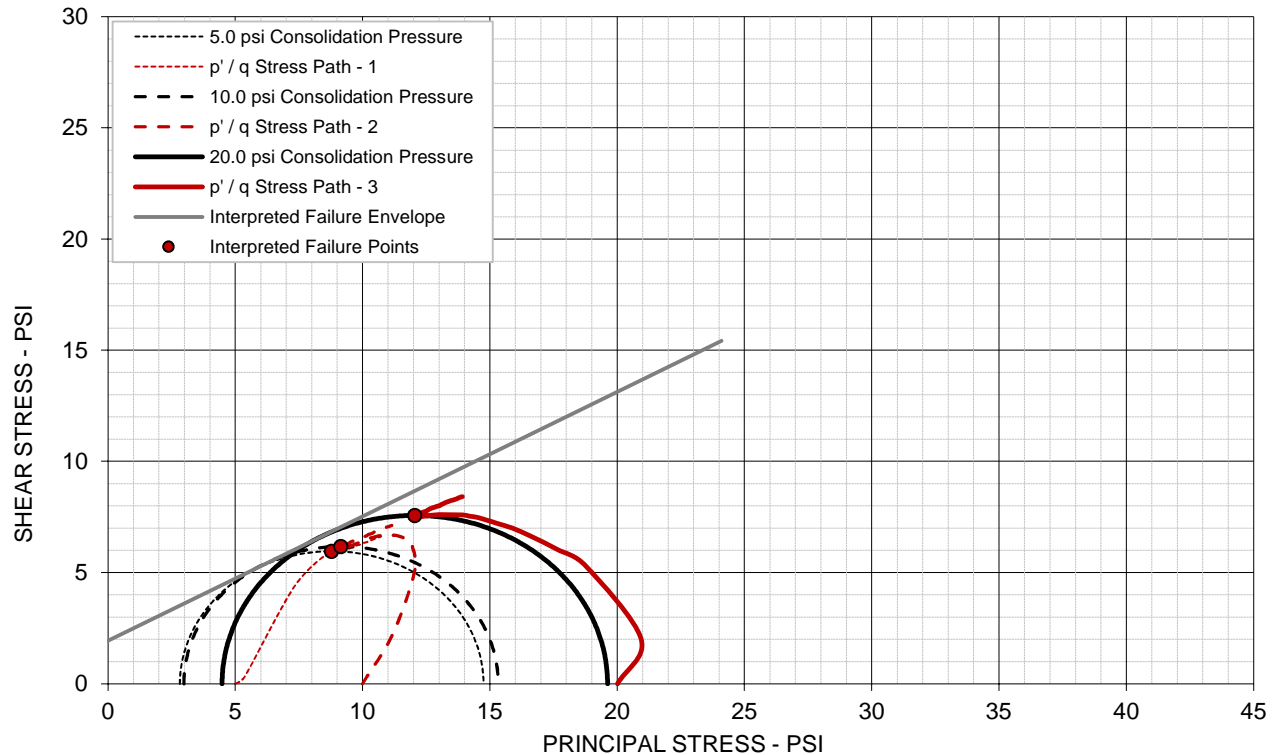
521 Clemson Road
 Columbia, SC



ICU TRIAXIAL COMPRESSION TEST

ASTM D4767 / AASHTO T297

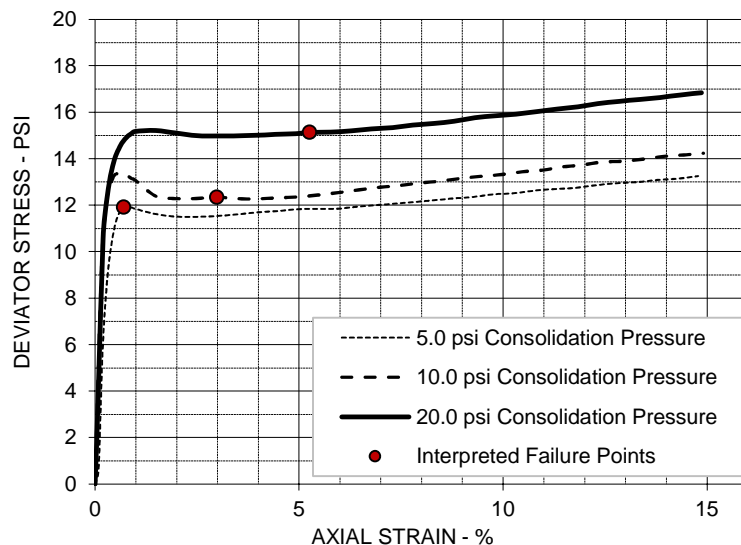
Failure Criteria: Max Obliquity (s1': s3')



EFFECTIVE STRESS PARAMETERS

$\phi' = 29.2$ deg

$c' = 1.9$ psi



SPECIMEN NO.

