



GEOTECHNICAL SUBSURFACE DATA REPORT - REV1

US 123 (Calhoun Memorial Hwy.) Northbound Bridge Replacement over Georges Creek
Pickens County, South Carolina

PREPARED FOR

SCDOT

955 Park Street

Columbia, South Carolina 29201



PREPARED BY

F&ME Consultants, Inc.

211 Business Park Boulevard

Columbia, South Carolina 29203

SCDOT Project ID: P041233

FME Project No.: G6400.110

February 15, 2023

February 15, 2023

Mr. Trapp Harris, P.E., DBIA
South Carolina Department of Transportation
955 Park Street
Columbia, South Carolina 29201

Re: Geotechnical Subsurface Data Report – REV1
US 123 (Calhoun Memorial Hwy.) Northbound Bridge Replacement over Georges Creek
Pickens County, South Carolina
SCDOT Project ID: P041233
FME Project No.: G6400.110

Mr. Harris:

Submitted herein is F&ME Consultants, Inc.'s (FME) Geotechnical Subsurface Data Report for the Bridge Replacements over US 123 (Calhoun Memorial Hwy.) NB Bridge Replacement over Georges Creek. This report contains findings from our subsurface field exploration and laboratory testing program.

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

Respectfully Submitted,

F&ME CONSULTANTS, INC.

A handwritten signature in blue ink that reads 'Rebecca M. Coldiron'.

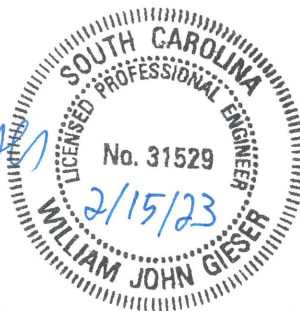
Rebecca M. Coldiron
Geotechnical Staff Professional

A handwritten signature in blue ink that reads 'Alex M. Abernethy'.

Alex M. Abernethy, E.I.T.
Geotechnical Staff Professional

A handwritten signature in blue ink that reads 'William J. Gieser'.

William J. Gieser, P.E.
Project Engineer



Attachments



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1. INTRODUCTION

This Geotechnical Subsurface Data Report (GDSR) provides a characterization of the subsurface conditions to the South Carolina Department of Transportation (SCDOT) for the proposed US 123 Northbound Bridge Replacement over Georges Creek, in Pickens County, South Carolina. The proposed bridge will replace the existing bridge over Georges Creek on Calhoun Memorial highway.

The field exploration consisted of three (3) Soil Test Borings (STB) with Standard Penetration Testing (SPT). Laboratory testing was performed on soil samples and rock collected from the Soil Test Borings. Field exploration methods and laboratory procedures were conducted in general accordance with the current American Association of State Highway and Transportation Officials (AASHTO), American Society of Testing and Materials (ASTM) Standards. This report was prepared in general accordance with the 2022 SCDOT Geotechnical Design Manual (GDM).

1.1. PROJECT DESCRIPTION

The project is located along the Calhoun Memorial Highway in Pickens County, South Carolina approximately seven (7) miles east of Easley, South Carolina. We understand that this project will involve the demolition and removal of the existing bridge structure and the replacement with a new bridge structure on the existing roadway alignment. A Site Location Plan is presented in Appendix A of the Appendix of this report.

The existing bridge over Georges Creek is approximately 200 feet in length and 32 feet wide and will be removed and replaced with a new bridge along the existing alignment. The proposed multi span replacement bridge will be approximately 250 feet in length and will accommodate two 12-foot lanes with 10-foot shoulders. Construction is anticipated to be completed with a temporary detour of traffic.

2. INVESTIGATIVE PROCEDURES

From January 23, 2023, through January 27, 2023, three (3) Soil Test Borings (designated as NBB-1, NBB-2, and NBB-3) were performed at the site. The soils were visually classified in the field based upon the Unified Soil Classification System (USCS) in general accordance with ASTM D2488. Testing locations and target exploration depths were provided by the SCDOT.

A Boring Location Plan (Figure 2) displaying the test locations performed during the subsurface exploration is contained in Appendix A within this report. Additionally, a Geotechnical Subsurface Profile is presented as Figure 3 within Appendix A of this report.

2.1. DRILLING AND SAMPLING

Soil Test Borings were performed with a CME 550X trailer mounted drill rig. FME utilized mud rotary wash drilling techniques to maintain a stable borehole. Soil Test Borings NBB-1, NBB-2 and NBB-3 were sampled continuously through the upper ten (10) feet below the existing ground surface. Following the continuous sampling, SPT testing was performed on standard five (5) foot intervals thereafter. SPT sampling was performed in general accordance with ASTM D1586 to determine the relative densities

and consistencies of the subsurface soils, and to collect subsurface soil samples. An automatic hammer with a measured energy transfer ratio of 85% was used to perform the SPTs. After drilling refusal was achieved rock coring utilizing NQ coring equipment was performed. Copies of the Soil Test Boring Logs are contained within Appendix B of this report. The locations, depths, and elevations of the Soil Test Borings performed for the subsurface investigation are provided in the following table.

Table 2-1. Field Exploration Summary Table

Test ID	Test Type	Soil Depth (ft)	Bridge Deck/ Air/ Water Gap (ft)	Rock Core Depth Below Soil (ft)	Total Boring Depth (ft)	Latitude	Longitude	Elevation (ft-MSL)
NBB-1	STB/RC	41.5	0.0	10.0	51.5	34.831207	-82.497219	838.4
NBB-2	STB/RC	31.0	42.0	18.6	91.6	34.831209	-82.496829	835.5
NBB-3	STB/RC	88.5	0.0	10.0	98.5	34.831216	-82.496475	834.2
TOTALS		161.0	42.0	38.6	241.6			

2.2. GROUNDWATER CONDITIONS

Groundwater depths were recorded at the time of boring (TOB) and twenty-four (24) hours following boring completion. Groundwater depth measurements are noted on the individual Subsurface Exploration Logs in Appendix B.

2.3. FIELD TESTING SUMMARY

The following table summarizes the state plane coordinates in feet, latitude-longitude in decimal degrees, and existing surface elevations of the test locations for the subsurface exploration.

Table 2-2. Field Soil Testing Summary

Test ID	Test Type	Northing	Easting	Latitude	Longitude	Elevation (ft-MSL)
NBB-1	STB/RC	1094036.780	1550677.331	34.831207	-82.497219	838.4
NBB-2	STB/RC	1094035.814	1550794.451	34.831209	-82.496829	835.5
NBB-3	STB/RC	1094036.876	1550900.711	34.831216	-82.496475	834.2

3. LABORATORY TESTING PROGRAM

Following completion of FME's field exploration, draft boring logs were created. Based on the data represented in these logs, soil samples were selected by the FME for laboratory testing.

The laboratory testing performed on the soil samples collected from the Soil Test Borings is summarized in the table below. Data sheets containing the results from this testing are provided in Appendix C of this report.

Table 3-1. Laboratory Testing Summary Table

Type of Test	Quantity	Procedure
Moisture Content	15	AASHTO T265 (ASTM D2216)
Atterberg Limits	7	AASHTO T89/T90 (ASTM D4318)
Wash 200	7	AASHTO T11 (ASTM D1140)
Compressive Strength of Rock Cores	7	ASTM D7012

3.1. SOIL AND ROCK PROPERTIES

Split spoon soil samples from the geotechnical subsurface site exploration for this bridge site were grouped and classified into AASHTO and USCS soil classifications. According to the AASHTO Soil Classification System, the classifications of these samples ranged from A-2-4 to A-7-6. According to the Unified Soil Classification System, the classifications of these samples ranged from poorly graded sand with silt (SP-SM) to sandy fat clay (CH). Tested samples yielded liquid limits ranging from non-plastic to 55 and plasticity indices ranging from non-plastic to 27.

Seven (7) unconfined compression tests were performed on recovered rock samples with unconfined strength results ranging from 4,300 psi to 19,500 psi. Results of laboratory testing are included in Appendix C.

4. LIMITATIONS TO REPORT

This report has been prepared for the exclusive use of the SCDOT or their agent, for specific application to the proposed US 123 NB Bridge over Georges Creek in Pickens County, South Carolina in accordance with generally accepted soil and foundation engineering practices. No other warranty expressed or implied is made. The subsurface investigation logs included herein, do not reflect variations in subsurface conditions which could exist intermediate of the boring locations or in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to perform additional subsurface exploration based upon on-site observations of the conditions.

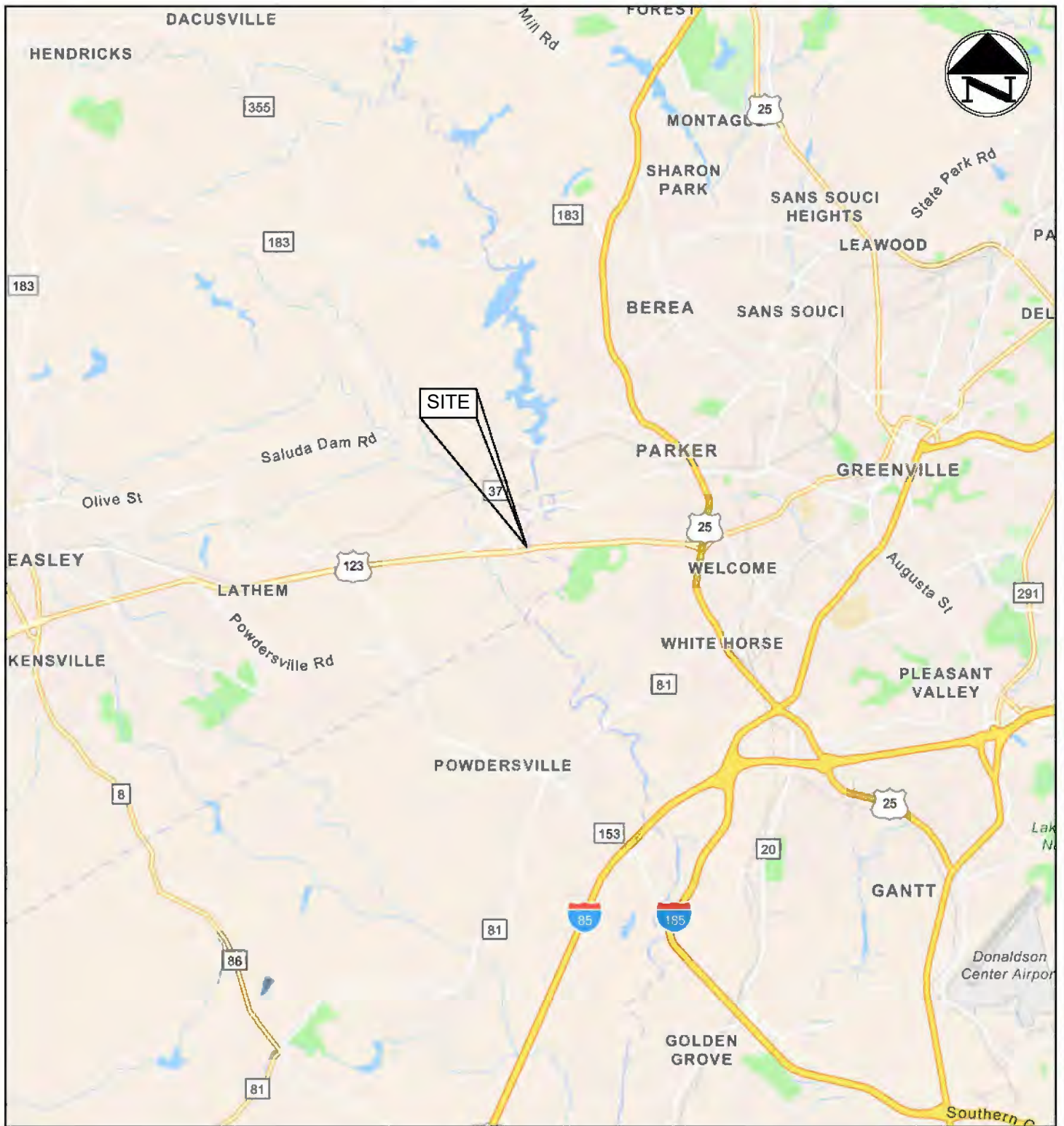
5. REFERENCES

SCDOT (2022) "Geotechnical Design Manual", Version 3.0;
<https://www.scdot.org/business/pdf/geotech/SCDOT-Geotechnical-Design-Manual-2022.pdf>

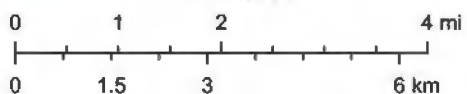
US 123 NB over Georges Creek
Geotechnical Subsurface Data Report

APPENDICES

**APPENDIX A SITE VICINITY MAP,
TEST LOCATION PLAN &
SUBSURFACE PROFILE**



1:144,000



F&ME CONSULTANTS, INC.
COLUMBIA, SC

4			
3			
2			
1			
REV.	BY	DATE	DESCRIPTION OF REVISION
TOPO.		DATE	
DWG.	CTC	DATE 2.8.23	GROUP -- --
R/W		DATE	

US 123 NB OVER GEORGES CREEK
PICKENS COUNTY, SOUTH CAROLINA

SITE LOCATION PLAN

SCDOT PROJECT ID: P041233

FME JOB NO. G6400.110

SCALE: AS NOTED


FIGURE 1



SUBSURFACE TESTING LOCATIONS							
Boring ID	Test Type	Northing	Easting	Latitude	Longitude	Test Elevation (MSL)	Test Depth (ft)
NBB-1	STB	1094036.780	1550677.331	34.83120713	-82.49721883	838.4	51.5
NBB-2	STB	1094035.814	1550794.451	34.83120914	-82.49682858	835.5	91.6
NBB-3	STB	1094036.876	1550900.711	34.83121629	-82.49647460	834.2	98.5



LEGEND:

 SOIL TEST BORING LOCATION

4			
3			
2			
1			
REV.	BY	DATE	DESCRIPTION OF REVISION
TOPO.		DATE	
DWG.	CTC	DATE 2.8.23	GROUP
R/W		DATE	



F&ME CONSULTANTS, INC.
COLUMBIA, SC

US 123 NB OVER GEORGES CREEK
PICKENS COUNTY, SOUTH CAROLINA

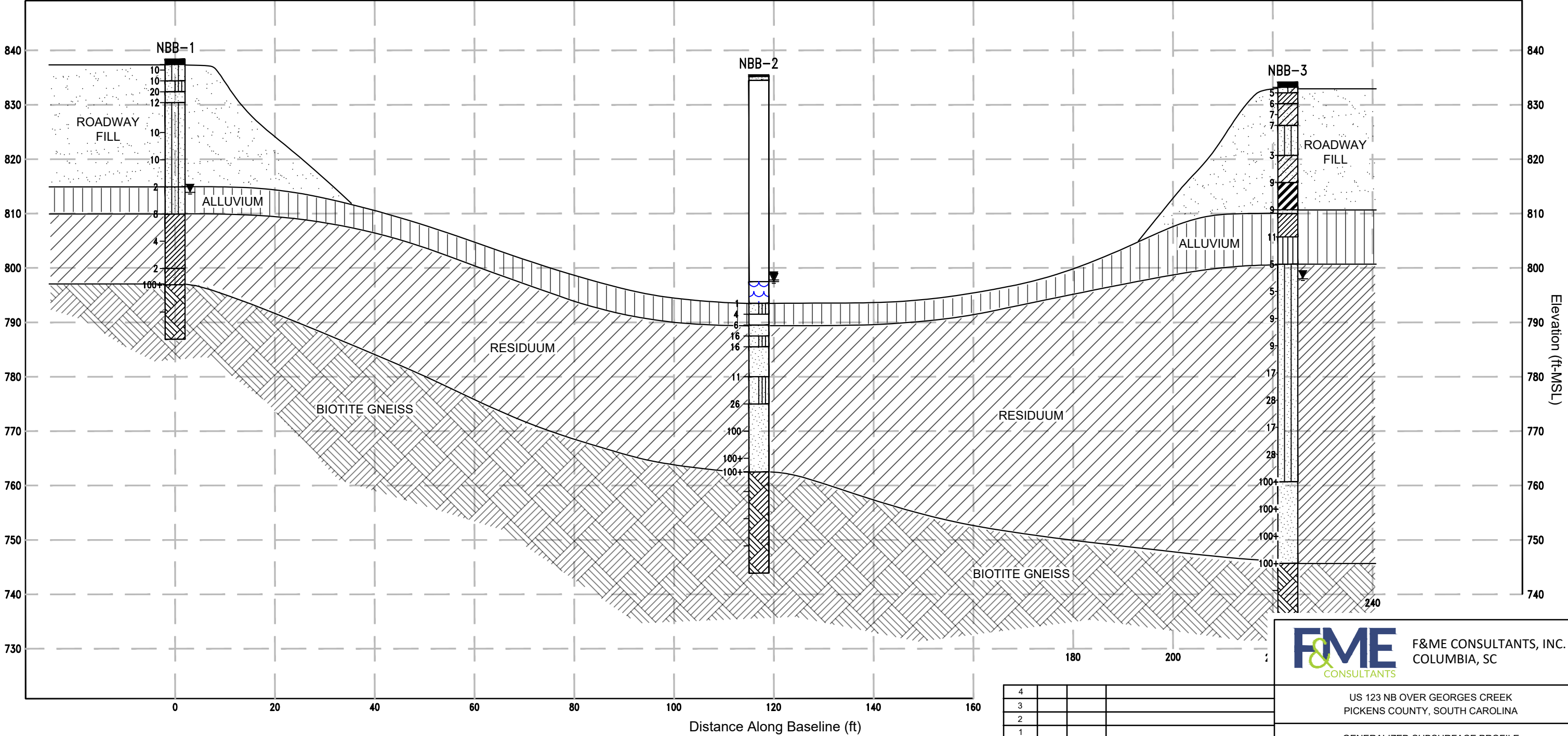
BORING LOCATION PLAN

SCDOT PROJECT ID: P041233

FME JOB NO. G6400.110

SCALE: 1"=40'

FIGURE 2



4			
3			
2			
1			
REV.	BY	DATE	DESCRIPTION OF REVISION
TOPO.		DATE	
DWG.	CTC	DATE 2.15.23	GROUP - -
R/W		DATE	

F&ME CONSULTANTS, INC.
COLUMBIA, SC

US 123 NB OVER GEORGES CREEK
PICKENS COUNTY, SOUTH CAROLINA

GENERALIZED SUBSURFACE PROFILE

SCDOT PROJECT ID: P041233	FME JOB NO. G6400.110
SCALE: NTS	FIGURE 3

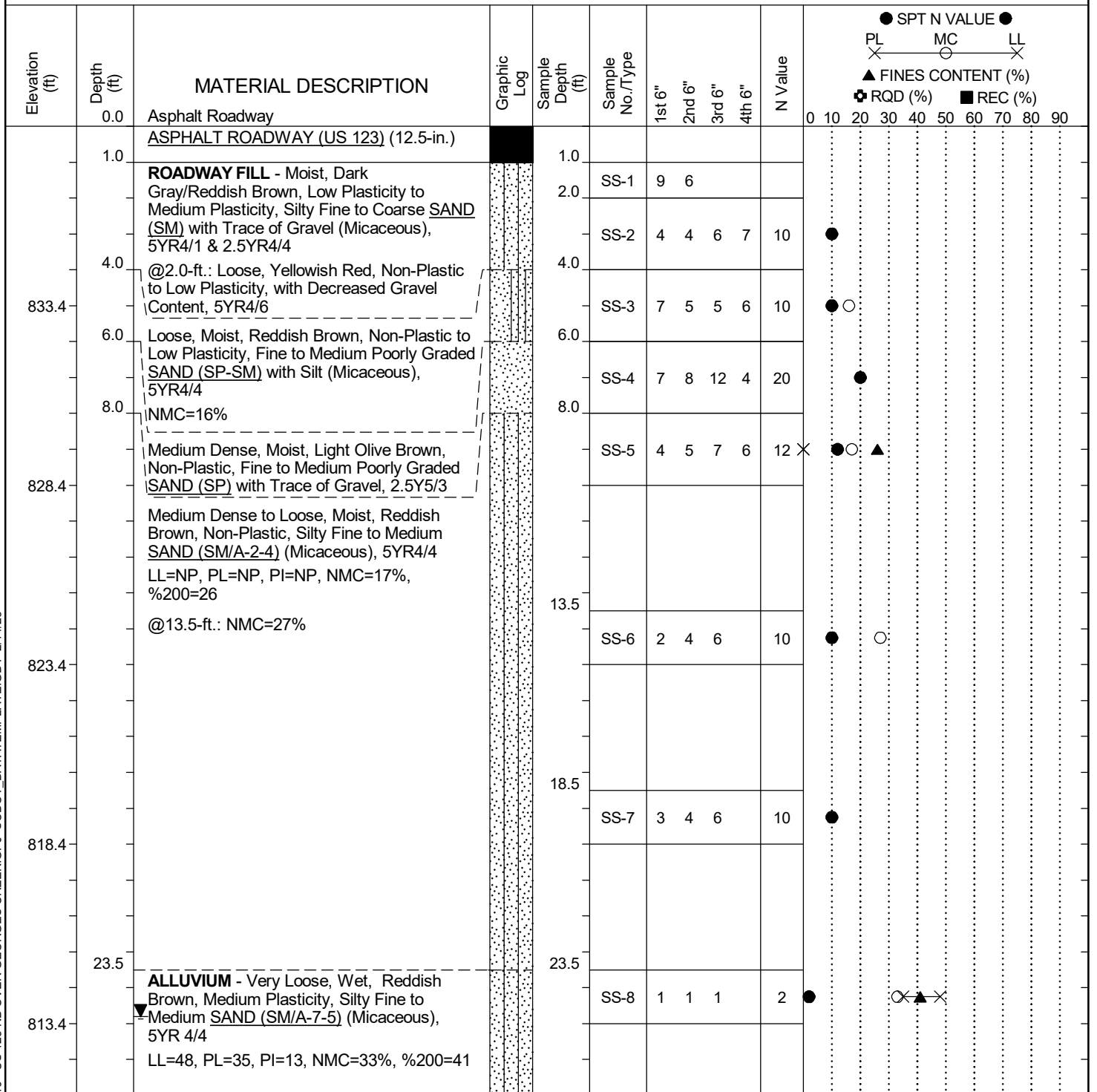
US 123 NB over Georges Creek
Geotechnical Subsurface Data Report