1 2 3

INITIAL

Moisture Content - %	17.1	17.1	17.1
Dry Density - pcf	103.1	103.2	103.2
Diameter - inches	2.86	2.86	2.86
Height - inches	6.00	6.00	6.00

AT TEST

Final Moisture - %	21.7	21.1	20.5
Dry Density - pcf	103.2	103.6	104.3
Calculated Diameter (in.)	2.84	2.85	2.83
Height - inches	5.97	5.98	5.94
Effect. Consol. Stress - psi	5.0	10.0	20.0
Failure Stress - psi	11.92	12.35	15.14
Total Pore Pressure - psi	82.2	87.0	95.5
Strain Rate - %/min.	0.0334	0.0331	0.0336
Failure Strain - %	0.7	3.0	5.3
σ_1' Failure - psi	14.75	15.33	19.62
σ_3' Failure - psi	2.82	2.98	4.48

TEST DESCRIPTION

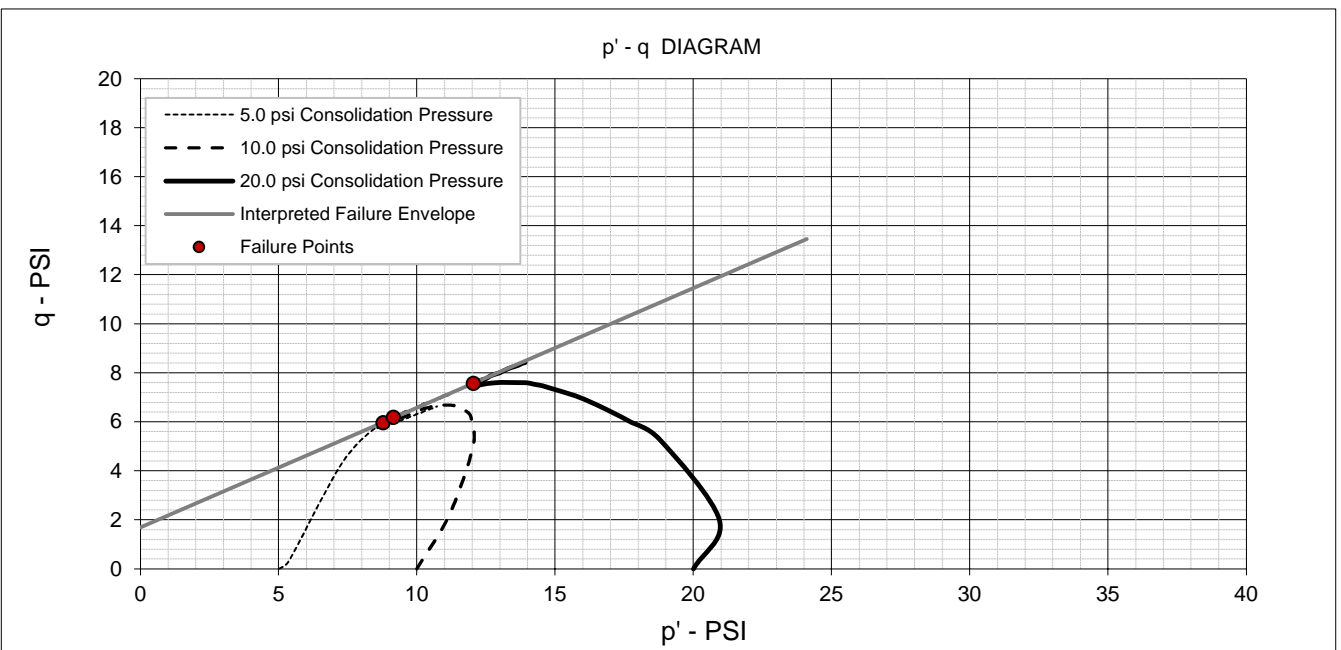
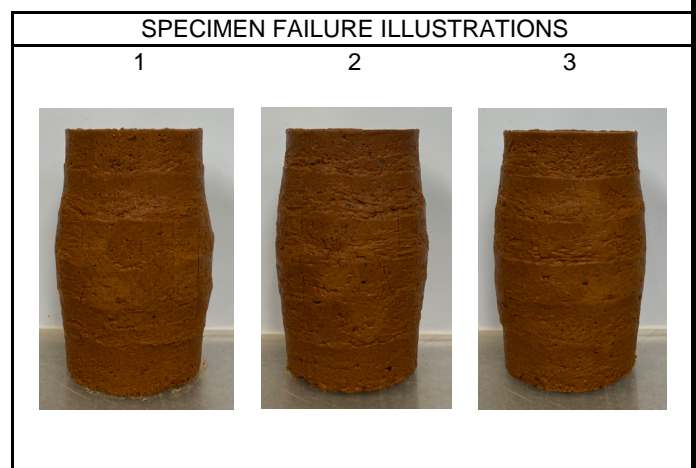
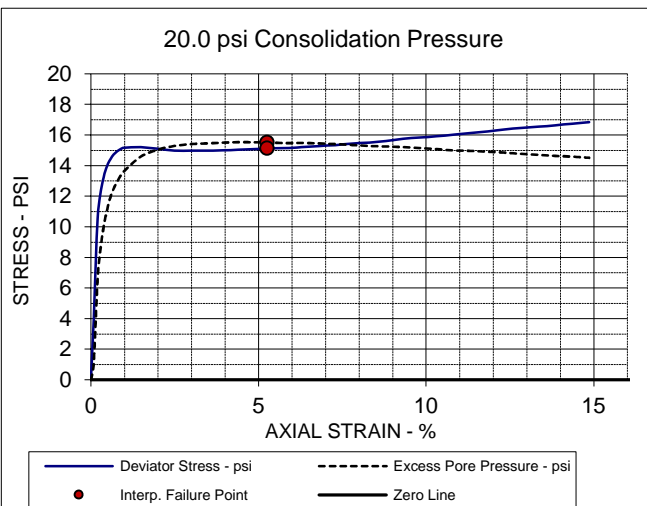
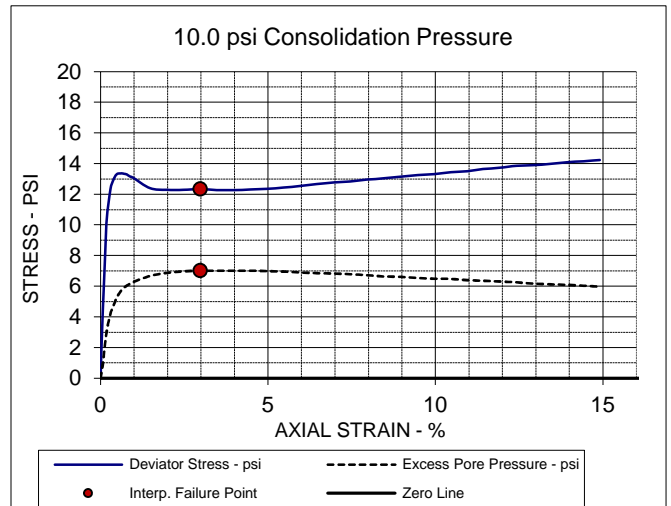
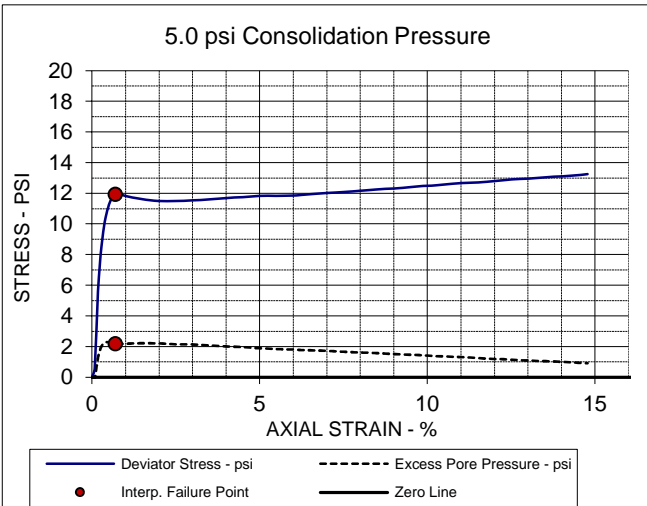
ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION
 SAMPLE TYPE: Remolded
 DESCRIPTION: Lean Clay with Sand (CL) / A-6 (12)
 SAMPLE ID: S-13-130-1 Bulk 0-5'
 SPECIFIC GRAVITY: 2.65
 LL: 38 PL: 19 PI: 19 Percent -200: 70.9%
 Remarks: Remolded to 95% of the Standard Proctor