APPENDICES

APPENDIX B BORING LOGS, ROCK CORE PHOTOS

SCDOT Soil Test Log

Project ID:	P041233	County:	Pickens	Boring No.:	NBB-1
Site Description:	US 123 NB over Georges Creek			Route:	US 123
Eng./Geo.:	T. Peterson	Boring Location:	N/A	Offset:	N/A
Elev.:	838.4 ft	Latitude:	34.83120713	Longitude:	-82.49721883
Date Started:	1/24/2022				
Total Depth:	51.5 ft	Soil Depth:	41.5 ft	Core Depth:	10 ft
Date Completed:	1/25/2023				
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	85%				
Core Size:	NQ	Driller:	J. Phillips	Groundwater:	TOB NR
24HR	24.8(Cave@34)				



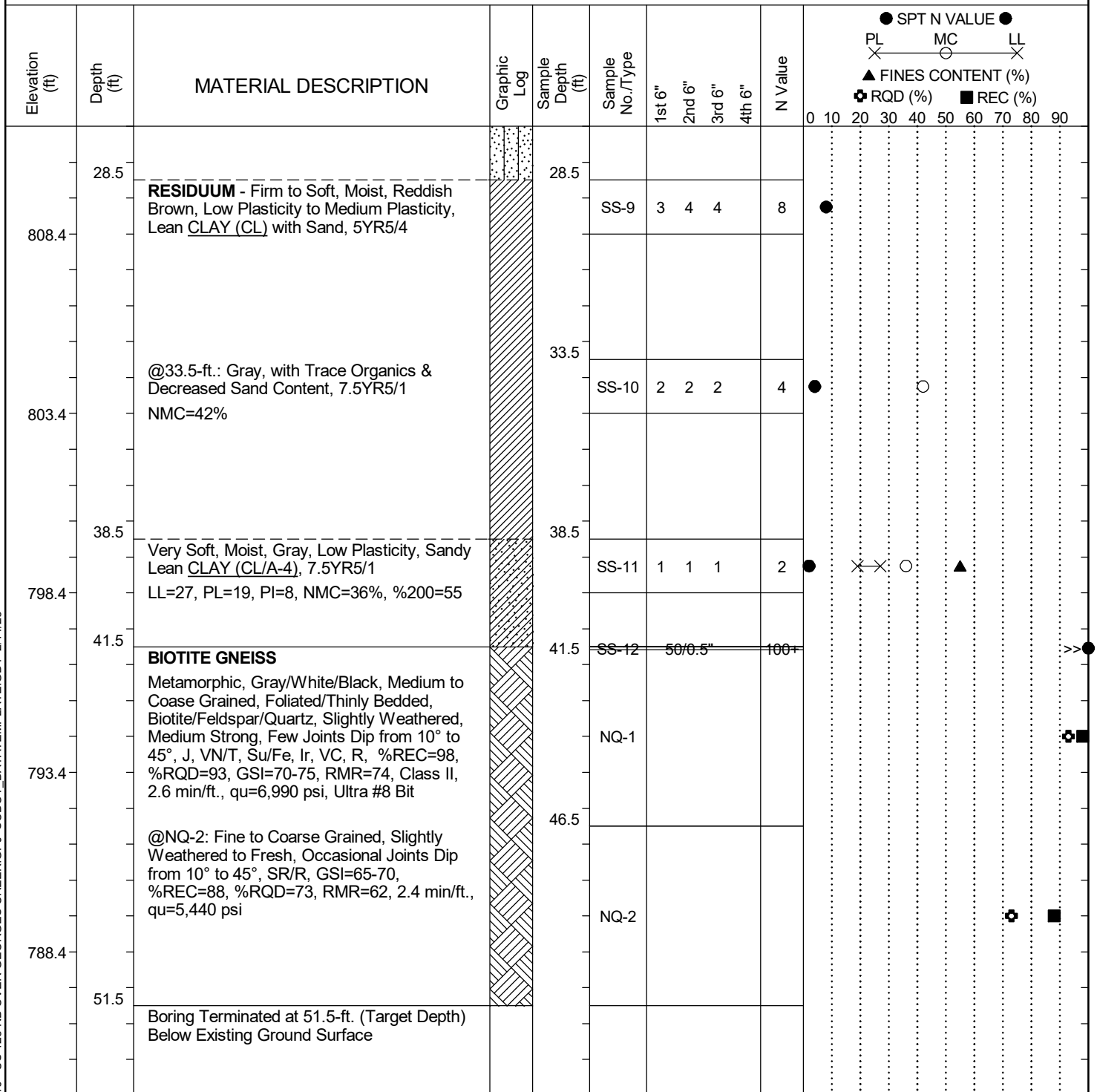
LEGEND

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

SCDOT Soil Test Log

Project ID:	P041233	County:	Pickens	Boring No.:	NBB-1
Site Description:	US 123 NB over Georges Creek			Route:	US 123
Eng./Geo.:	T. Peterson	Boring Location:	N/A	Offset:	N/A
Elev.:	838.4 ft	Latitude:	34.83120713	Longitude:	-82.49721883
Date Started:	1/24/2022				
Total Depth:	51.5 ft	Soil Depth:	41.5 ft	Core Depth:	10 ft
Date Completed:	1/25/2023				
Bore Hole Diameter (in):	4	Sampler Configuration	Liner Required: Y (N)		Liner Used: Y (N)
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	85%				
Core Size:	NQ	Driller:	J. Phillips	Groundwater:	TOB NR
24HR	24.8(Cave@34)				



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 G6400.110 - US 123 NB OVER GEORGES CREEK.GPJ SCDOT_DATATEMPLATE.GDT 2/14/23

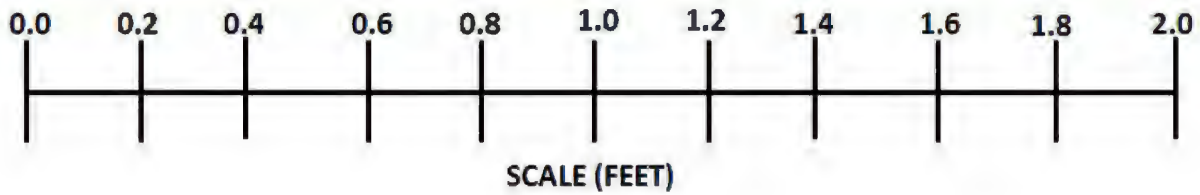
US 123 NB over Georges Creek CORE PHOTOGRAPHS: NBB-1

Begin Run 1
41.5 Feet



Begin Run 2
46.5 Feet

End Run 2
51.5 Feet





Project ID: P041233				County: Pickens		Boring No.: NBB-2		
Site Description: US 123 NB over Georges Creek					Route: US 123			
Eng./Geo.: T. Peterson			Boring Location: N/A		Offset: N/A		Alignment: Existing	
Elev.: 835.5 ft		Latitude: 34.83120914		Longitude: -82.49682858		Date Started: 1/26/2023		
Total Depth: 91.6 ft		Soil Depth: 31 ft		Core Depth: 18.6 ft		Date Completed: 1/27/2023		
Bore Hole Diameter (in): 4		Sampler Configuration			Liner Required: Y [Ⓝ]		Liner Used: Y [Ⓝ]	
Drill Machine: CME 550X		Drill Method: RW/RC		Hammer Type: Automatic		Energy Ratio: 85%		
Core Size: NQ		Driller: J. Phillips		Groundwater: TOB 38 ft		24HR: 38 ft		

[illegible]

LEGEND

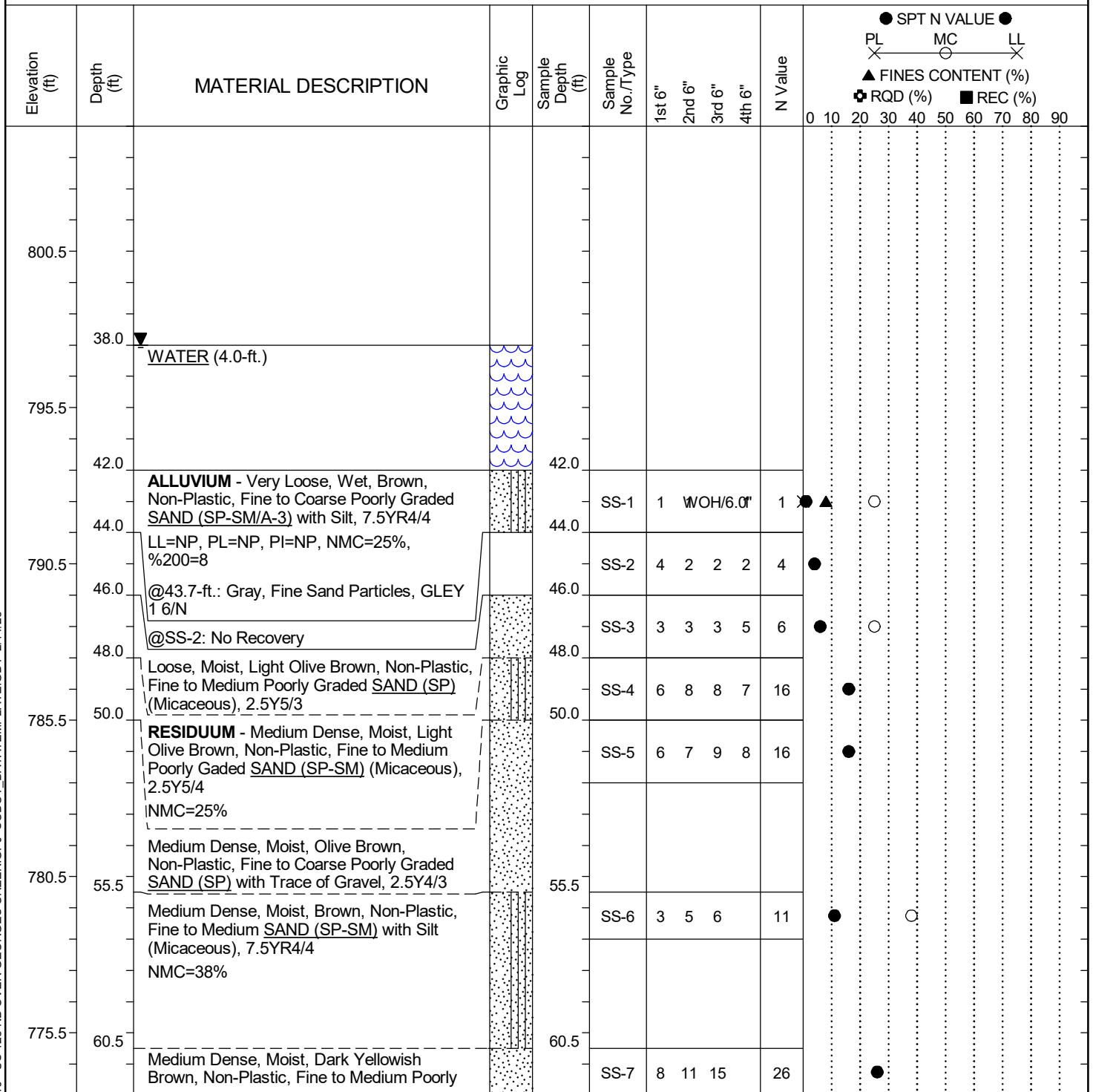
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SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving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

SC_DOT G6400.110 - US 123 NB OVER GEORGES CREEK.GPJ SCDOT_DATATEMPLATE.GDT 2/14/23

SCDOT Soil Test Log

Project ID:	P041233				County:	Pickens			Boring No.:	NBB-2			
Site Description:		US 123 NB over Georges Creek							Route:	US 123			
Eng./Geo.:	T. Peterson		Boring Location:			N/A		Offset:	N/A		Alignment:	Existing	
Elev.:	835.5 ft		Latitude:	34.83120914		Longitude:	-82.49682858		Date Started:		1/26/2023		
Total Depth:		91.6 ft		Soil Depth:	31 ft		Core Depth:	18.6 ft		Date Completed:		1/27/2023	
Bore Hole Diameter (in):			4		Sampler Configuration			Liner Required:	Y (N)		Liner Used:	Y (N)	
Drill Machine:		CME 550X		Drill Method:		RW/RC		Hammer Type:	Automatic		Energy Ratio:	85%	
Core Size:		NQ		Driller:	J. Phillips			Groundwater:	TOB	38 ft		24HR	38 ft



LEGEND

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

SC.DOT G6400.110 - US 123 NB OVER GEORGES CREEK.GPJ SCDOT_DATATEMPLATE.GDT 2/14/23

[illegible]

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	

US 123 NB over Georges Creek CORE PHOTOGRAPHS: NBB-2

Begin Run 1
73.0 Feet

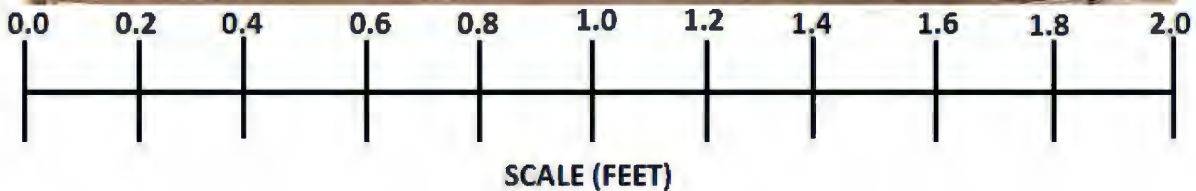
Begin Run 2
76.6 Feet

End Run 2
81.6 Feet

Begin Run 3
81.6 Feet

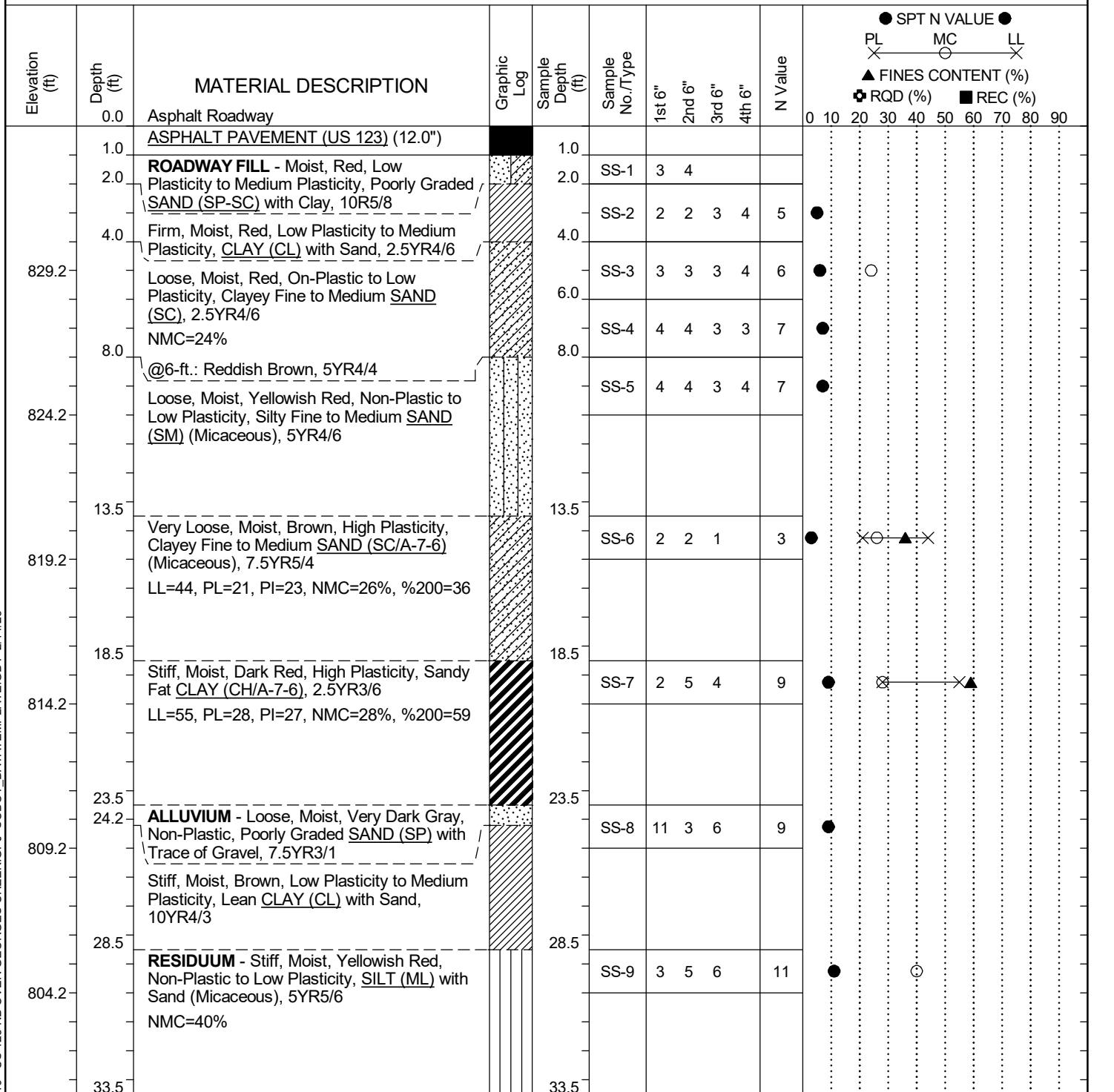
Begin Run 4
86.6 Feet

End Run 4
91.6 Feet



SCDOT Soil Test Log

Project ID:	P041233	County:	Pickens	Boring No.:	NBB-3
Site Description:	US 123 NB over Georges Creek			Route:	US 123
Eng./Geo.:	T. Peterson	Boring Location:	N/A	Offset:	N/A
Elev.:	834.2 ft	Latitude:	34.83121629	Longitude:	-82.4964746
Date Started:	1/23/23				
Total Depth:	98.5 ft	Soil Depth:	88.5 ft	Core Depth:	10 ft
Date Completed:	1/23/2023				
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	85%				
Core Size:	NQ	Driller:	J. Phillips	Groundwater:	TOB NR
24HR	36.5(Cave @				



LEGEND

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

SCDOT Soil Test Log

Project ID:	P041233	County:	Pickens	Boring No.:	NBB-3
Site Description:	US 123 NB over Georges Creek			Route:	US 123
Eng./Geo.:	T. Peterson	Boring Location:	N/A	Offset:	N/A
Elev.:	834.2 ft	Latitude:	34.83121629	Longitude:	-82.4964746
Date Started:	1/23/23				
Total Depth:	98.5 ft	Soil Depth:	88.5 ft	Core Depth:	10 ft
Date Completed:	1/23/2023				
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	85%				
Core Size:	NQ	Driller:	J. Phillips	Groundwater:	TOB NR
24HR	36.5(Cave @				

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value	SPT N VALUE	PL	MC	LL	FINES CONTENT (%)	RQD (%)	REC (%)
799.2		Loose to Medium Dense, Moist, Strong Brown, Non-Plastic, Silty Fine SAND (SM/A-2-4) (Micaceous), 7.5YR4/6			SS-10	2	2	3		5	X						
		LL=NP, PL=NP, PI=NP, NMC=39, %200=29															
		@38.5-ft.: Yellowish Brown, 10YR5/6		38.5													
794.2					SS-11	1	2	3		5							
				43.5													
789.2					SS-12	3	4	5		9							
		@48.5-ft.: Light Olive Brown, 2.5Y5/4		48.5													
784.2					SS-13	3	4	5		9							
		@53.5-ft.: Light Olive Brown/White, 2.5Y5/4 & 2.5Y8/1		53.5													
779.2					SS-14	5	5	12		17							
		@58.5-ft.: Very Dark Gray/White/Light Olive Brown, Fine to Medium Sand Particles, 5Y3/1, 5Y8/1 & 2.5Y5/4		58.5													
774.2		NMC=17%			SS-15	45	17	11		28							
		@63.5-ft.: Light Olive Brown, 2.5Y5/4		63.5													
769.2					SS-16	5	7	10		17							

LEGEND

Continued Next Page

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

[illegible]

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	

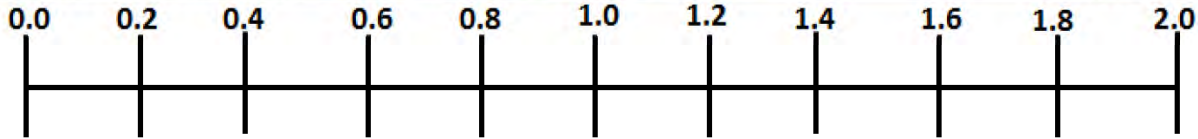
US 123 NB over Georges Creek CORE PHOTOGRAPHS: NBB-3

Begin Run 1
88.5 Feet



Begin Run 4
93.5 Feet

End Run 4
98.5 Feet



SCALE (FEET)

US 123 NB over Georges Creek
Geotechnical Subsurface Data Report

APPENDICES

APPENDIX C LABORATORY TESTING



SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 1

PROJECT ID P041233

PROJECT NAME US 123 NB over Georges Creek

PROJECT COUNTY Pickens

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Classification	Water Content (%)	Dry Density (pcf)	Saturation (%)	Void Ratio
NBB-1	6.0						SP-SM	16.3			
NBB-1	10.0	NP	NP	NP	0.075	26	SM	17.2			
NBB-1	15.0						SM	27.3			
NBB-1	25.0	48	35	13	0.075	41	SM	32.5			
NBB-1	35.0						CL	41.7			
NBB-1	40.0	27	19	8	0.075	55	CL	36.0			
NBB-2	44.0	NP	NP	NP	0.075	8	SP-SM	25.4			
NBB-2	50.0						SP-SM	25.0			
NBB-2	57.0						SP-SM	37.6			
NBB-3	6.0						SC	23.8			
NBB-3	15.0	44	21	23	0.075	36	SC	25.8			
NBB-3	20.0	55	28	27	0.075	59	CH	28.2			
NBB-3	30.0						ML	39.6			
NBB-3	35.0	NP	NP	NP	0.075	29	SM	38.7			
NBB-3	60.0						SM	16.7			



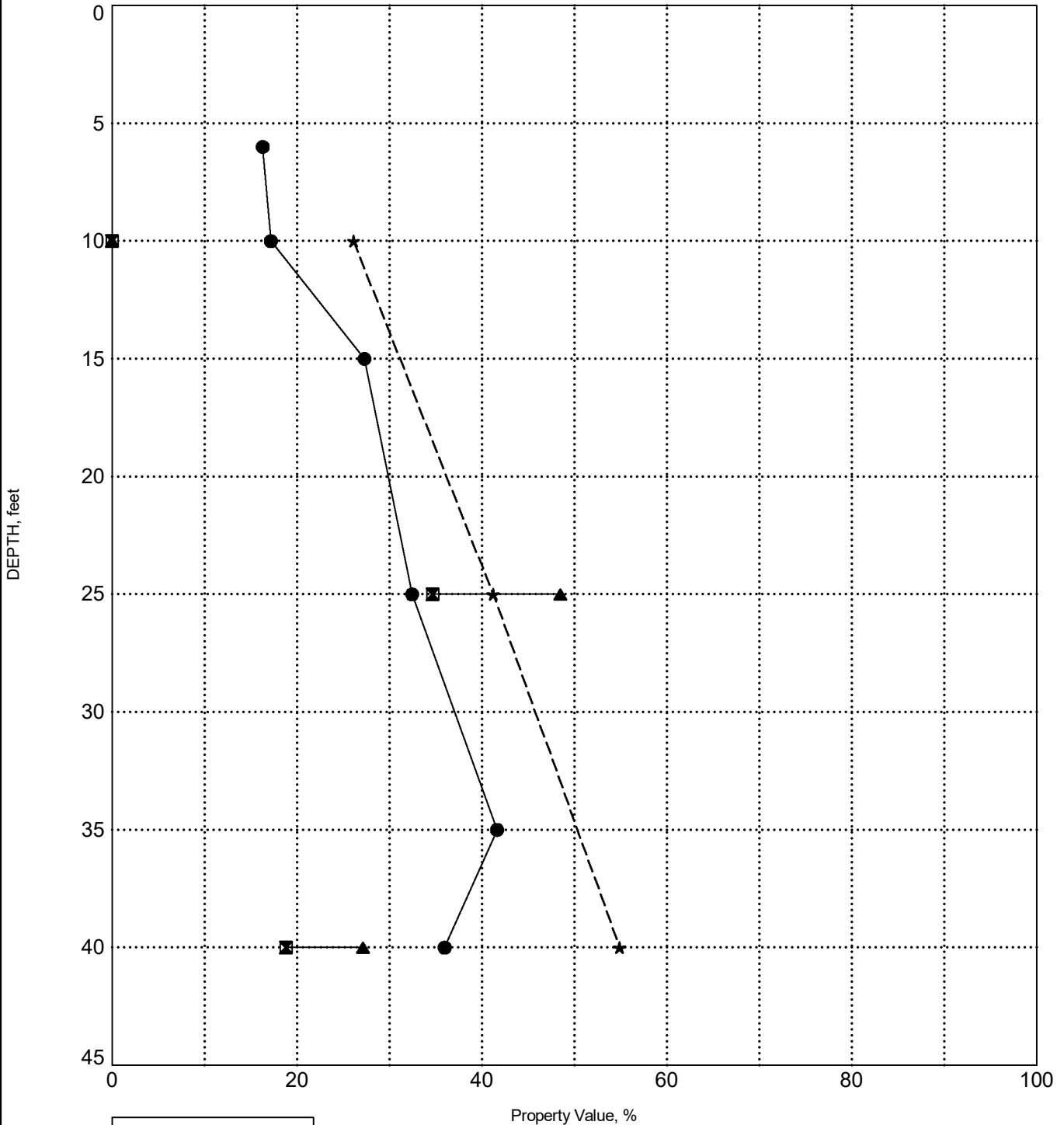
INDEX PROPERTIES VERSUS DEPTH

PROJECT ID P041233

PROJECT NAME US 123 NB over Georges Creek

PROJECT COUNTY Pickens

BORING NBB-1

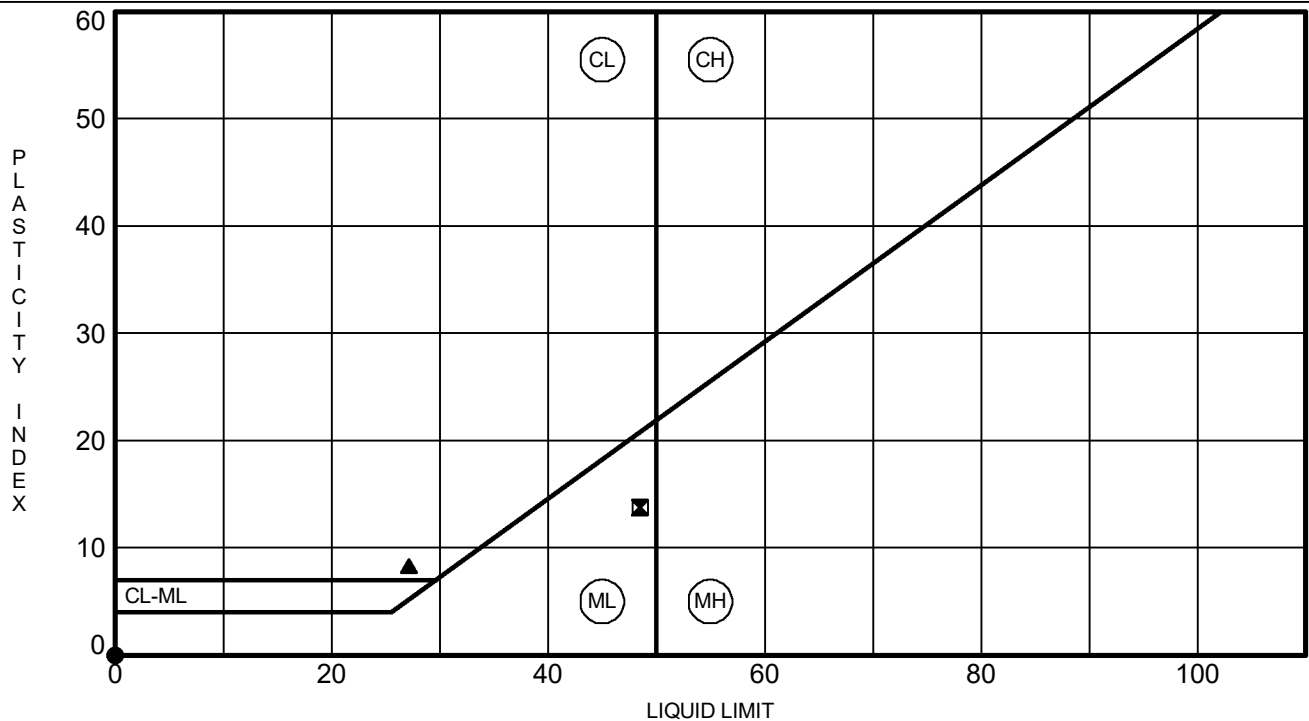


LEGEND	
●	Water Content
■	Plastic Limit
▲	Liquid Limit
★	Fines



PROJECT ID P041233

PROJECT NAME US 123 NB over Georges Creek

PROJECT COUNTY Pickens[illegible]

ATTERBERG LIMITS G6400.110 - US 123 NB OVER GEORGES CREEK.GPJ SCDOT DATA TEMPLATE 01 30 2015.GDT 2/6/23

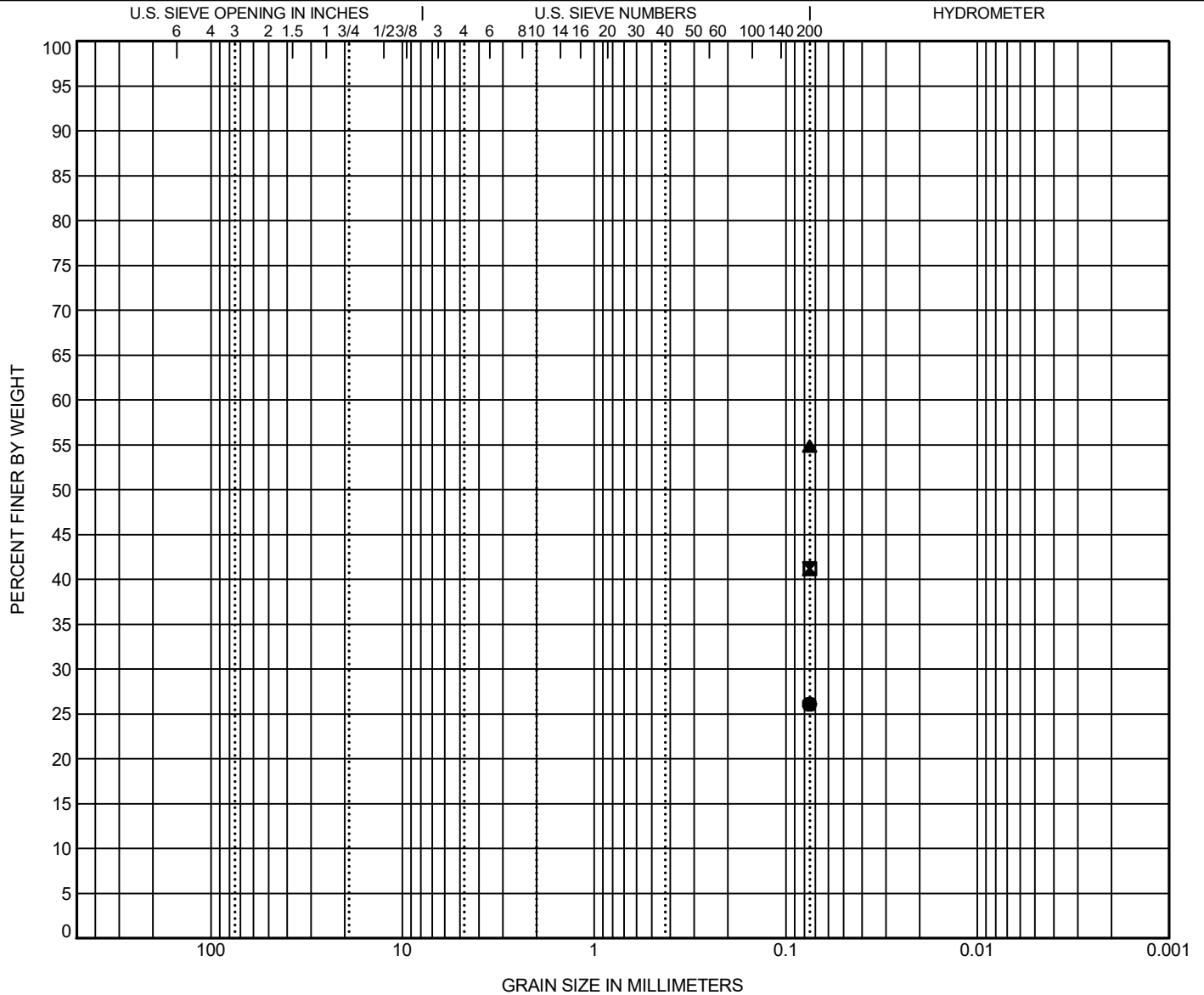


GRAIN SIZE DISTRIBUTION

PROJECT ID P041233

PROJECT NAME US 123 NB over Georges Creek

PROJECT COUNTY Pickens



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● NBB-1	10.0	SILTY SAND (SM/A-2-4)					NP	NP	NP		
■ NBB-1	25.0	SILTY SAND (SM/A-7-5)					48	35	13		
▲ NBB-1	40.0	SANDY LEAN CLAY (CL/A-4)					27	19	8		
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● NBB-1	10.0	0.075						26.1			
■ NBB-1	25.0	0.075						41.2			
▲ NBB-1	40.0	0.075						54.9			

F&ME CONSULTANTS, INC.

MOISTURE CONTENT DETERMINATION (AASHTO T265)

PROJECT: US 123 NB over Georges Creek **SCDOT PROJECT No.:** P041233
SAMPLE NUMBER: 23-0290 **DATE SAMPLE RECEIVED:** 1/25/2023
DESCRIPTION OF SOIL: Various
TESTED BY: RC **DATE SETUP:** 1/25/2023
WEIGHED BY: DH **DATE OF WEIGHING:** 1/26/2023

BORING NO.	NBB-1	NBB-1	NBB-1	NBB-1	NBB-1
SAMPLE NO.	SS-3	SS-5	SS-6	SS-8	SS-10
SAMPLE DEPTH (FT.)	4.0 - 6.0	8.0 - 10.0	13.5 - 15.0	23.5 - 25.0	33.5 - 35.0
WATER CONTENT, W%	16.3	17.2	27.3	32.5	41.7

BORING NO.	NBB-1				
SAMPLE NO.	SS-11				
SAMPLE DEPTH (FT.)	38.5 - 40.0				
WATER CONTENT, W%	36.0				

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH (FT.)					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH (FT.)					
WATER CONTENT, W%					



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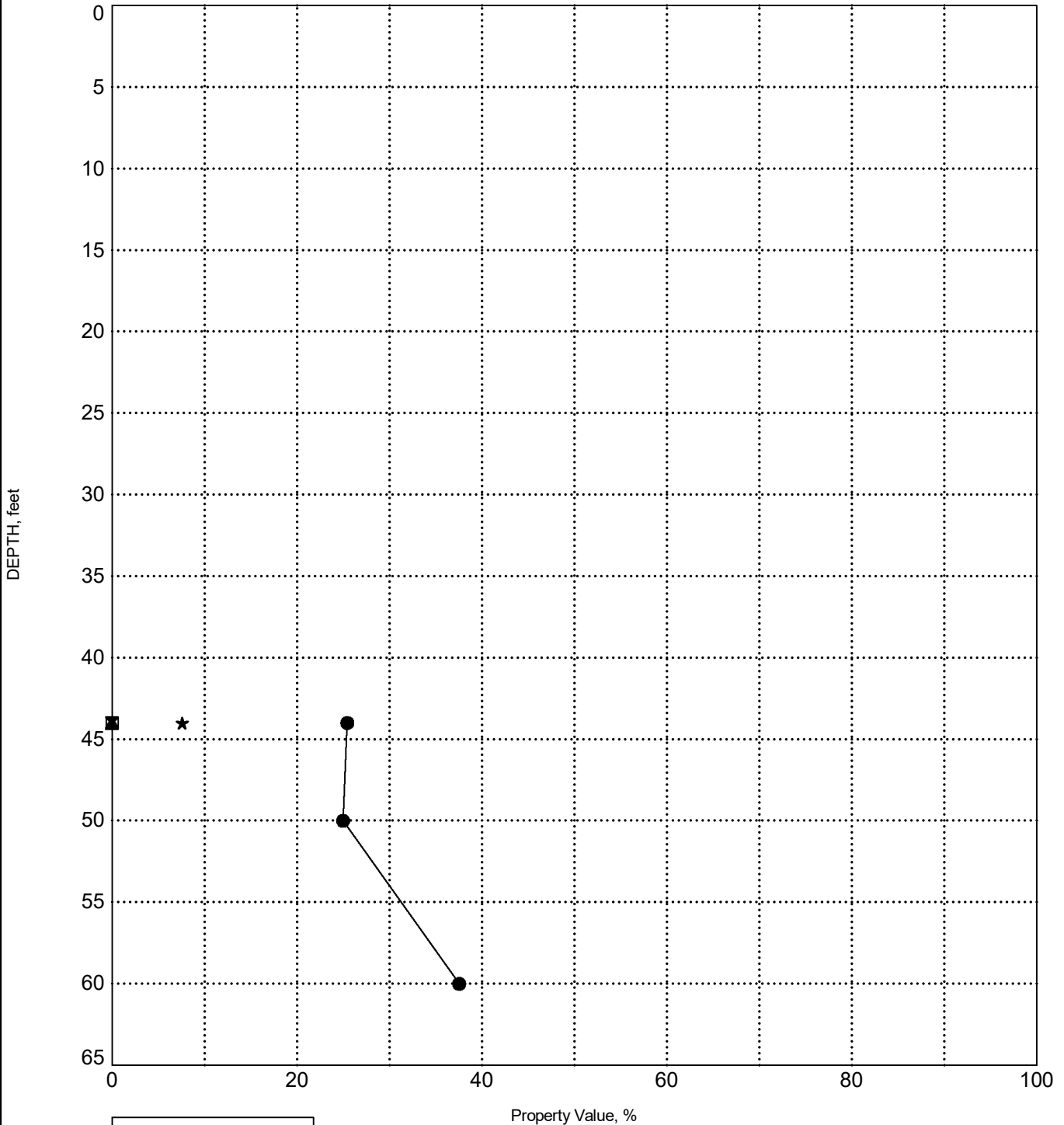
INDEX PROPERTIES VERSUS DEPTH