PROJECT INFORMATION

PROJECT: S-13-130 BRO Clay Creek
 LOCATION: Chesterfield County, SC
 PROJECT #: 7323P100
 CLIENT: HNTB
 DATE: 07/12/23

521 Clemson Road
 Columbia, SC





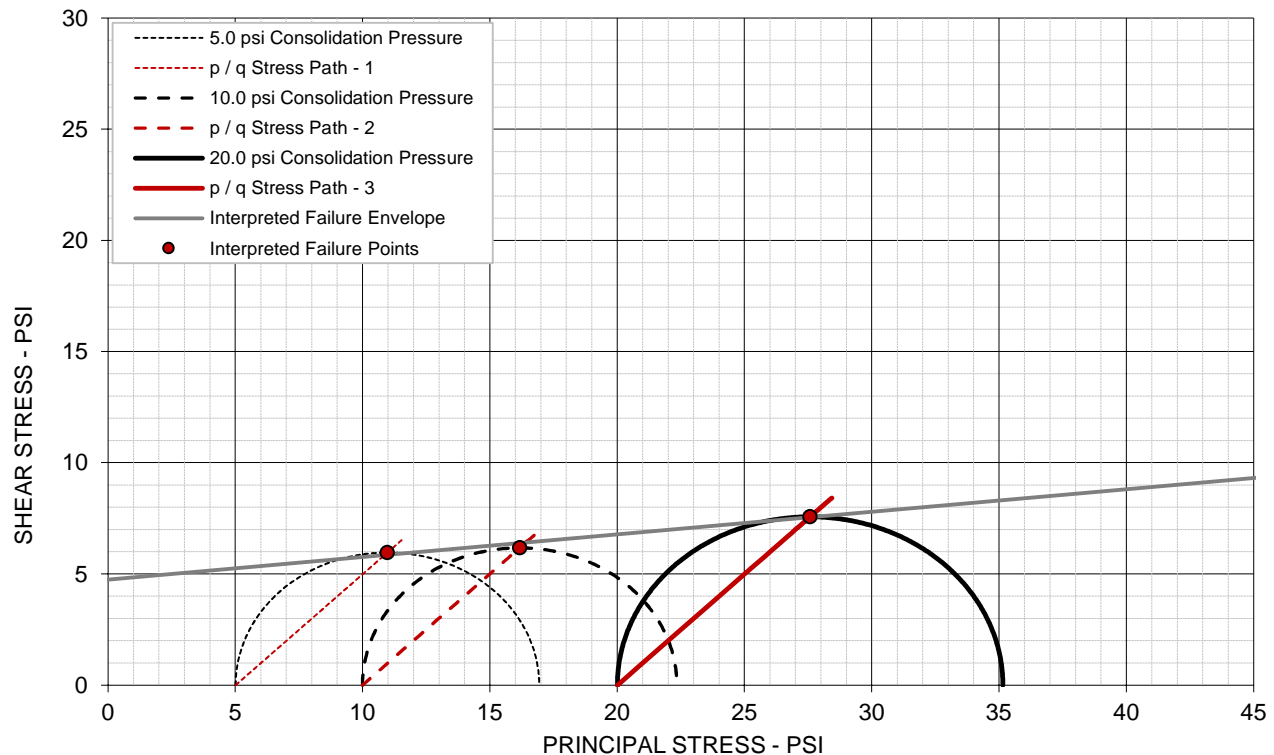
EFFECTIVE STRESS PARAMETERS		R ² = 1.00	α = 26.0 deg	a = 1.7 psi
PROJECT: S-13-130 BRO Clay Creek			ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION TEST	
LOCATION: Chesterfield County, SC			CLIENT: HNTB	
SAMPLE ID: S-13-130-1 Bulk 0-5'			<div>521 Clemson Road Columbia, SC</div> <div></div>	
DESCRIPTION: Lean Clay with Sand (CL) / A-6 (12)				



ICU TRIAXIAL COMPRESSION TEST

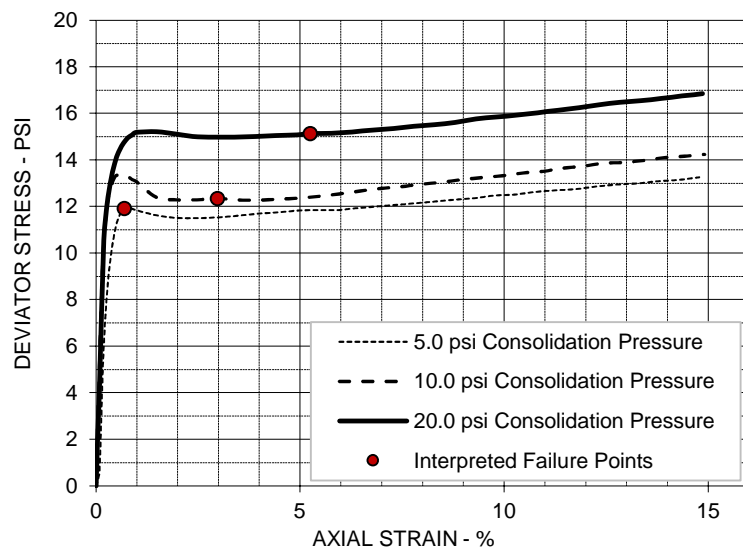
ASTM D4767 / AASHTO T297

Failure Criteria: Max Obliquity (s1': s3')



TOTAL STRESS PARAMETERS

$\phi = 5.8$ deg $c = 4.8$ psi



SPECIMEN NO.

1 2 3

INITIAL

Moisture Content - %	17.1	17.1	17.1
Dry Density - pcf	103.1	103.2	103.2
Diameter - inches	2.86	2.86	2.86
Height - inches	6.00	6.00	6.00

AT TEST

Final Moisture - %	21.7	21.1	20.5
Dry Density - pcf	103.2	103.6	104.3
Calculated Diameter (in.)	2.84	2.85	2.83
Height - inches	5.97	5.98	5.94
Effect. Consol. Stress - psi	5.0	10.0	20.0
Failure Stress - psi	11.92	12.35	15.14
Total Pore Pressure - psi	82.2	87.0	95.5
Strain Rate - %/min.	0.0334	0.0331	0.0336
Failure Strain - %	0.7	3.0	5.3
σ_1 Failure - psi	16.94	22.34	35.15
σ_3 Failure - psi	5.01	9.99	20.01

TEST DESCRIPTION

ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION
 SAMPLE TYPE: Remolded
 DESCRIPTION: Lean Clay with Sand (CL) / A-6 (12)
 SAMPLE ID: S-13-130-1 Bulk 0-5'
 SPECIFIC GRAVITY: 2.65
 LL: 38 PL: 19 PI: 19 Percent -200: 70.9%
 Remarks: Remolded to 95% of the Standard Proctor