PROJECT ID P041233

PROJECT NAME US 123 NB over Georges Creek

PROJECT COUNTY Pickens

BORING NBB-2



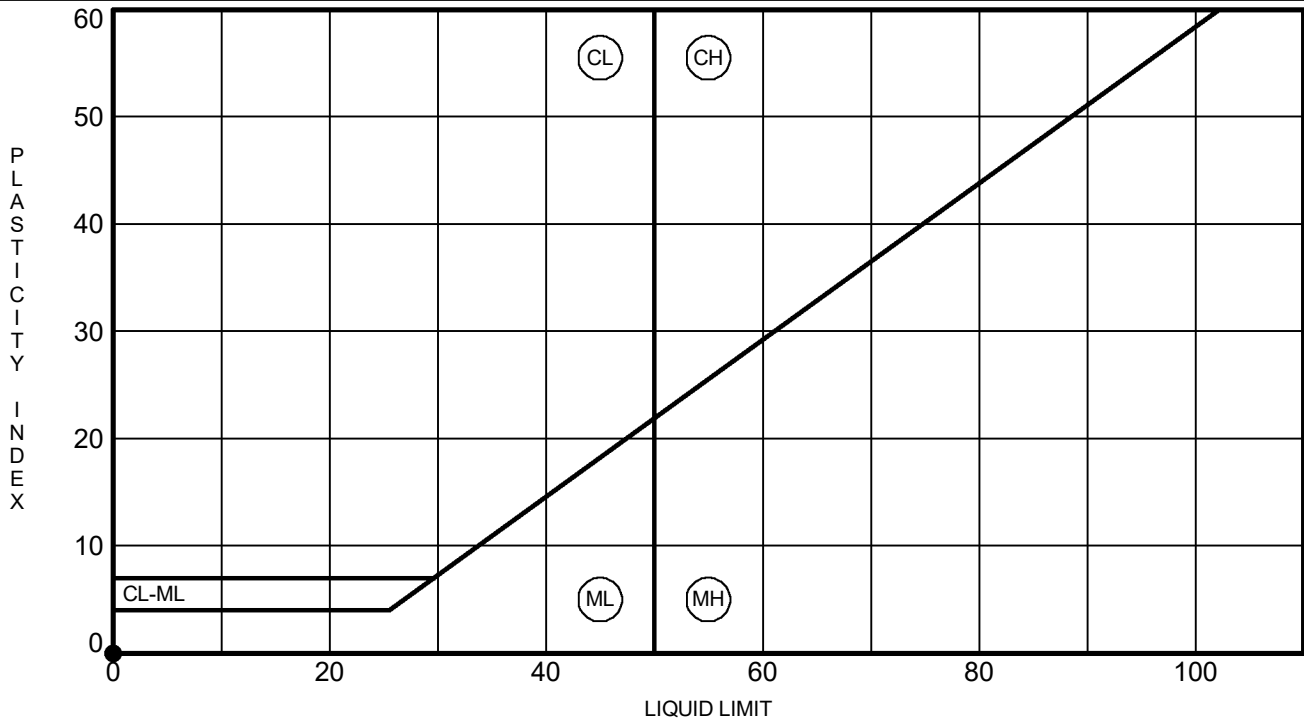
LEGEND	
●	Water Content
■	Plastic Limit
▲	Liquid Limit
★	Fines

ATTERBERG LIMITS' RESULTS

PROJECT ID P041233

PROJECT NAME US 123 NB over Georges Creek

PROJECT COUNTY Pickens

[illegible]

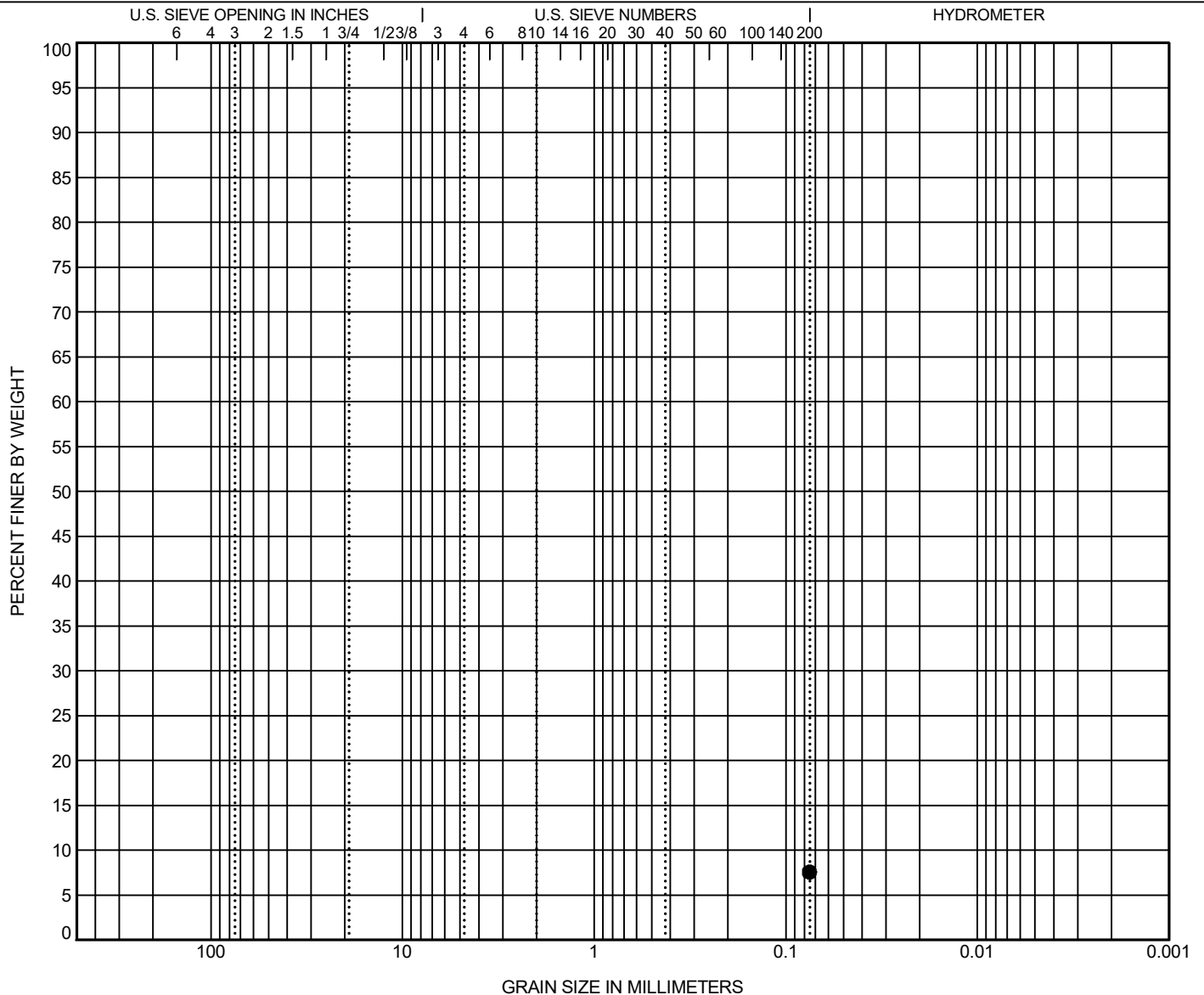


GRAIN SIZE DISTRIBUTION

PROJECT ID P041233

PROJECT NAME US 123 NB over Georges Creek

PROJECT COUNTY Pickens



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● NBB-2	44.0	POORLY GRADED SAND (SP/A-3) with SILT					NP	NP	NP		
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● NBB-2	44.0	0.075						7.6			

F&ME CONSULTANTS, INC.

MOISTURE CONTENT DETERMINATION (AASHTO T265)

PROJECT: US 123 NB over Georges Creek **SCDOT PROJECT No.:** P041233
SAMPLE NUMBER: 23-0291 **DATE SAMPLE RECEIVED:** 1/30/2023
DESCRIPTION OF SOIL: Various
TESTED BY: RC **DATE SETUP:** 1/30/2023
WEIGHED BY: DH **DATE OF WEIGHING:** 1/31/2023

BORING NO.	NBB-2	NBB-2	NBB-2		
SAMPLE NO.	SS-1	SS-4	SS-6		
SAMPLE DEPTH (FT.)	42.0 - 44.0	48.0 - 50.0	55.5 - 57.0		
WATER CONTENT, W%	25.4	25.0	37.6		

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH (FT.)					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH (FT.)					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH (FT.)					
WATER CONTENT, W%					



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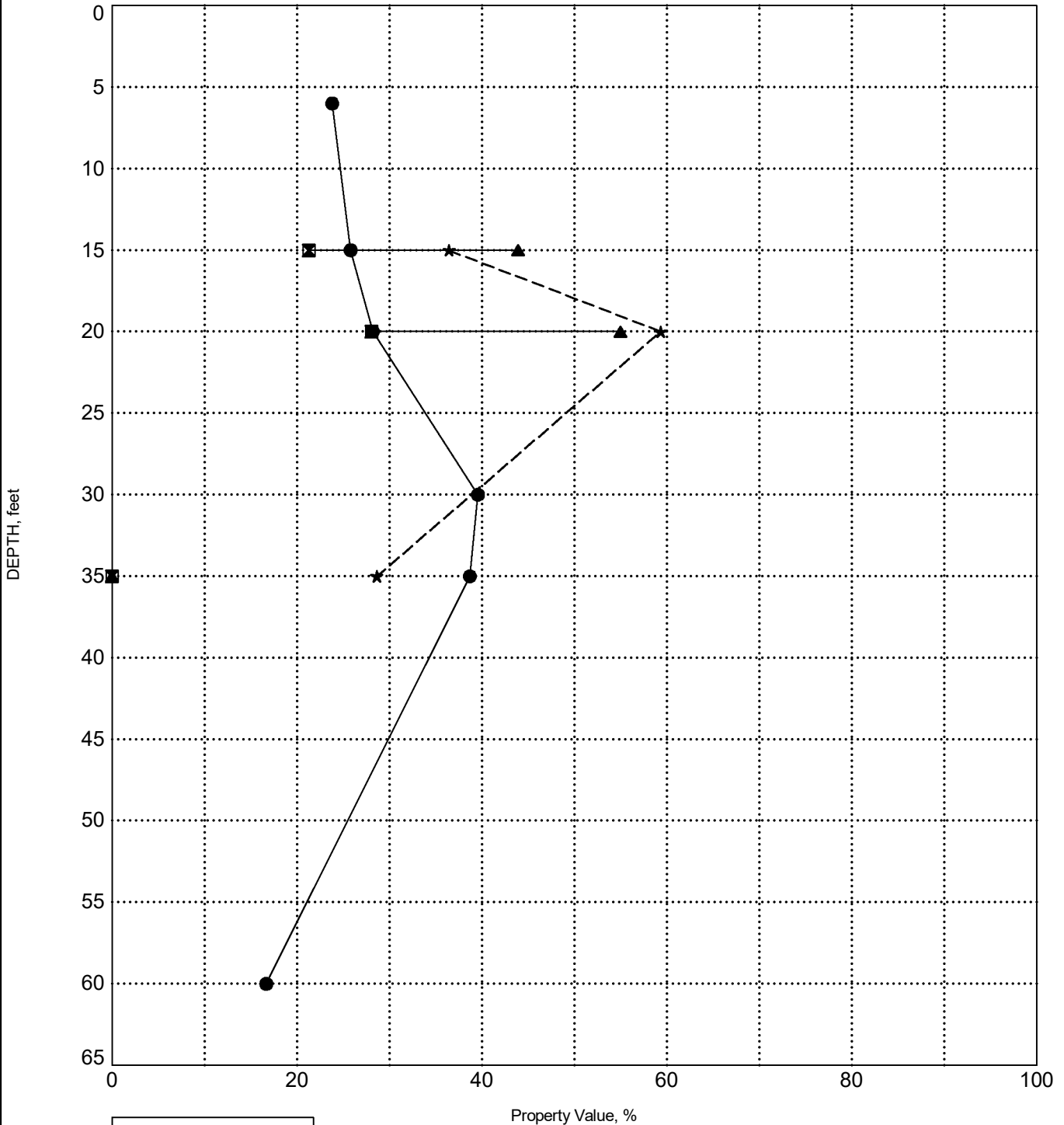
INDEX PROPERTIES VERSUS DEPTH

PROJECT ID P041233

PROJECT NAME US 123 NB over Georges Creek

PROJECT COUNTY Pickens

BORING NBB-3

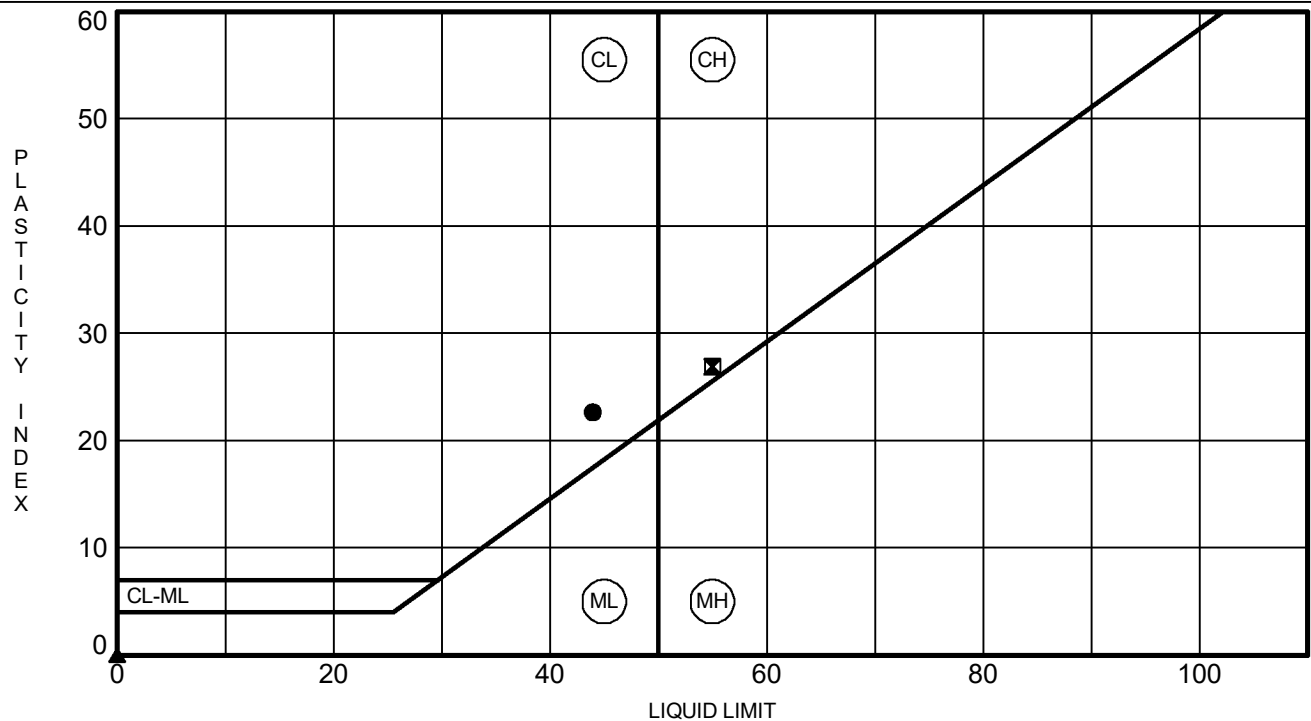


LEGEND	
●	Water Content
■	Plastic Limit
▲	Liquid Limit
★	Fines



PROJECT ID P041233

PROJECT NAME US 123 NB over Georges Creek

PROJECT COUNTY Pickens[illegible]

ATTERBERG LIMITS G6400.110 - US 123 NB OVER GEORGES CREEK.GPJ SCDOT DATA TEMPLATE 01 30 2015.GDT 2/6/23

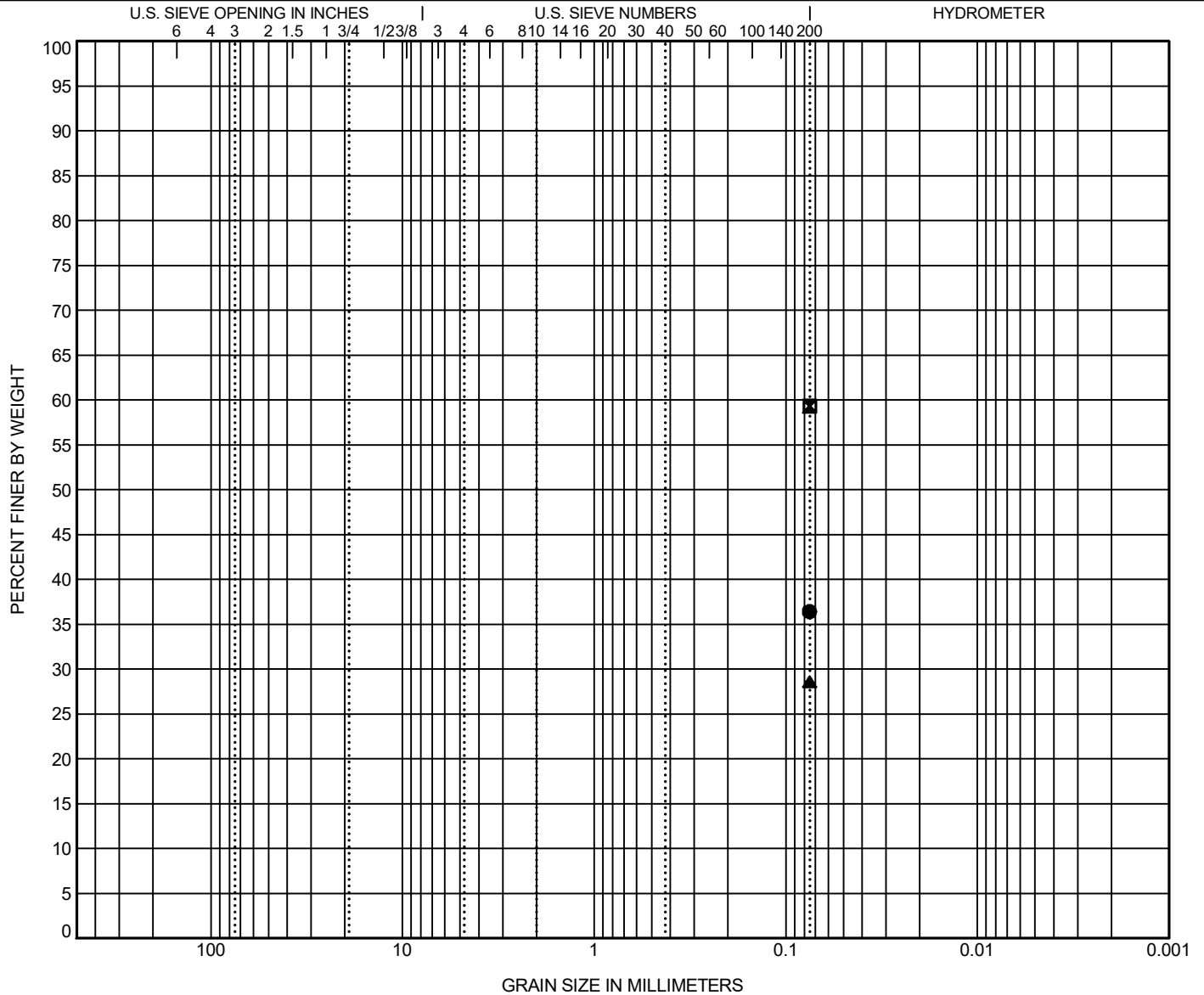


GRAIN SIZE DISTRIBUTION

PROJECT ID P041233

PROJECT NAME US 123 NB over Georges Creek

PROJECT COUNTY Pickens



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● NBB-3	15.0	CLAYEY SAND (SC/A-7-6)					44	21	23		
■ NBB-3	20.0	SANDY FAT CLAY (CH/A-7-6)					55	28	27		
▲ NBB-3	35.0	SILTY SAND (SM/A-2-4)					NP	NP	NP		
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● NBB-3	15.0	0.075						36.5			
■ NBB-3	20.0	0.075						59.3			
▲ NBB-3	35.0	0.075						28.6			

F&ME CONSULTANTS, INC.

MOISTURE CONTENT DETERMINATION (AASHTO T265)

PROJECT: US 123 NB over Georges Creek **SCDOT PROJECT No.:** P041233
SAMPLE NUMBER: 23-0234 **DATE SAMPLE RECEIVED:** 1/25/2023
DESCRIPTION OF SOIL: Various
TESTED BY: RC **DATE SETUP:** 1/25/2023
WEIGHED BY: DH **DATE OF WEIGHING:** 1/26/2023

BORING NO.	NBB-3	NBB-3	NBB-3	NBB-3	NBB-3
SAMPLE NO.	SS-3	SS-6	SS-7	SS-9	SS-10
SAMPLE DEPTH (FT.)	4.0 - 6.0	13.5 - 15.0	18.5 - 20.0	28.5 - 30.0	33.5 - 35.0
WATER CONTENT, W%	23.8	25.8	28.2	39.6	38.7

BORING NO.	NBB-3				
SAMPLE NO.	SS-15				
SAMPLE DEPTH (FT.)	58.5 - 60.0				
WATER CONTENT, W%	16.7				

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH (FT.)					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH (FT.)					
WATER CONTENT, W%					



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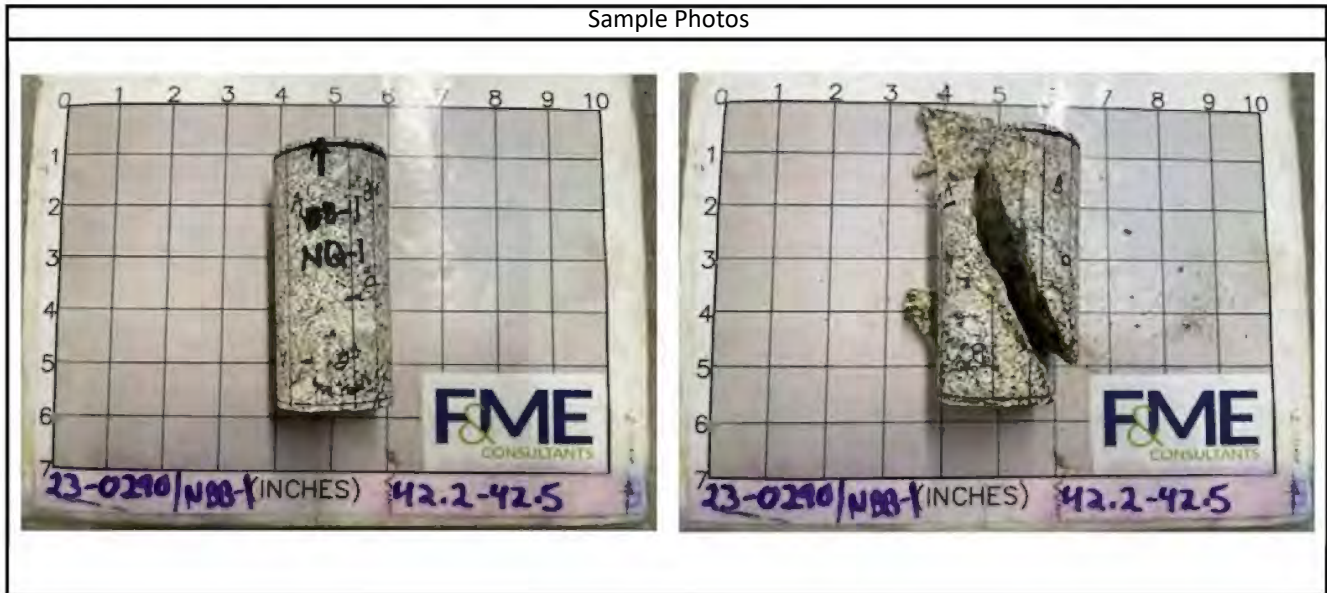
PROJECT ID P041233 PROJECT NAME US 123 NB over Georges Creek
PROJECT COUNTY Pickens

Borehole	Core Run Number	Core Run Top Depth	REC (%)	RQD (%)	q _u (psi)	Poisson's Ratio	Elastic Modulus (ksi)	Unit Weight (pcf)	RMR	GSI
NBB-1	NQ-1	41.5	98	93	6,990	0.12	1,210	164	74	75
NBB-1	NQ-2	46.5	88	73	5,440	0.21	1,450	171	62	70
NBB-2	NQ-1	73.0	56	23	4,300	0.29	1,160	163	47	45
NBB-2	NQ-2	76.6	88	65	5,170	0.11	3,270	171	85	70
NBB-2	NQ-3	81.6	100	98	12,950	0.15	4,300	168	85	80
NBB-2	NQ-4	86.6	100	100	N/A	N/A	N/A	N/A	85	80
NBB-3	NQ-1	88.5	100	100	10,220	0.15	3,230	180	75	85
NBB-3	NQ-2	93.5	100	100	19,500	0.15	6,080	182	80	85

Compressive Strength and Elastic Moduli of Intact Rock Core Specimens
ASTM D7012 - Method D / SC-T-39

Project	US 123 NB RBO Georges Creek			Date	2/6/2023
Project No.	G6400.110	Sample Diameter (in.)	1.869	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.19	Reviewed By	WJG
Boring	NBB-1	Unit Weight (pcf)	164.4	Core Size	NQ
Sample No.	NQ-1 / 23-0235A	L/D Ratio	2.24	Recovery	98%
Depth	42.2' - 42.5'	Load Rate (psi/sec)	20	RQD	93%
Description	Black/White/Gray Biotite Gneiss				

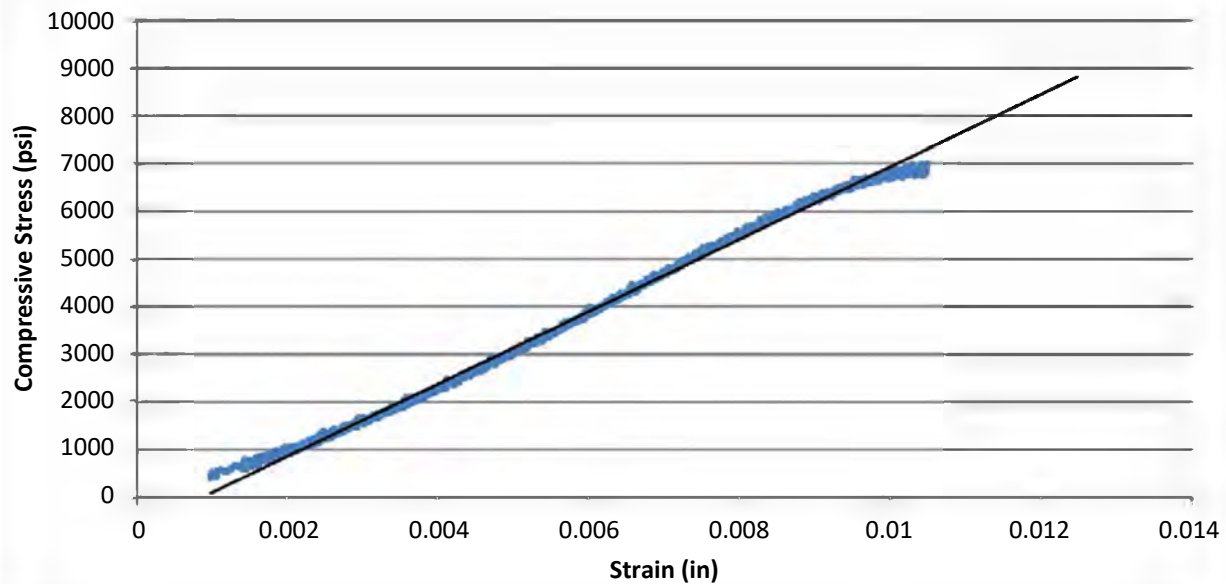
Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	-1486	111	1,967	717	0.97	0.07
20%	-2720	220	3,830	1,396	1.03	0.08
30%	-3720	353	5,748	2,095	1.13	0.09
40%	-4736	529	7,696	2,805	1.18	0.11
50%	-5579	743	9,578	3,491	1.25	0.13
60%	-6422	1031	11,573	4,218	1.31	0.16
70%	-7256	1447	13,487	4,916	1.36	0.20
80%	-8076	2083	15,323	5,585	1.38	0.26
90%	-9065	2576	17,294	6,303	1.39	0.28
100%	-10481	3525	19,172	6,988		



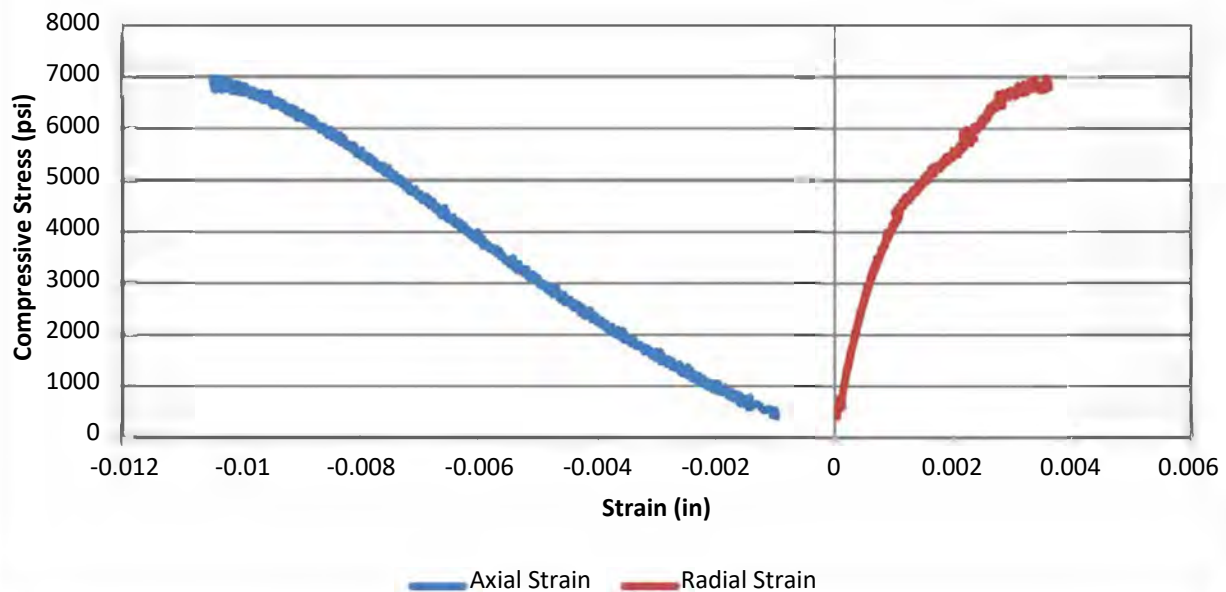
Test Results			
Unconfined Compressive Strength (psi)		6,990	Elastic Modulus (psi)
			1.21E+06
			Poisson's Ratio in Elastic Range
			0.12
Comments	Elastic range was taken as between 0.003 and 0.007 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.		

Project	US 123 NB RBO Georges Creek			Date	2/6/2023
Project No.	G6400.110	Sample Diameter (in.)	1.869	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.19	Reviewed By	WJG
Boring	NBB-1	Unit Weight (pcf)	164.4	Core Size	NQ
Sample No.	NQ-1 / 23-0235A	L/D Ratio	2.24	Recovery	98%
Depth	42.2' - 42.5'	Load Rate (psi/sec)	20	RQD	93%
Description	Black/White/Gray Biotite Gneiss				

Axial Stress vs. Strain



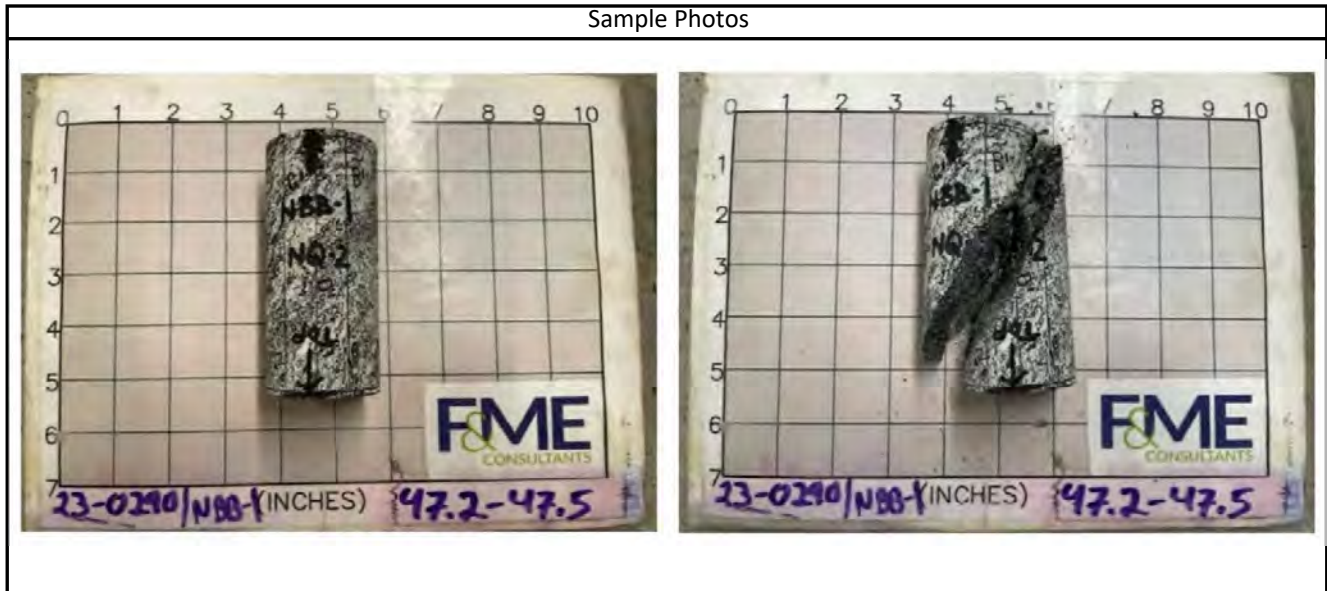
Stress vs. Strain



Compressive Strength and Elastic Moduli of Intact Rock Core Specimens
ASTM D7012 - Method D / SC-T-39

Project	US 123 NB RBO Georges Creek			Date	2/6/2023
Project No.	G6400.110	Sample Diameter (in.)	1.868	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.204	Reviewed By	WJG
Boring	NBB-1	Unit Weight (pcf)	171.3	Core Size	NQ
Sample No.	NQ-2 / 23-0235B	L/D Ratio	2.25	Recovery	88%
Depth	47.2' - 47.5'	Load Rate (psi/sec)	20	RQD	73%
Description	Black/White/Gray Biotite Gneiss				

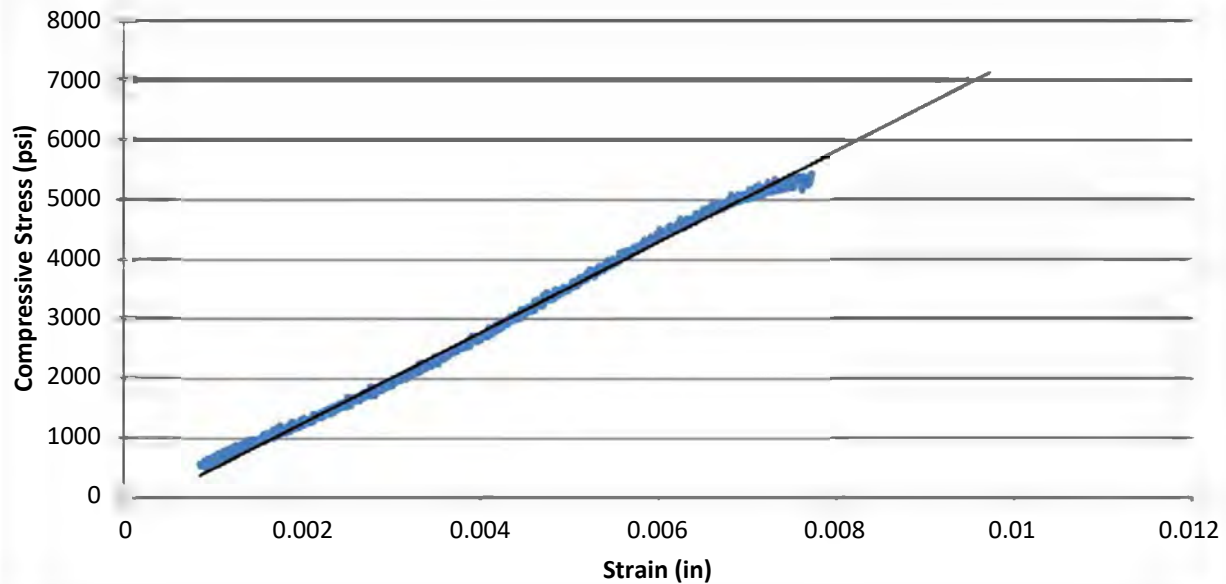
Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	-922	270	1,450	529	1.15	0.29
20%	-1713	328	2,936	1,071	1.25	0.19
30%	-2597	459	4,471	1,631	1.26	0.18
40%	-3290	588	5,955	2,173	1.32	0.18
50%	-4057	765	7,464	2,723	1.34	0.19
60%	-4685	944	8,939	3,262	1.39	0.20
70%	-5360	1178	10,483	3,825	1.43	0.22
80%	-6003	1447	11,933	4,354	1.45	0.24
90%	-6712	1792	13,420	4,897	1.46	0.27
100%	-7727	2609	14,904	5,438		



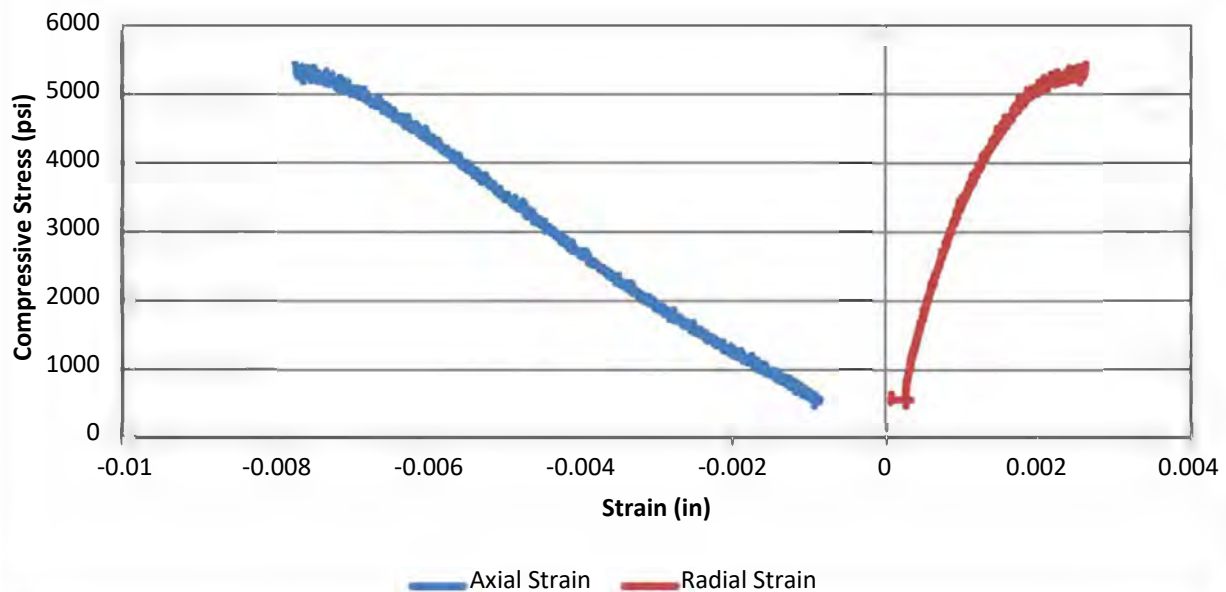
Test Results			
Unconfined Compressive Strength (psi)		5,440	Elastic Modulus (psi)
			1.45E+06
			Poisson's Ratio in Elastic Range
			0.21
Comments	Elastic range was taken as between 0.002 and 0.005 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.		