PROJECT INFORMATION

PROJECT: S-13-130 BRO Clay Creek
 LOCATION: Chesterfield County, SC
 PROJECT #: 7323P100
 CLIENT: HNTB
 DATE: 07/12/23

521 Clemson Road
 Columbia, SC



Client

HNTB North Carolina PC
Raleigh, NC

Project

S-13-130 BRO Clay Creek
7323P100

Date Received: 6/27/2023

Results from Corrosion Testing

Sample Location	S-13-130-1
Sample Depth (ft.)	0'-10'

pH Analysis, ASTM G 51	6.63
------------------------	------

Water Soluble Sulfate (SO ₄), ASTM D516-07 (mg/kg)	12
---	----

Chlorides, APHA 4500-Cl ⁻ E, (mg/kg)	24
---	----

Resistivity (Saturated), ASTM G 57, (ohm-cm)	5300
--	------

Analyzed By: Kyle Lemcke
Laboratory Manager

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.

Appendix C

Supporting Documents

Rig Calibration Report (5 Pages)

Note: All exhibits are one page unless noted above.

SPT Automatic Hammer Energy Measurement Report

Drill Rig Model: Diedrich D-50
 Drill Rig Serial Number: D50-479
 Asset Number: DR#1109

July 3, 2023

July 03, 2023

Terracon Consultants Inc.
 521 Clemson Rd.
 Columbia, SC 29229

Attn: Chris Costner
 E: chris.costner@terracon.com

Re: SPT Automatic Hammer Energy Measurement Report
 Rig Serial Number: D50-479 Terracon Project Number: DUXX0500

Dear Mr. Costner:

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)
Diedrich D50	D50-479	2021	DR#1109	93.9% ± 2.3%	1.57

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

James P. Smith

James P. Smith
 National Manager of Equipment & Training

Rob Kramer

Rob Kramer
 Geophysical Services Manager, COG

Attachments:

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



Prepared for:

Terracon Consultants, Inc.
 Columbia, South Carolina



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

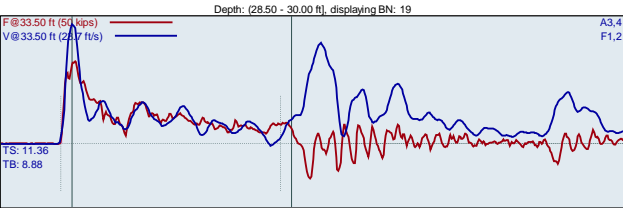


MEASUREMENT SUMMARY

ITEM	DESCRIPTION
Drill Rig Owner	Terracon Consultant, Inc. - Columbia, SC
Drill Rig Operator	Shiver Truesdale; Terracon Exploration
Testing Date	07/03/2023
Testing Location	Columbia, SC
Boring Identification	B-1
Hammer Type	140 pounds (automatic)
Boring Method	Rotary Wash
Drill Rods	<ul style="list-style-type: none"> ■ AWJ ■ 1-3/4" outside diameter ■ 3/16" wall thickness
Calibration Testing Equipment	<ul style="list-style-type: none"> ■ 2-foot AWJ rod instrumented w/ two strain gauges and two accelerometers ■ Model SPT Analyzer™ (PDA)
ASTM Methods Used	<p>ASTM D1586, Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils</p> <p>ASTM D4633-16, Standard Method for Energy Measurement for Dynamic Penetrometers</p>
SPT Calibration Personnel	Micah Hatch- Department Manager, Terracon Consultants, Inc.

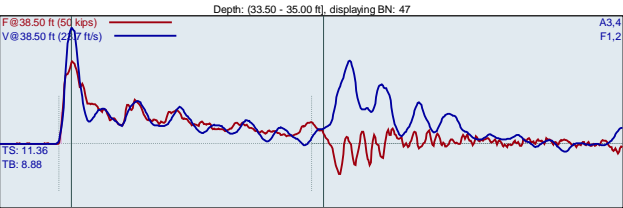
Exhibit A

PDA SPT Analyzer Results



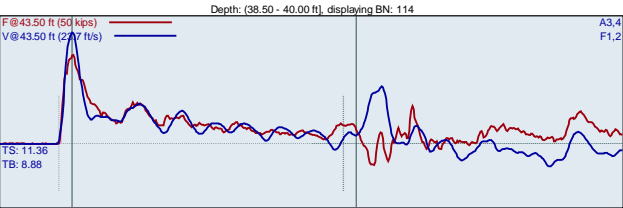
F1 : [512AWJ] 207.75 PDICAL (1) FF1				A3 (PR): [K5998] 403.535 mw/6.4v/5000g (1) VF1			
F2 : [512AWJ2] 208.76 PDICAL (1) FF1				A4 (PR): [K10493] 411.89 mw/6.4v/5000g (1) VF1			
FMX: Maximum Force				EFV: Maximum Energy			
VMX: Maximum Velocity				ETR: Energy Transfer Ratio - Rated			
BPM: Blows/Minute							
BL#	BC ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR %	
3	6	32	23.8	48.1	315	89.9	
4	6	34	23.8	47.8	319	91.3	
5	6	32	23.5	48.4	316	90.4	
6	6	32	23.3	47.8	324	92.5	
7	6	32	23.0	48.3	325	92.8	
8	6	32	22.2	48.2	316	90.4	
9	6	32	22.0	47.7	324	92.7	
10	6	32	22.7	48.5	324	92.7	
11	6	32	21.6	47.9	326	93.3	
12	6	31	21.3	48.4	326	93.1	
13	9	32	21.7	47.7	329	94.1	
14	9	32	22.1	48.0	326	93.3	
15	9	32	21.8	47.9	331	94.7	
16	9	31	21.7	48.2	329	93.9	
17	9	32	21.8	48.1	334	95.4	
18	9	33	22.2	47.5	338	96.5	
19	9	32	22.1	48.4	340	97.1	
20	9	32	22.2	48.1	326	93.2	
21	9	32	22.7	47.8	332	94.8	
Average		32	22.1	48.1	329	93.9	
Std Dev		0	0.4	0.3	6	1.6	
Maximum		33	23.0	48.5	340	97.1	
Minimum		31	21.3	47.5	316	90.4	
N-value: 15							

Sample Interval Time: 22.48 seconds.



F1 : [512AWJ] 207.75 PDICAL (1) FF1					A3 (PR): [K5998] 403.535 mw/6.4v5000g (1) VF1				
F2 : [512AWJ2] 208.76 PDICAL (1) FF1					A4 (PR): [K10453] 411.89 mw/6.4v5000g (1) VF1				
BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR %			
23	7	32	19.5	48.3	314	89.7			
24	7	31	19.4	48.4	305	87.0			
25	7	31	19.9	48.1	311	88.9			
26	7	31	19.4	48.2	310	88.6			
27	7	31	19.5	48.0	311	88.8			
28	7	31	19.9	48.1	310	88.7			
29	9	31	19.6	48.0	314	89.8			
30	9	32	19.8	48.3	314	89.7			
31	9	30	19.2	48.0	309	88.3			
32	9	31	19.7	48.2	313	89.5			
33	9	31	19.6	47.9	313	89.5			
34	9	30	19.3	48.0	310	88.7			
35	9	32	21.2	48.3	319	91.2			
36	9	32	21.3	48.3	321	91.7			
37	9	33	22.0	48.1	327	93.5			
38	12	32	20.4	48.2	302	86.2			
39	12	32	21.6	47.9	319	91.2			
40	12	32	21.1	47.9	321	91.7			
41	12	31	20.4	48.0	311	88.9			
42	12	31	20.9	48.1	324	92.6			
43	12	32	21.8	48.0	322	92.1			
44	12	32	22.3	48.1	323	92.3			
45	12	32	21.4	48.1	317	90.6			
46	12	32	21.8	48.2	323	92.4			
47	12	32	21.5	48.2	322	92.0			
48	12	33	22.0	48.2	320	91.4			
49	12	32	21.8	47.7	322	92.1			

Sample Interval Time: 32.40 seconds.



F1 : [512AWJ] 207.75 PDICAL (1) FF1					A3 (PR): [K5998] 403.535 mw/6.4v5000g (1) VF1				
F2 : [512AWJ2] 208.76 PDICAL (1) FF1					A4 (PR): [K10453] 411.89 mw/6.4v5000g (1) VF1				
BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR %			
51	17	35	21.7	47.4	339	96.8			
52	17	35	21.7	48.4	336	96.0			
53	17	35	21.7	48.2	336	96.1			
54	17	34	21.7	48.2	337	96.3			
55	17	34	21.7	48.1	339	96.9			
56	17	34	21.2	48.1	337	96.2			
57	17	34	21.2	48.3	336	95.9			
58	17	33	21.2	48.4	322	92.1			
59	17	35	22.2	48.1	343	98.0			
60	17	33	21.2	48.0	324	92.6			
61	17	34	21.8	48.3	337	96.3			
62	17	34	21.7	48.0	331	94.5			
63	17	33	21.3	48.2	335	95.6			
64	17	34	21.8	48.2	336	95.9			
65	17	34	22.1	48.0	329	94.0			
66	17	33	21.4	48.3	336	96.1			
67	19	34	21.7	48.5	331	94.7			
68	19	33	21.3	47.8	336	95.9			
69	19	33	21.2	48.2	344	98.4			
70	19	35	22.9	47.7	344	98.4			
71	19	34	22.1	48.1	339	96.9			
72	19	33	20.9	48.3	333	95.0			
73	19	33	20.8	48.1	331	94.4			
74	19	34	20.7	47.9	329	94.1			
75	19	34	20.9	48.2	331	94.6			
76	19	34	21.1	47.7	343	97.9			
77	19	35	20.9	48.3	332	94.9			
78	19	35	21.1	48.3	336	96.1			
79	19	34	20.5	48.1	338	96.5			
80	19	34	20.6	48.4	338	96.7			
81	19	34	20.4	48.3	326	93.2			