Project	US 123 NB RBO Georges Creek			Date	2/6/2023
Project No.	G6400.110	Sample Diameter (in.)	1.868	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.204	Reviewed By	WJG
Boring	NBB-1	Unit Weight (pcf)	171.3	Core Size	NQ
Sample No.	NQ-2 / 23-0235B	L/D Ratio	2.25	Recovery	88%
Depth	47.2' - 47.5'	Load Rate (psi/sec)	20	RQD	73%
Description	Black/White/Gray Biotite Gneiss				

Axial Stress vs. Strain



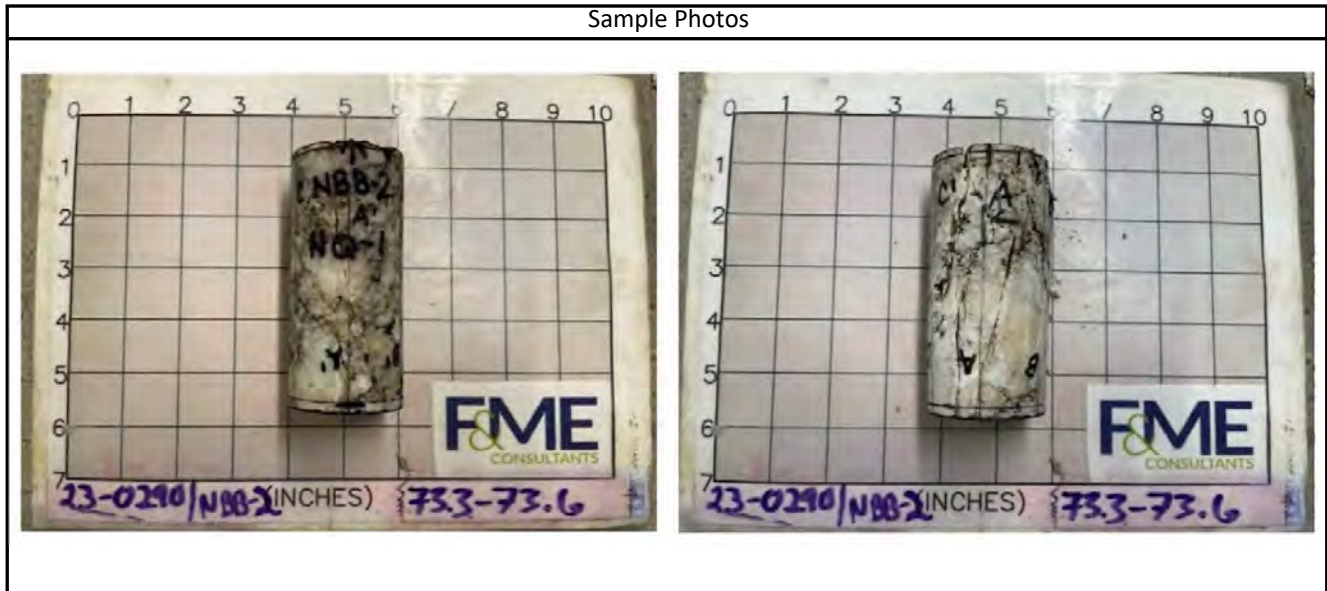
Stress vs. Strain



Compressive Strength and Elastic Moduli of Intact Rock Core Specimens
ASTM D7012 - Method D / SC-T-39

Project	US 123 NB RBO Georges Creek			Date	2/6/2023
Project No.	G6400.110	Sample Diameter (in.)	1.868	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.248	Reviewed By	WJG
Boring	NBB-2	Unit Weight (pcf)	162.7	Core Size	NQ
Sample No.	NQ-1 / 23-0291A	L/D Ratio	2.27	Recovery	56%
Depth	73.3' - 73.6'	Load Rate (psi/sec)	10	RQD	23%
Description	Black/White/Gray Biotite Gneiss				

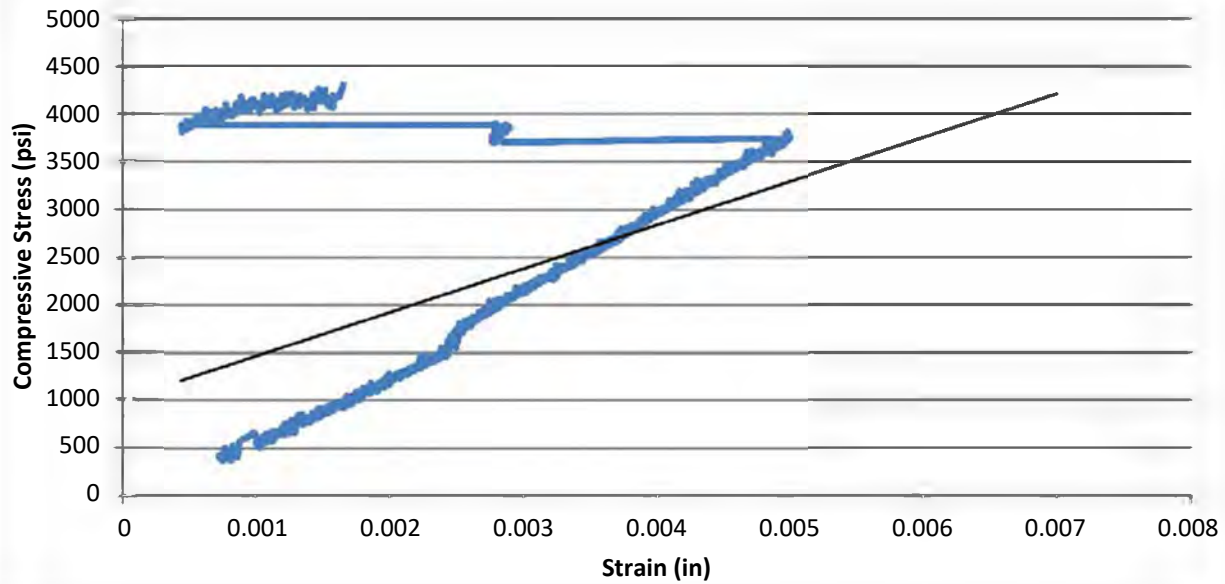
Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	-781	116	1,180	430	1.10	0.15
20%	-1449	421	2,365	863	1.19	0.29
30%	-2097	769	3,551	1,296	1.24	0.37
40%	-2523	1207	4,756	1,735	1.38	0.48
50%	-2974	1645	5,861	2,139	1.44	0.55
60%	-3582	2068	7,061	2,576	1.44	0.58
70%	-4061	2533	8,256	3,012	1.48	0.62
80%	-4584	3216	9,457	3,451	1.51	0.70
90%	-486	4370	10,632	3,879	15.98	9.00
100%	-1658	7873	11,797	4,305		



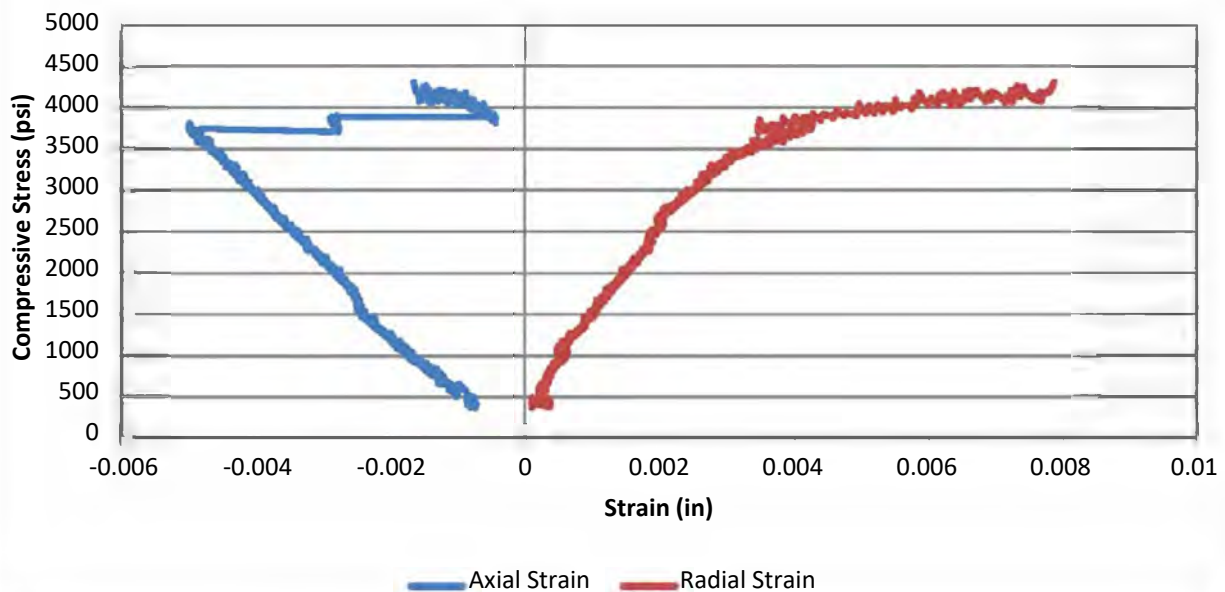
Test Results			
Unconfined Compressive Strength (psi)		4,300	Elastic Modulus (psi)
			1.16E+06
			Poisson's Ratio in Elastic Range
			0.29
Comments	Elastic range was taken as between 0.001 and 0.002 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range. Sample suffered a partial failure around 1,500 psi and 3,600 psi.		

Project	US 123 NB RBO Georges Creek			Date	2/6/2023
Project No.	G6400.110	Sample Diameter (in.)	1.868	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.248	Reviewed By	WJG
Boring	NBB-2	Unit Weight (pcf)	162.7	Core Size	NQ
Sample No.	NQ-1 / 23-0291A	L/D Ratio	2.27	Recovery	56%
Depth	73.3' - 73.6'	Load Rate (psi/sec)	10	RQD	23%
Description	Black/White/Gray Biotite Gneiss				

Axial Stress vs. Strain



Stress vs. Strain



Compressive Strength and Elastic Moduli of Intact Rock Core Specimens
ASTM D7012 - Method D / SC-T-39

Project	US 123 NB RBO Georges Creek			Date	2/6/2023
Project No.	G6400.110	Sample Diameter (in.)	1.867	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.207	Reviewed By	WJG
Boring	NBB-2	Unit Weight (pcf)	171.3	Core Size	NQ
Sample No.	NQ-2 / 23-0291B	L/D Ratio	2.25	Recovery	88%
Depth	78.4' - 78.7'	Load Rate (psi/sec)	20	RQD	65%
Description	Black/White/Gray Biotite Gneiss				

Test Data						
Percent of Failure Load	Strain (10 ⁻⁶)		Load (lbs)	Compressive Stress (psi)	Secant Modulus x10 ⁶ (psi)	Poisson's Ratio
	Axial	Radial				
10%	Sample Preload Range					
20%	-684	22	2,812	1,027	3.00	0.03
30%	-1000	72	4,259	1,556	3.11	0.07
40%	-1296	123	5,676	2,073	3.20	0.09
50%	-1575	176	7,043	2,572	3.27	0.11
60%	-1829	231	8,473	3,095	3.39	0.13
70%	-2155	309	9,897	3,615	3.36	0.14
80%	-2457	383	11,303	4,129	3.36	0.16
90%	-2855	515	12,723	4,647	3.26	0.18
100%	-3286	890	14,141	5,166		

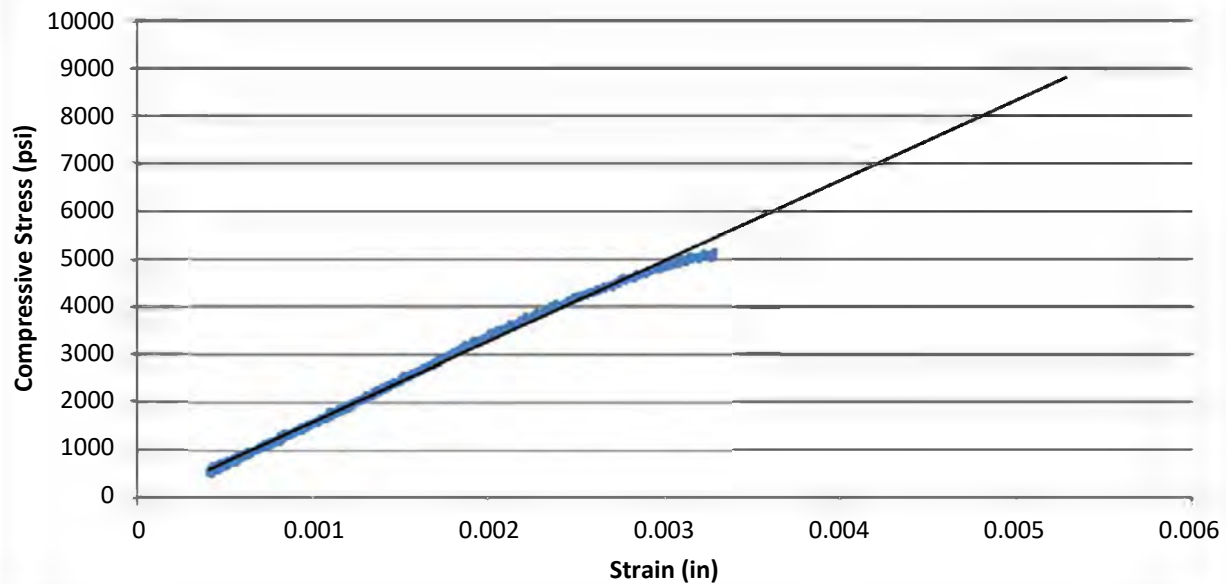
Sample Photos



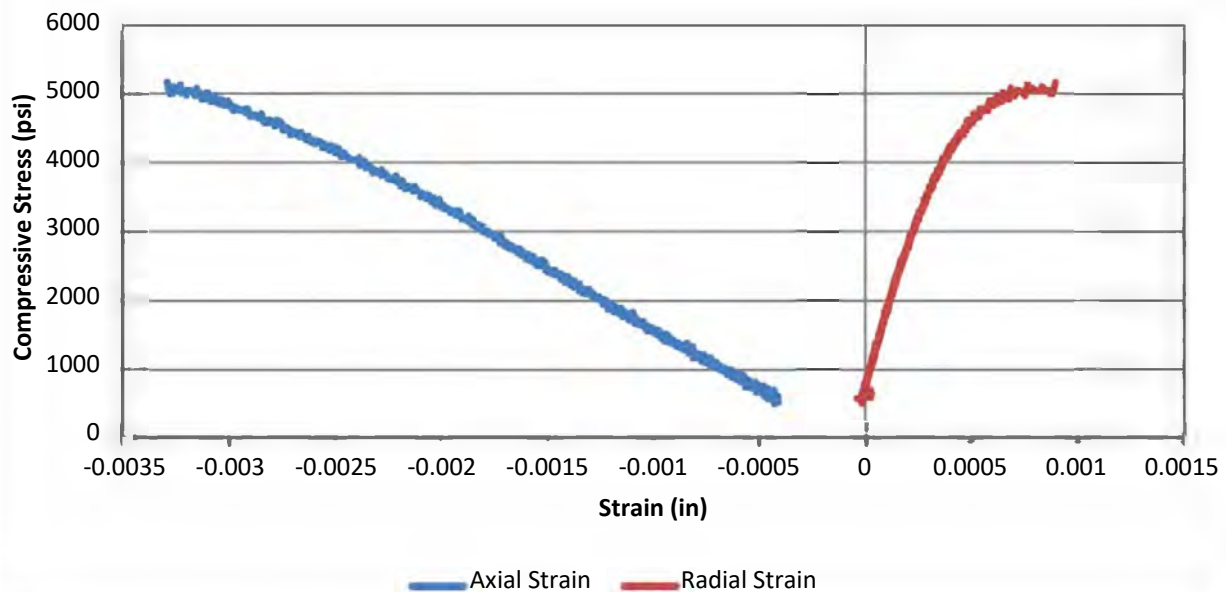
Test Results				
Unconfined Compressive Strength (psi)		5,170	Elastic Modulus (psi)	3.27E+06
			Poisson's Ratio in Elastic Range	0.11
Comments	Elastic range was taken as between 0.001 and 0.002 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.			

Project	US 123 NB RBO Georges Creek			Date	2/6/2023
Project No.	G6400.110	Sample Diameter (in.)	1.867	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.207	Reviewed By	WJG
Boring	NBB-2	Unit Weight (pcf)	171.3	Core Size	NQ
Sample No.	NQ-2 / 23-0291B	L/D Ratio	2.25	Recovery	88%
Depth	78.4' - 78.7'	Load Rate (psi/sec)	20	RQD	65%
Description	Black/White/Gray Biotite Gneiss				

Axial Stress vs. Strain



Stress vs. Strain

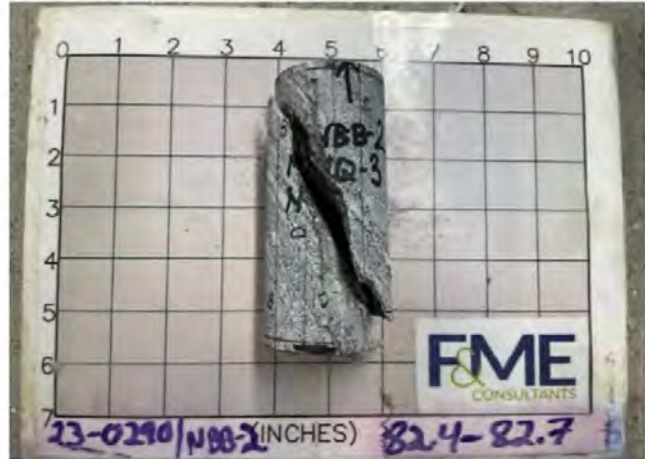
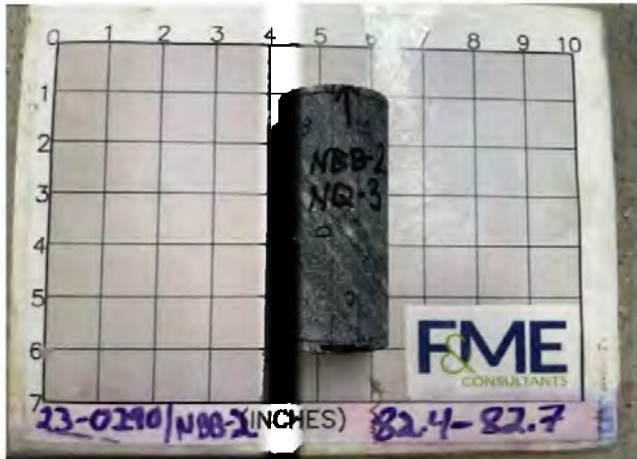


Compressive Strength and Elastic Moduli of Intact Rock Core Specimens
ASTM D7012 - Method D / SC-T-39

Project	US 123 NB RBO Georges Creek			Date	2/6/2023
Project No.	G6400.110	Sample Diameter (in.)	1.867	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.231	Reviewed By	WJG
Boring	NBB-2	Unit Weight (pcf)	167.7	Core Size	NQ
Sample No.	NQ-3 / 23-0291C	L/D Ratio	2.27	Recovery	100%
Depth	82.4' - 82.7'	Load Rate (psi/sec)	20	RQD	98%
Description	Black/White/Gray Biotite Gneiss				

Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	-771	37	3,479	1,271	3.30	0.05
20%	-1353	142	7,043	2,573	3.80	0.10
30%	-1861	252	10,614	3,877	4.17	0.14
40%	-2313	366	14,168	5,175	4.47	0.16
50%	-2733	494	17,778	6,494	4.75	0.18
60%	-3110	633	21,280	7,773	5.00	0.20
70%	-3490	815	24,888	9,091	5.21	0.23
80%	-3855	1055	28,366	10,361	5.38	0.27
90%	-4210	1407	31,838	11,630	5.52	0.33
100%	-4586	2642	35,461	12,953		

Sample Photos

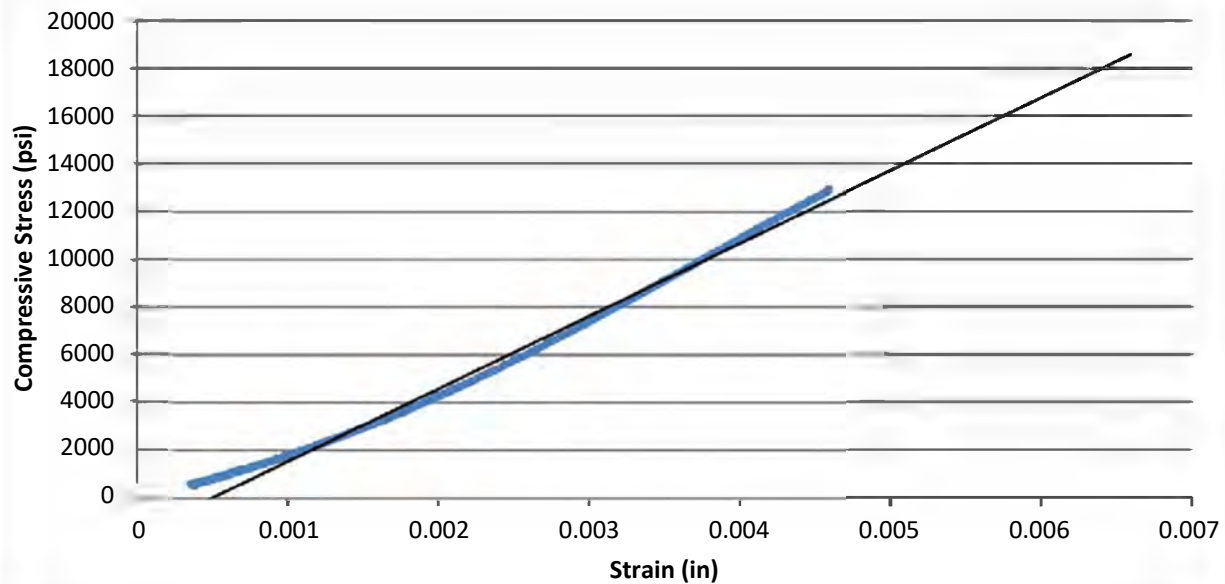


Test Results

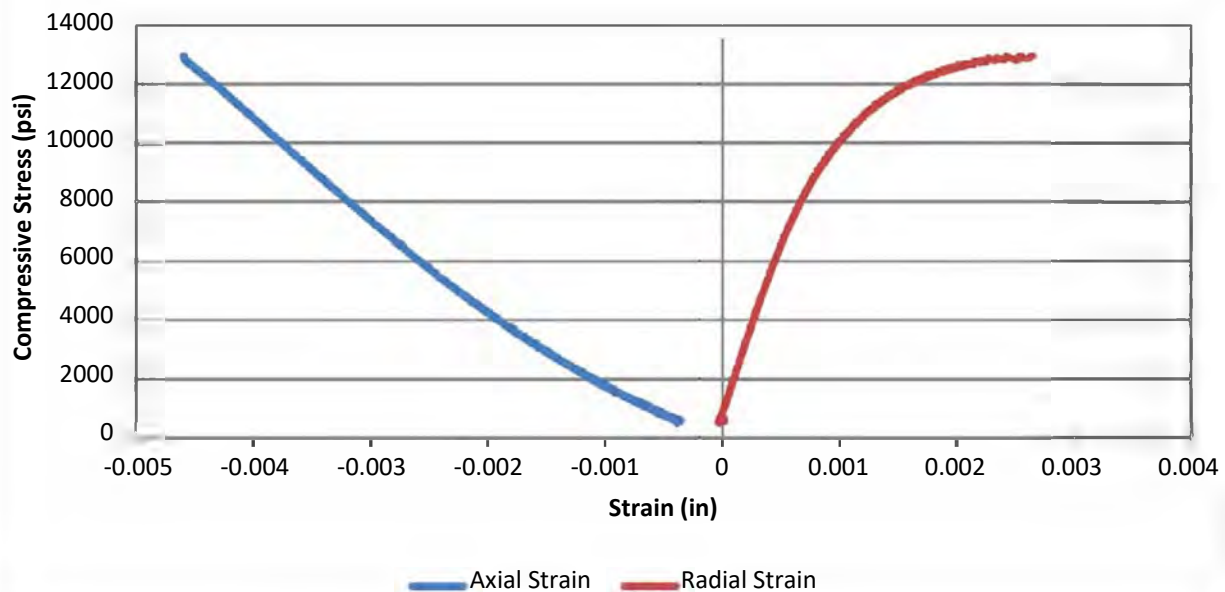
Unconfined Compressive Strength (psi)		12,950	Elastic Modulus (psi)	4.30E+06
			Poisson's Ratio in Elastic Range	0.15
Comments	Elastic range was taken as between 0.001 and 0.003 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.			

Project	US 123 NB RBO Georges Creek			Date	2/6/2023
Project No.	G6400.110	Sample Diameter (in.)	1.867	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.231	Reviewed By	WJG
Boring	NBB-2	Unit Weight (pcf)	167.7	Core Size	NQ
Sample No.	NQ-3 / 23-0291C	L/D Ratio	2.27	Recovery	100%
Depth	82.4' - 82.7'	Load Rate (psi/sec)	20	RQD	98%
Description	Black/White/Gray Biotite Gneiss				

Axial Stress vs. Strain



Stress vs. Strain

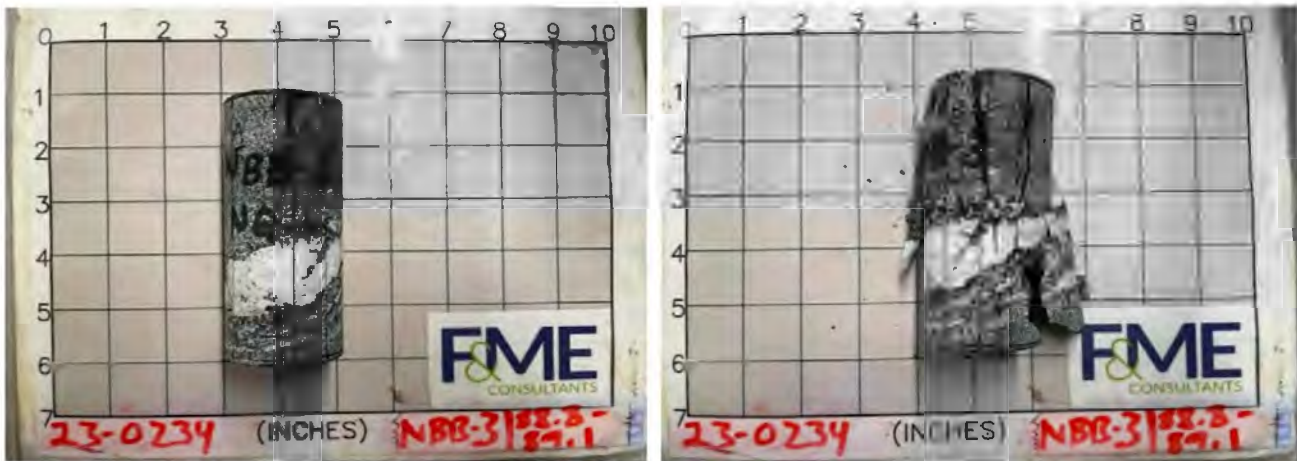


Compressive Strength and Elastic Moduli of Intact Rock Core Specimens
ASTM D7012 - Method D / SC-T-39

Project	US 123 NB RBO Georges Creek			Date	1/27/2023
Project No.	G6400.110	Sample Diameter (in.)	1.868	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.116	Reviewed By	WJG
Boring	NBB-3	Unit Weight (pcf)	179.8	Core Size	NQ
Sample No.	NQ-1 / 23-0234A	L/D Ratio	2.20	Recovery	100%
Depth	88.8' - 89.1'	Load Rate (psi/sec)	20	RQD	100%
Description	Black/White/Gray Biotite Gneiss				

Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	-949	94	2,828	1,032	2.18	0.10
20%	-1601	191	5,669	2,069	2.58	0.12
30%	-2115	289	8,435	3,078	2.91	0.14
40%	-2547	385	11,257	4,108	3.23	0.15
50%	-2940	488	14,003	5,109	3.48	0.17
60%	-3320	597	16,808	6,133	3.69	0.18
70%	-3681	713	19,608	7,155	3.89	0.19
80%	-4031	845	22,404	8,175	4.06	0.21
90%	-4369	1007	25,227	9,205	4.21	0.23
100%	-8084	1416	28,003	10,218		

Sample Photos

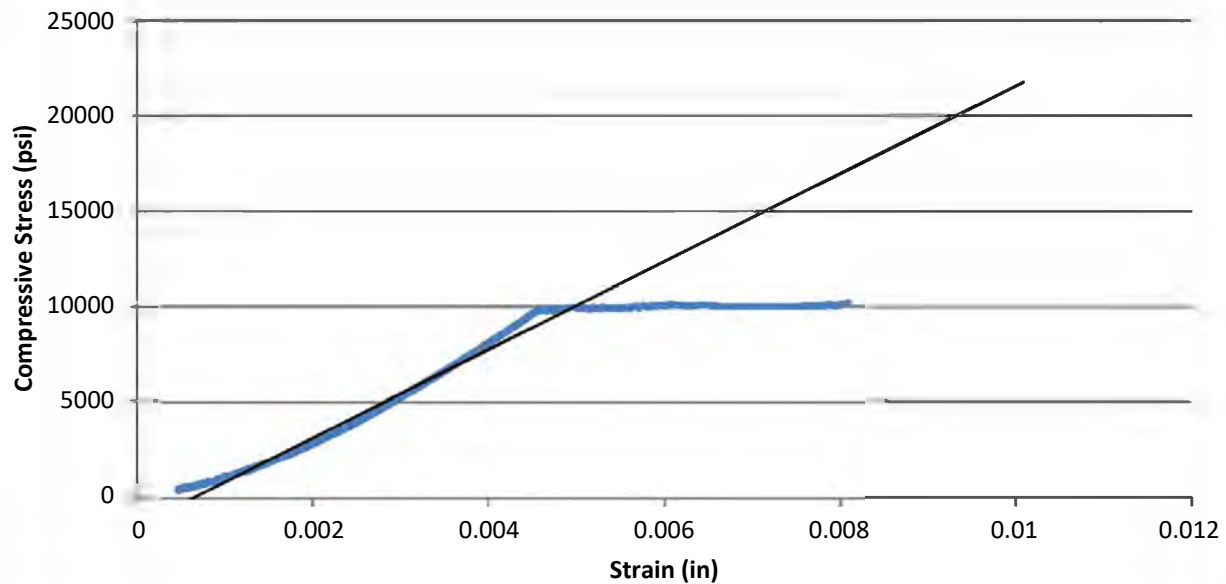


Test Results

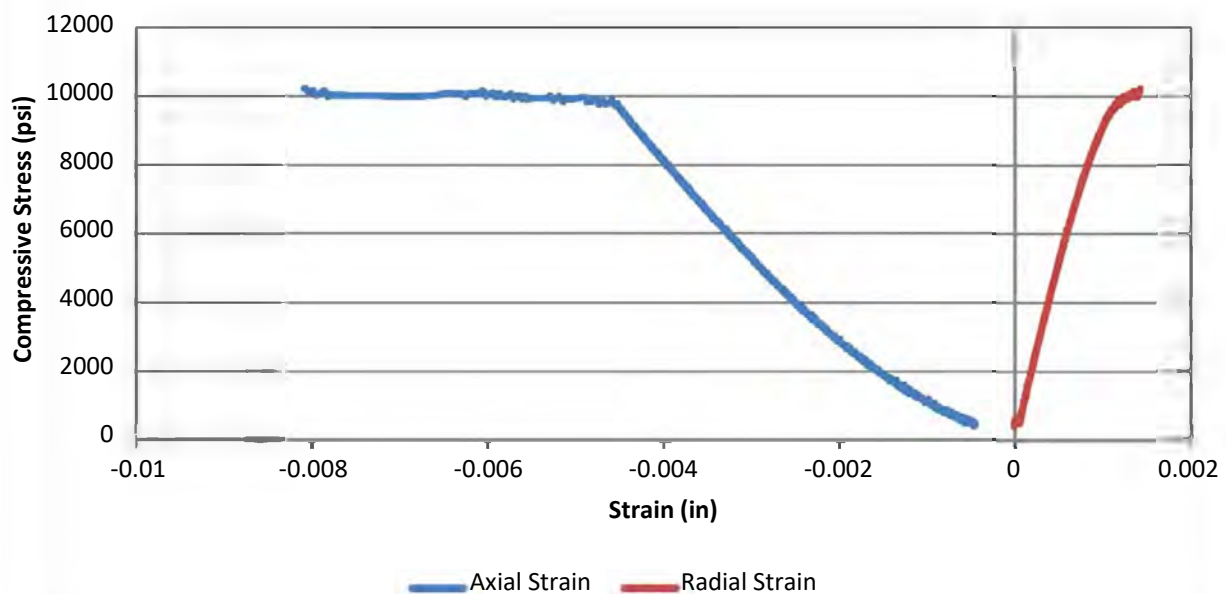
Unconfined Compressive Strength (psi)		10,220	Elastic Modulus (psi)	3.23E+06
			Poisson's Ratio in Elastic Range	0.15
Comments	Elastic range was taken as between 0.0015 and 0.0035 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.			

Project	US 123 NB RBO Georges Creek			Date	1/27/2023
Project No.	G6400.110	Sample Diameter (in.)	1.868	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.116	Reviewed By	WJG
Boring	NBB-3	Unit Weight (pcf)	179.8	Core Size	NQ
Sample No.	NQ-1 / 23-0234A	L/D Ratio	2.20	Recovery	100%
Depth	88.8' - 89.1'	Load Rate (psi/sec)	20	RQD	100%
Description	Black/White/Gray Biotite Gneiss				

Axial Stress vs. Strain



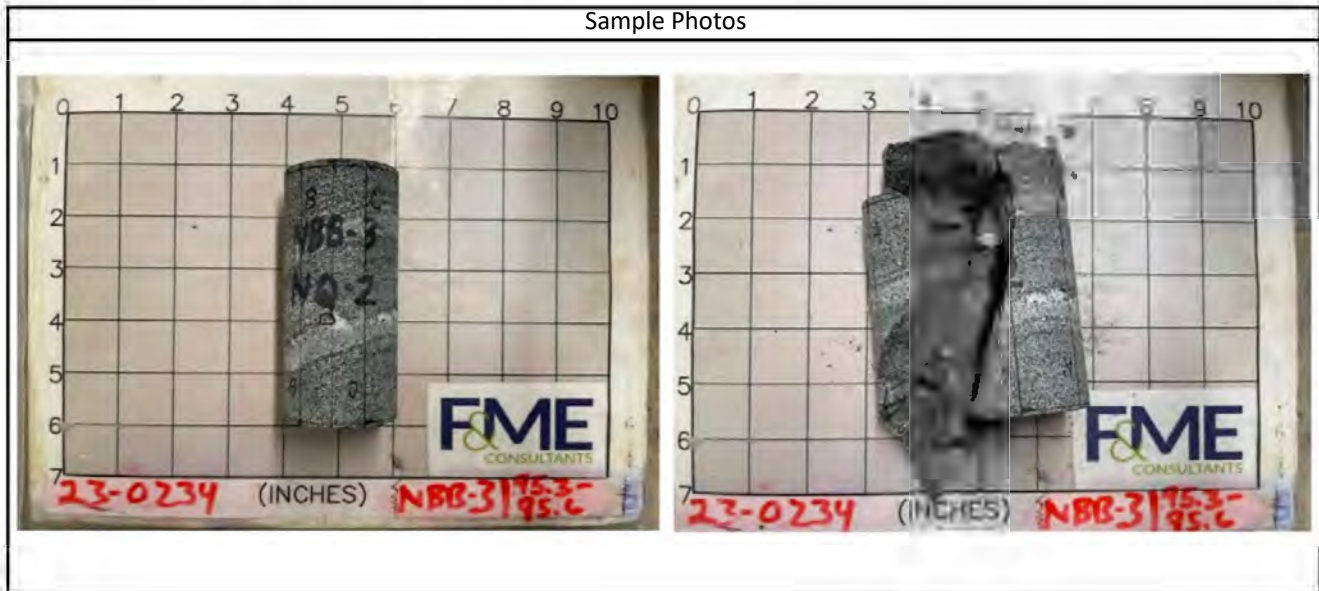
Stress vs. Strain



Compressive Strength and Elastic Moduli of Intact Rock Core Specimens
ASTM D7012 - Method D / SC-T-39

Project	US 123 NB RBO Georges Creek			Date	1/27/2023
Project No.	G6400.110	Sample Diameter (in.)	1.868	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.149	Reviewed By	WJG
Boring	NBB-3	Unit Weight (pcf)	181.8	Core Size	NQ
Sample No.	NQ-2 / 23-0234B	L/D Ratio	2.22	Recovery	100%
Depth	95.3' - 95.6'	Load Rate (psi/sec)	20	RQD	100%
Description	Black/White/Gray Biotite Gneiss				

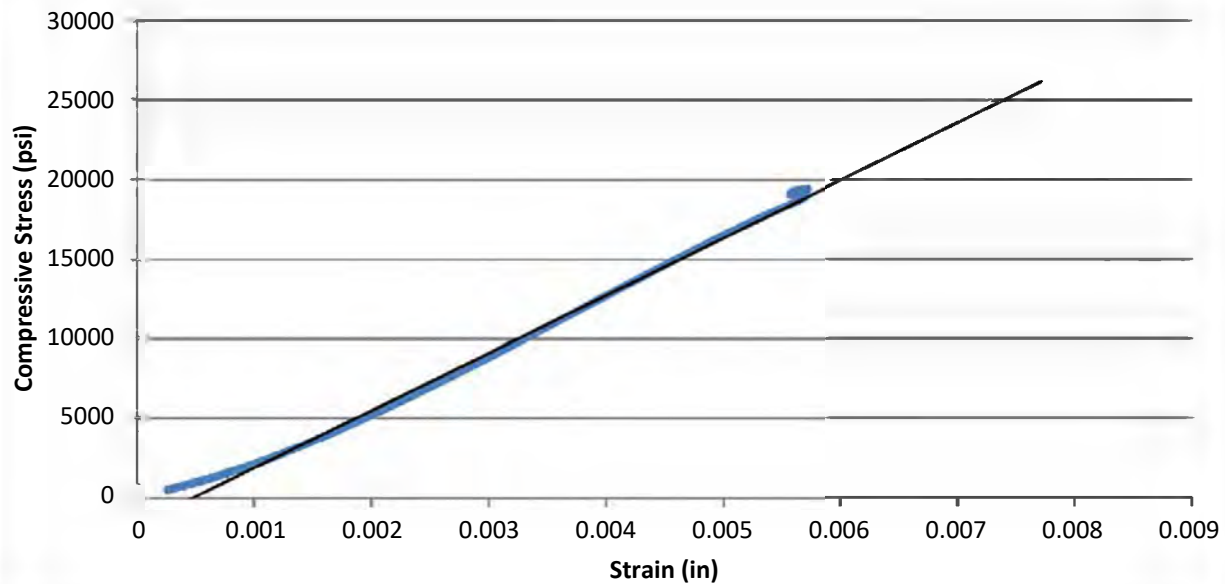
Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	-928	94	5,348	1,951	4.20	0.10
20%	-1588	173	10,635	3,880	4.89	0.11
30%	-2191	263	16,159	5,896	5.38	0.12
40%	-2721	359	21,387	7,804	5.74	0.13
50%	-3237	462	26,756	9,763	6.03	0.14
60%	-3739	578	32,036	11,690	6.25	0.15
70%	-4249	706	37,446	13,663	6.43	0.17
80%	-4746	861	42,736	15,594	6.57	0.18
90%	-5287	1055	48,079	17,543	6.64	0.20
100%	-5717	2251	53,446	19,502		



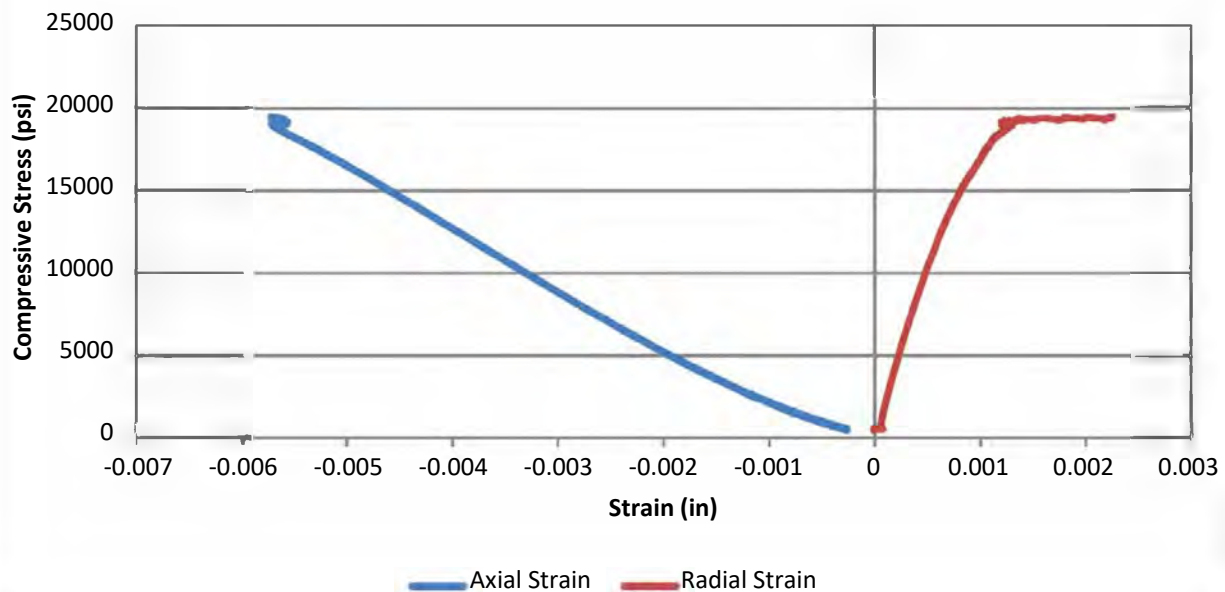
Test Results				
Unconfined Compressive Strength (psi)		19,500	Elastic Modulus (psi)	6.08E+06
			Poisson's Ratio in Elastic Range	0.15
Comments	Elastic range was taken as between 0.002 and 0.005 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.			

Project	US 123 NB RBO Georges Creek			Date	1/27/2023
Project No.	G6400.110	Sample Diameter (in.)	1.868	Tested By	WAP
SCDOT ID	P041233	Sample Length (in.)	4.149	Reviewed By	WJG
Boring	NBB-3	Unit Weight (pcf)	181.8	Core Size	NQ
Sample No.	NQ-2 / 23-0234B	L/D Ratio	2.22	Recovery	100%
Depth	95.3' - 95.6'	Load Rate (psi/sec)	20	RQD	100%
Description	Black/White/Gray Biotite Gneiss				

Axial Stress vs. Strain



Stress vs. Strain



US 123 NB over Georges Creek
Geotechnical Subsurface Data Report

APPENDICES

**APPENDIX D SPT HAMMER ENERGY
CALIBRATION REPORT**



**CAROLINAS
GEOTECHNICAL
GROUP**

Report of SPT Hammer Energy

Prepared for:
Breccia Construction, LLC
620-B Industrial Way
Chester, South Carolina 29706

March 23, 2022





2400 Crownpoint Executive Drive
Suite 800
Charlotte, NC 28227



(980) 339-8684



contact@carolinasgeotech.com



www.carolinasgeotech.com

March 23, 2022

Mr. Jarod S. Ford
Breccia Construction, LLC
620-B Industrial Way
Chester, South Carolina 29706

SUBJECT: **Report of SPT Hammer Energy**
Breccia Construction, LLC CME 550X ATV Rig (SN 269553)
Chester, South Carolina
CG2 Project No.: 240021095

Dear Mr. Ford:

Carolinas Geotechnical Group, PLLC (CG2) has completed the Standard Penetration Test (SPT) energy measurements on the automatic hammer mounted on a Breccia Construction, LLC (Breccia) CME 550X ATV-mounted drill rig with a serial number of 269553, see attached Drill Rig Photo Log. This service was performed by Mr. Robert E. Kral, PE on March 11, 2022. SPT energy testing was performed in general accordance with ASTM D4633 and the most recent revision of the North Carolina Department of Transportation (NCDOT), Geotechnical Engineering Unit's requirements. The testing procedures, equipment used during testing, and detailed results are presented in this report.

CG2 recommends Breccia submit this Report of SPT Hammer Energy to the NCDOT Geotechnical Engineering Unit for review and approval no later than April 8, 2022.