82	19	33	20.2	48.0	336	96.0
83	19	34	20.3	48.3	333	95.1
84	19	33	20.1	47.7	325	92.8
85	19	33	19.9	48.4	330	94.4
86	31	35	20.5	47.9	332	94.9
87	31	34	20.5	48.1	330	94.3
88	31	33	20.3	47.8	324	92.5
89	31	33	20.8	48.3	336	95.9
90	31	33	20.6	48.0	331	94.6
91	31	34	20.4	48.4	338	96.7
92	31	33	20.2	48.5	329	94.0
93	31	34	20.6	48.0	336	96.1
94	31	34	20.7	48.6	334	95.3
95	31	34	20.5	48.6	334	95.4
96	31	34	20.3	48.5	331	94.5
97	31	33	20.3	48.4	331	94.6
98	31	34	20.3	48.5	332	94.9
99	31	33	20.5	48.4	333	95.2
100	31	33	20.0	48.0	338	96.5
101	31	34	21.1	48.3	332	94.8
102	31	33	20.0	48.1	334	95.4
103	31	34	20.2	48.8	329	93.9
104	31	33	20.0	48.3	331	94.4
105	31	33	20.1	48.1	330	94.3
106	31	35	20.4	47.9	334	95.5
107	31	34	20.2	48.3	331	94.5
108	31	34	20.1	48.0	335	95.7
109	31	34	20.0	48.3	327	93.3
110	31	34	20.0	47.9	330	94.2
111	31	34	20.3	47.6	331	94.6
112	31	34	20.5	47.2	333	95.1
113	31	35	20.4	47.6	336	95.9
114	31	35	20.6	47.7	335	95.7
115	31	34	20.6	47.2	335	95.7
116	31	34	20.6	47.2	339	96.7
Average	34	20.6	48.1	333	95.2	
Std Dev	1	0.6	0.4	4	1.2	
Maximum	35	22.9	48.8	344	98.4	
Minimum	33	19.9	47.2	324	92.5	
N-value: 50						

Sample Interval Time: 81.06 seconds.

Summary of SPT Test Results

Project: Dietrich D50 (SN 479), Test Date: 7/3/2023						EFV: Maximum Energy ETR: Energy Transfer Ratio - Rated				
FMX: Maximum Force VMX: Maximum Velocity BPM: Blows/Minute										
Test Length ft		Blows Applied /ft	N Value	N50 Value	Average FMX kips	Average VMX ft/s	Average BPM bpm	Average EFV ft-lb	Average ETR %	
33.50		6-6-9	15	23	32	22.1	48.1	329	93.9	
38.50		7-9-12	21	32	32	20.9	48.1	318	90.7	
43.50		17-19-31	50	78	34	20.6	48.1	333	95.2	
Overall Average Values:						33	20.9	48.1	328	93.9
Standard Deviation:						1	0.9	0.3	8	2.3
Overall Maximum Value:						35	23.0	48.8	344	98.4
Overall Minimum Value:						30	19.2	47.2	302	86.2



Exhibit B

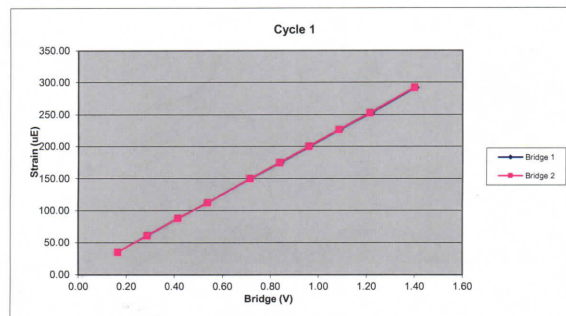
PDA Equipment Calibration



512AWJ		Cycle 1		
Sample	Force (lb)	Strain (µE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1203.06	34.31	0.16	0.16
3	2126.16	60.40	0.29	0.29
4	3077.44	86.97	0.42	0.42
5	3982.41	111.72	0.54	0.54
6	5285.39	149.30	0.72	0.72
7	6200.50	174.57	0.84	0.84
8	7099.62	199.59	0.96	0.96
9	8021.85	226.03	1.09	1.08
10	8981.90	252.42	1.22	1.21
11	10350.08	291.62	1.40	1.40

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7371.63	Force Calibration (lb/V)	7404.01
Offset	-2.95	Offset	-5.32
Correlation	1.000000	Correlation	0.999999
Strain Calibration (µE/V)	207.13	Strain Calibration (µE/V)	208.04
Offset	0.34	Offset	0.27
Correlation	0.999991	Correlation	0.999992

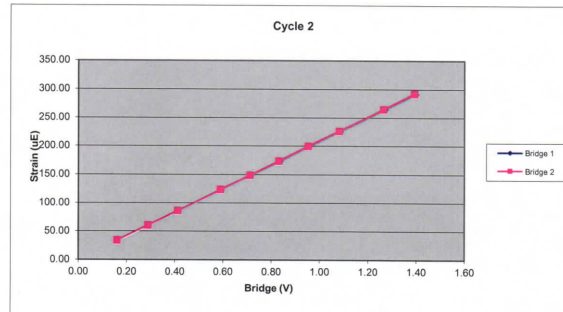
Force Strain Calibration	
EA (Kips)	35589.20
Offset	-14.99
Correlation	0.999992



512AWJ		Cycle 2		
Sample	Force (lb)	Strain (µE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1195.16	33.02	0.16	0.16
3	2140.49	59.36	0.29	0.29
4	3060.77	84.68	0.41	0.41
5	4361.31	122.48	0.59	0.59
6	5276.03	147.78	0.71	0.71
7	6152.73	172.65	0.83	0.83
8	7048.15	198.82	0.96	0.95
9	8008.49	225.14	1.08	1.08
10	9364.20	264.06	1.27	1.26
11	10320.35	291.14	1.40	1.39

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7383.19	Force Calibration (lb/V)	7408.85
Offset	1.99	Offset	1.61
Correlation	0.999999	Correlation	1.000000
Strain Calibration (µE/V)	209.13	Strain Calibration (µE/V)	209.86
Offset	-1.28	Offset	-1.29
Correlation	0.999988	Correlation	0.999991

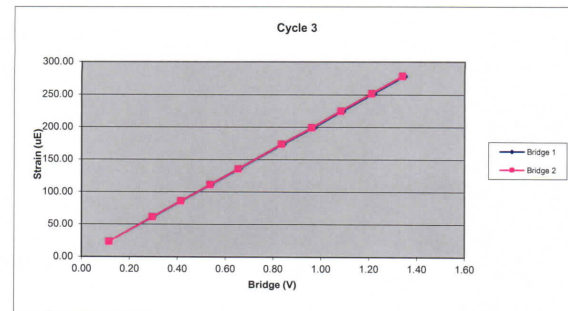
Force Strain Calibration	
EA (Kips)	35302.85
Offset	47.38
Correlation	0.999989



512AWJ		Cycle 3		
Sample	Force (lb)	Strain (µE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	843.37	22.72	0.11	0.11
3	2199.17	60.67	0.30	0.29
4	3069.54	85.62	0.42	0.41
5	3979.10	110.64	0.54	0.54
6	4849.18	135.11	0.66	0.65
7	6197.28	173.33	0.84	0.84
8	7134.13	198.98	0.97	0.96
9	8033.64	224.83	1.09	1.08
10	8976.83	251.64	1.22	1.21
11	9937.94	277.86	1.35	1.34

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7369.64	Force Calibration (lb/V)	7419.12
Offset	-2.56	Offset	0.17
Correlation	0.999999	Correlation	0.999999
Strain Calibration (µE/V)	206.99	Strain Calibration (µE/V)	208.38
Offset	-1.03	Offset	-0.95
Correlation	0.999995	Correlation	0.999995

Force Strain Calibration	
EA (Kips)	35602.66
Offset	34.21
Correlation	0.999994



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

Calibration Factors		512AWJ	
Bridge 1 (µE/V)	207.75	Bridge 2 (µE/V)	208.76
EA Factor (Kips)	35498.24	Area (in ²)	1.18

Calibrated by: Sam Davis
Calibrated Date: 8/31/2022

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 03Aug2022

Serial No: K5998 Temperature: 74.7 °F
Model: PR Humidity: 53%
Calibrated on: Channel 3 on 8G 5161 LE

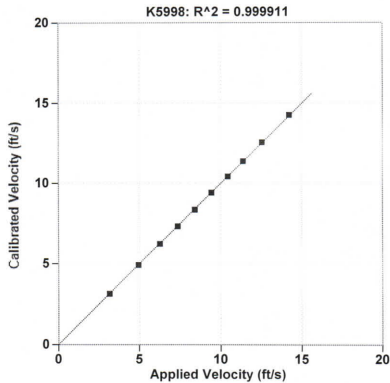
PDA CALIBRATION FACTOR
403.5 mv/5000g
(80.7 μ v/g)
R²: 0.999911 [Chip programmed]

Operator: William Johnson

Signed

Ref Acc 1: 72505! Cal on: 24Mar2022
1035 g/s/volt
Ref Acc 2: 72517! Cal on: 24Mar2022
1049 g/s/volt

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



Date printed: 03Aug2022, version: 2020.30.170 -1.89

Accelerometer Calibration Certificate
Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.
Calibration performed on 03Aug2022

Serial No: K10493 Temperature: 74.7 °F
Model: PR Humidity: 53%
Calibrated on: Channel 3 on 8G 5161 LE

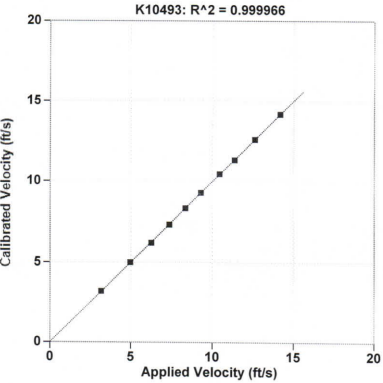
PDA CALIBRATION FACTOR
411.9 mv/5000g
(82.4 μ v/g)
R²: 0.999966 [Chip programmed]

Operator: William Johnson

Signed

Ref Acc 1: 72505! Cal on: 24Mar2022
1035 g/s/volt
Ref Acc 2: 72517! Cal on: 24Mar2022
1049 g/s/volt

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



Date printed: 03Aug2022, version: 2020.30.170 -1.65