DYNAMIC TESTING METHODOLOGY

Testing was performed using a model SPT (Serial No. 4549 TB) Pile Driving Analyzer™ (PDA) manufactured by Pile Dynamics, Inc. The PDA was used to record and interpret data from two piezoresistive accelerometers (Serial Nos. K11957 and K10959) bolted to a 2-foot long AWJ drill rod (SN 528AWJ) internally instrumented with two strain transducers. The instrumented AWJ drill rod has a cross-sectional area of 1.19 square inches, an outside diameter of approximately 1.75 inches, and an inside diameter of 1.25 inches at the gauge location. The accelerometers and strain gauges, which are mounted on opposing axis near the middle of the instrumented rod, monitor acceleration and strain for each hammer blow. The analyzer converts the data to velocities and forces and computes the maximum transferred hammer energies with the "EFV" method described in ASTM D4633. Preliminary results are recorded and displayed in real-time for each blow. Calibration sheets for the PDA, accelerometers, and the instrumented rod are included in the Appendix III.

Report of SPT Hammer Energy
 Chester, South Carolina
 CG2 Project No.: 240021095

TESTING AND OBSERVATIONS

CG2 personnel was on site March 11, 2022 to observe and perform high-strain dynamic testing during SPT sampling on the CME 550X ATV-mounted drill rig operated by J. Phillips of Breccia. The measurements were taken during drilling operations at 1817 Lowrys Highway in Chester, South Carolina (Chester County). The approximate coordinates (not professionally surveyed) for the test location are 34.770590, -81.245583. No Soil Test Boring Log was maintained. SPT energy measurements were recorded during three intervals at depths of approximately 28½, 33½, and 38½ feet below the existing ground surface. The information presented in the table below summarizes the equipment tested and tooling used during the SPT energy measurements.

Table 1: SPT Field Data

Drill Rig Information	
Manufacturer	CME
Model	550X
Serial Number	269553
Operator	J. Phillips
Carrier	ATV
Hammer Information	
Model / Type	CME / Auto
Serial Number	269553
Anvil Height (inches)	11.5
Anvil Diameter (inches)	2.5
Drop Height (inches)	30
Ram Weight (pounds)	140
Ram Serial Number	N/A
Drilling and Instrumented Rod Information	
Drill Rod Type	AWJ
OD (inches)	1.75
ID (inches)	1.25
Cross-Sectional Area (in ²)	1.19
Typical Lengths (feet)	5
Instrumented Rod Type	AWJ (SN 528)
OD (inches)	1.75
ID (inches)	1.25
Cross-Sectional Area (in ²)	1.19
Total Instrumented Rod Length (feet)	2.00
Length Below Gages (feet)	0.70
Split-Spoon Length (feet)	2.85

Report of SPT Hammer Energy
Chester, South Carolina
CG2 Project No.: 240021095

DYNAMIC TESTING RESULTS

The total rod length from the instrumentation to the tip of the split-spoon sampler was determined by adding 3.6 feet to the required drill rod length at each sample depth. Based on the test data, the automatic hammer on the CME 550X ATV-mounted drill rig operated at a rate of about 45.9 to 57.8 blows per minute (BPM) during dynamic testing. The measured transferred hammer energy (EFV) ranged from 279.8 to 331.3 foot-pounds, which corresponds to Energy Transfer Ratio (ETR) values of 79.9 to 94.7%, respectively.

The SPT Energy Measurement Data Summary tables in the Appendix present the test data from every hammer blow at each sampling interval along with representative force and velocity traces for each test interval. The reported blow counts, obtained by the drill rig personnel, and a summary of the test data and average computed hammer energy and transfer ratio values are provided in Table 2. Plots and tables of the following are also included in the Appendix and present the test data with depth for each test interval:

- Penetration vs. BLC
- Penetration vs. CSX
- Average ETR vs. Rod Length
- Penetration vs. FMX
- Penetration vs. VMX
- ETR vs. Rod Length
- Penetration vs. EFV
- Penetration vs. ETR

Table 2: Summary of Dynamic Testing Results

Data Set ID	Sample Depth (ft)	Drill Rod Length (ft)	Instrumentation to Sampler Tip Length (ft)	Blows per 6" Increment / N-value	Soil Sample Description (Piedmont Residual)	Avg. BPM	Avg. EFV (ft-lbs)	Avg. ETR (%)
1	28½ - 30	30	33.6	3-6-8 / 14	SA SILT	51.3	290.2	82.9
2	33½ - 35	35	38.6	6-9-12 / 21	SA SILT	54.7	297.2	84.9
3	38½ - 40	40	43.6	4-7-9 / 16	SA SILT	54.2	305.8	87.4
Overall Average						53.6	298.0	85.1

The average hammer rate, transferred energy, and transfer ratio were calculated for each depth interval. Per ASTM D4633, only the blows from the final foot of each sample interval (i.e., the blows that determine the N-value) were included when computing the average values shown in Table 2. The overall average transferred hammer energy for the automatic hammer on the CME 550X ATV-mounted drill rig (for all the depth intervals tested) was 298.0 foot-pounds, with an average ETR of 85.1%.

Report of SPT Hammer Energy
Chester, South Carolina
CG2 Project No.: 240021095

LIMITATIONS OF REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The information contained in this report were based on the applicable standards of our profession in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

CLOSING

CG2 is pleased to have the opportunity to provide these services to you. If you have questions concerning the content of this report, or if CG2 can be of further service, please contact CG2 at (980) 339-8684.

Sincerely,
Carolinas Geotechnical Group, PLLC

DocuSigned by:
D. Matthew Brewer
386129CCA4C1462..
D. Matthew Brewer, PE
Senior Project Engineer

DocuSigned by:
Robert E. Kral
8AD703B2A8484F4..
Robert E. Kral, PE
Senior Project Engineer
NC Registration No. 042642



Appendices:

- Appendix I - CME 550X ATV Rig (SN 269553) SPT Energy Measurements Summary Plots and Tables
- Appendix II - SPT Hammer Energy Field Form (Field Log) and Drill Rig Photo Log
- Appendix III - Instrumented Rod and Accelerometer Calibration Sheets
- Appendix IV - Certificate of Proficiency



APPENDIX I

CME 550X (SN 269553)

B-3

REK

Interval start: 3/11/2022

B-3

AR: 1.19 in²

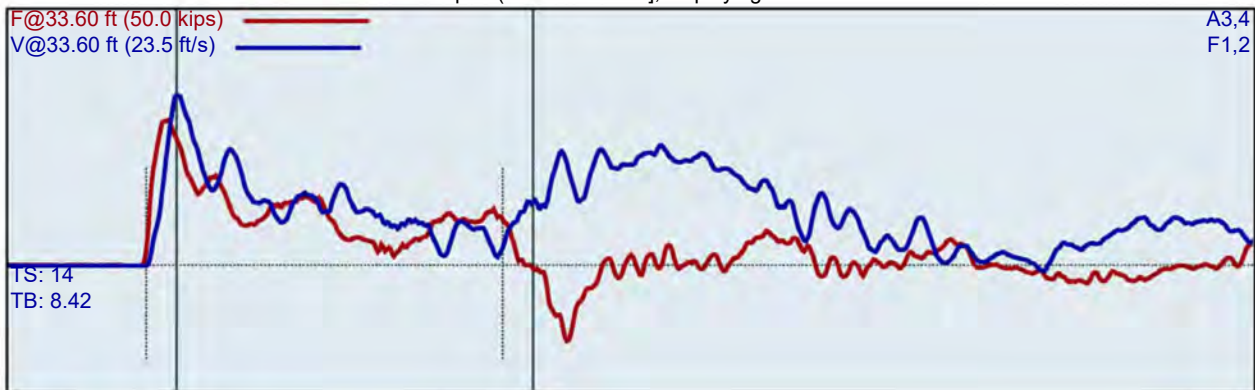
SP: 0.492 k/ft³

LE: 33.60 ft

EM: 30000 ksi

WS: 16807.9 ft/s

Depth: (28.50 - 30.00 ft), displaying BN: 15



F1 : [528AWJ1] 205.26 PDICAL (1) FF1
F2 : [528AWJ2] 205.86 PDICAL (1) FF1

A3 (PR): [K11957] 407.045 mv/6.4v/5000g (1) VF1
A4 (PR): [K10959] 417.27 mv/6.4v/5000g (1) VF1

BPM: Blows/Minute

CSX: Compression Stress Maximum

FMX: Maximum Force

DFN: Final Displacement

VMX: Maximum Velocity

EFV: Maximum Energy

DMX: Maximum Displacement

ETR: Energy Transfer Ratio - Rated

LP	BL#	BC	BPM	FMX	VMX	DMX	CSX	DFN	EFV	ETR
ft		/6"	bpm	kips	ft/s	in	ksi	in	ft-lb	%
28.67	1	3	1.9	25.7	14.4	2.5	21.6	2.0	264.5	75.6
28.83	2	3	47.5	24.8	16.2	2.0	20.8	2.0	281.4	80.4
29.00	3	3	49.5	26.0	16.2	2.0	21.9	2.0	298.2	85.2
29.08	4	6	50.5	26.4	16.3	1.4	22.1	1.0	290.1	82.9
29.17	5	6	51.0	26.9	15.5	1.3	22.6	1.0	284.1	81.2
29.25	6	6	50.7	27.9	15.8	1.3	23.4	1.0	293.0	83.7
29.33	7	6	50.8	28.4	15.6	1.2	23.9	1.0	297.8	85.1
29.42	8	6	51.3	27.3	14.8	1.1	23.0	1.0	280.4	80.1
29.50	9	6	51.0	27.5	15.0	1.1	23.1	1.0	279.8	79.9
29.56	10	8	51.5	28.0	15.5	1.1	23.5	0.7	295.9	84.5
29.63	11	8	51.3	27.8	15.2	1.0	23.4	0.7	294.2	84.1
29.69	12	8	51.6	27.6	15.5	0.9	23.2	0.7	291.7	83.3
29.75	13	8	51.5	27.9	15.4	0.9	23.5	0.7	287.1	82.0
29.81	14	8	51.5	28.0	15.3	0.9	23.6	0.7	293.1	83.7
29.88	15	8	51.9	28.1	15.5	0.8	23.6	0.7	286.8	81.9
29.94	16	8	51.2	28.0	15.0	0.8	23.5	0.7	291.8	83.4
30.00	17	8	51.9	26.9	16.8	0.8	22.6	0.7	297.1	84.9
Average			51.3	27.6	15.5	1.1	23.2	0.9	290.2	82.9
Std Dev			0.4	0.6	0.5	0.2	0.5	0.1	5.6	1.6
Maximum			51.9	28.4	16.8	1.4	23.9	1.0	297.8	85.1
Minimum			50.5	26.4	14.8	0.8	22.1	0.7	279.8	79.9

N-value: 14

Sample Interval Time: 18.86 seconds.

CME 550X (SN 269553)

B-3

REK

Interval start: 3/11/2022

B-3

AR: 1.19 in²

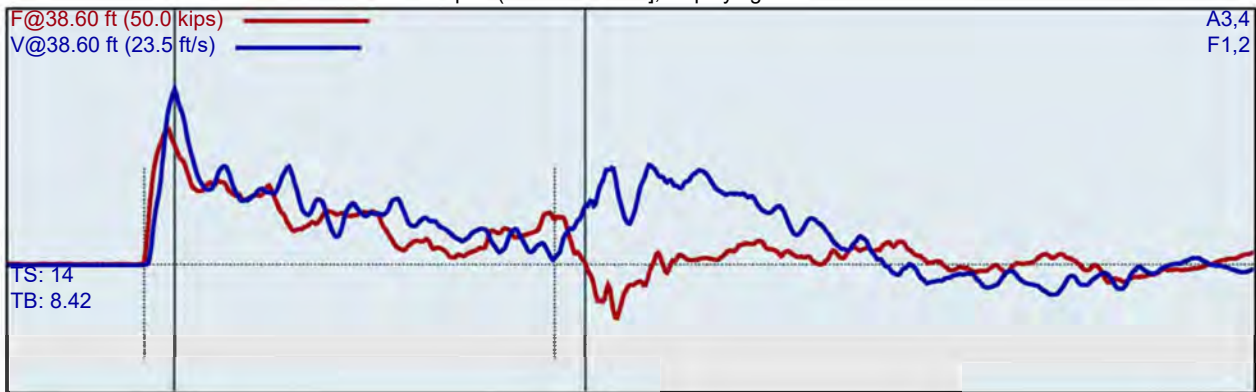
SP: 0.492 k/ft³

LE: 38.60 ft

EM: 30000 ksi

WS: 16807.9 ft/s

Depth: (33.50 - 35.00 ft), displaying BN: 25



F1 : [528AWJ1] 205.26 PDICAL (1) FF1

A3 (PR): [K11957] 407.045 mv/6.4v/5000g (1) VF1

F2 : [528AWJ2] 205.86 PDICAL (1) FF1

A4 (PR): [K10959] 417.27 mv/6.4v/5000g (1) VF1

LP ft	BL#	BC /6"	BPM bpm	FMX kips	VMX ft/s	DMX in	CSX ksi	DFN in	EFV ft-lb	ETR %
33.58	1	6	1.9	25.0	14.5	1.1	21.0	1.0	247.7	70.8
33.67	2	6	39.8	25.6	15.7	1.1	21.5	1.0	271.2	77.5
33.75	3	6	41.0	26.0	16.1	1.1	21.9	1.0	283.4	81.0
33.83	4	6	52.7	26.6	16.3	1.1	22.3	1.0	297.4	85.0
33.92	5	6	54.0	26.7	17.1	1.0	22.4	1.0	297.0	84.9
34.00	6	6	54.3	26.3	16.1	1.0	22.1	1.0	301.2	86.1
34.06	7	9	54.5	27.3	16.8	0.8	22.9	0.7	299.2	85.5
34.11	8	9	54.3	26.1	15.7	0.8	21.9	0.7	287.4	82.1
34.17	9	9	54.7	26.5	16.0	0.7	22.3	0.7	293.1	83.8
34.22	10	9	54.2	26.6	15.9	0.7	22.3	0.7	297.6	85.0
34.28	11	9	55.1	26.1	16.1	0.7	22.0	0.7	288.5	82.4
34.33	12	9	54.4	26.3	16.3	0.7	22.1	0.7	296.7	84.8
34.39	13	9	54.9	26.9	16.2	0.7	22.6	0.7	295.1	84.3
34.44	14	9	54.5	26.8	15.8	0.7	22.5	0.7	298.5	85.3
34.50	15	9	54.8	26.6	16.1	0.7	22.3	0.7	296.0	84.6
34.54	16	12	54.9	26.0	16.3	0.6	21.9	0.5	293.7	83.9
34.58	17	12	54.4	26.3	16.1	0.6	22.1	0.5	296.7	84.8
34.63	18	12	54.8	26.2	16.1	0.6	22.0	0.5	296.1	84.6
34.67	19	12	54.5	26.2	15.8	0.5	22.0	0.5	298.4	85.3
34.71	20	12	54.9	27.2	16.9	0.5	22.8	0.5	306.1	87.4
34.75	21	12	54.4	26.2	15.6	0.5	22.0	0.5	297.9	85.1
34.79	22	12	54.9	26.2	16.3	0.5	22.0	0.5	296.4	84.7
34.83	23	12	54.5	26.3	17.0	0.5	22.1	0.5	304.0	86.9
34.88	24	12	54.8	26.4	16.9	0.5	22.2	0.5	305.0	87.1
34.92	25	12	54.8	26.5	16.1	0.5	22.3	0.5	301.4	86.1
34.96	26	12	54.8	26.3	16.4	0.5	22.1	0.5	298.2	85.2
35.00	27	12	55.1	26.5	16.1	0.5	22.2	0.5	296.2	84.6

Average	54.7	26.4	16.2	0.6	22.2	0.6	297.2	84.9
Std Dev	0.3	0.3	0.4	0.1	0.3	0.1	4.5	1.3
Maximum	55.1	27.3	17.0	0.8	22.9	0.7	306.1	87.4
Minimum	54.2	26.0	15.6	0.5	21.9	0.5	287.4	82.1

N-value: 21

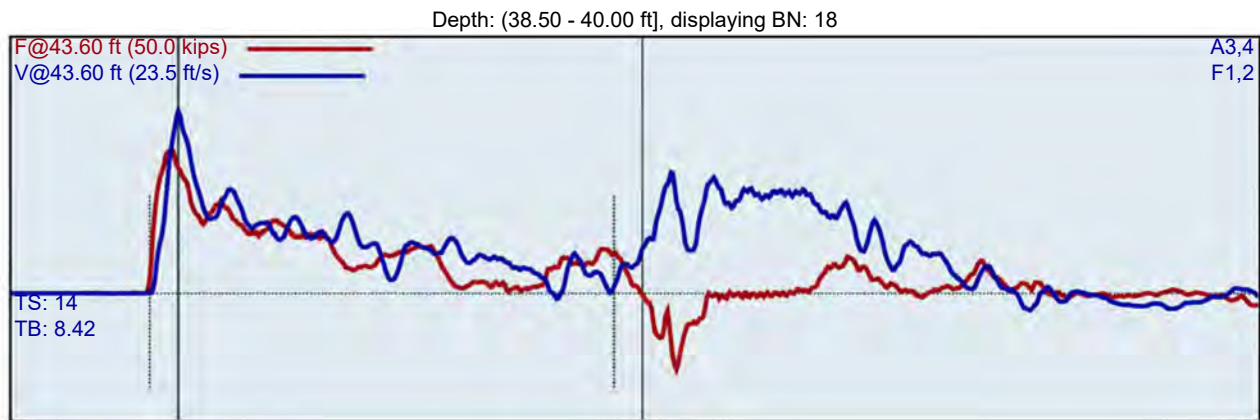
Sample Interval Time: 29.35 seconds.

CME 550X (SN 269553)
REK
B-3

B-3
Interval start: 3/11/2022

AR: 1.19 in²
LE: 43.60 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft³
EM: 30000 ksi



F1 : [528AWJ1] 205.26 PDICAL (1) FF1
F2 : [528AWJ2] 205.86 PDICAL (1) FF1

A3 (PR): [K11957] 407.045 mv/6.4v/5000g (1) VF1
A4 (PR): [K10959] 417.27 mv/6.4v/5000g (1) VF1

LP ft	BL#	BC /6"	BPM bpm	FMX kips	VMX ft/s	DMX in	CSX ksi	DFN in	EFV ft-lb	ETR %
38.63	1	4	1.9	26.1	15.0	1.8	22.0	1.5	274.0	78.3
38.75	2	4	44.8	27.0	15.6	1.7	22.7	1.5	284.1	81.2
38.88	3	4	45.1	27.5	16.5	1.5	23.1	1.5	297.6	85.0
39.00	4	4	45.9	26.3	15.7	1.5	22.1	1.5	294.9	84.3
39.07	5	7	46.0	26.6	15.6	1.1	22.4	0.9	290.1	82.9
39.14	6	7	45.9	26.4	15.6	1.1	22.2	0.9	292.0	83.4
39.21	7	7	46.1	26.4	15.6	1.0	22.2	0.9	289.5	82.7
39.29	8	7	46.0	26.5	15.7	1.0	22.3	0.9	286.2	81.8
39.36	9	7	52.5	27.6	16.5	1.2	23.2	0.9	331.3	94.7
39.43	10	7	57.3	28.2	16.5	1.2	23.7	0.9	316.0	90.3
39.50	11	7	57.8	27.7	16.8	1.1	23.3	0.9	314.8	90.0
39.56	12	9	57.0	27.9	16.0	1.0	23.4	0.7	323.0	92.3
39.61	13	9	57.7	27.5	15.6	1.0	23.1	0.7	310.1	88.6
39.67	14	9	57.4	28.0	16.2	0.9	23.5	0.7	303.8	86.8
39.72	15	9	57.3	28.5	16.7	0.9	24.0	0.7	306.8	87.7
39.78	16	9	57.3	27.7	16.5	0.7	23.3	0.7	303.9	86.8
39.83	17	9	57.0	28.1	16.6	0.8	23.6	0.7	308.5	88.2
39.89	18	9	57.6	27.6	16.6	0.7	23.2	0.7	303.2	86.6
39.94	19	9	56.7	27.9	17.0	0.8	23.5	0.7	308.7	88.2
40.00	20	9	57.5	27.7	17.0	0.7	23.3	0.7	304.2	86.9
Average			54.2	27.5	16.3	1.0	23.1	0.7	305.8	87.4
Std Dev			4.9	0.6	0.5	0.2	0.5	0.1	11.9	3.4
Maximum			57.8	28.5	17.0	1.2	24.0	0.9	331.3	94.7
Minimum			45.9	26.4	15.6	0.7	22.2	0.7	286.2	81.8

N-value: 16

Sample Interval Time: 21.86 seconds.

Summary of SPT Test Results

Project: CME 550X (SN 269553), Test Date: 3/11/2022

BPM: Blows/Minute

FMX: Maximum Force

VMX: Maximum Velocity

DMX: Maximum Displacement

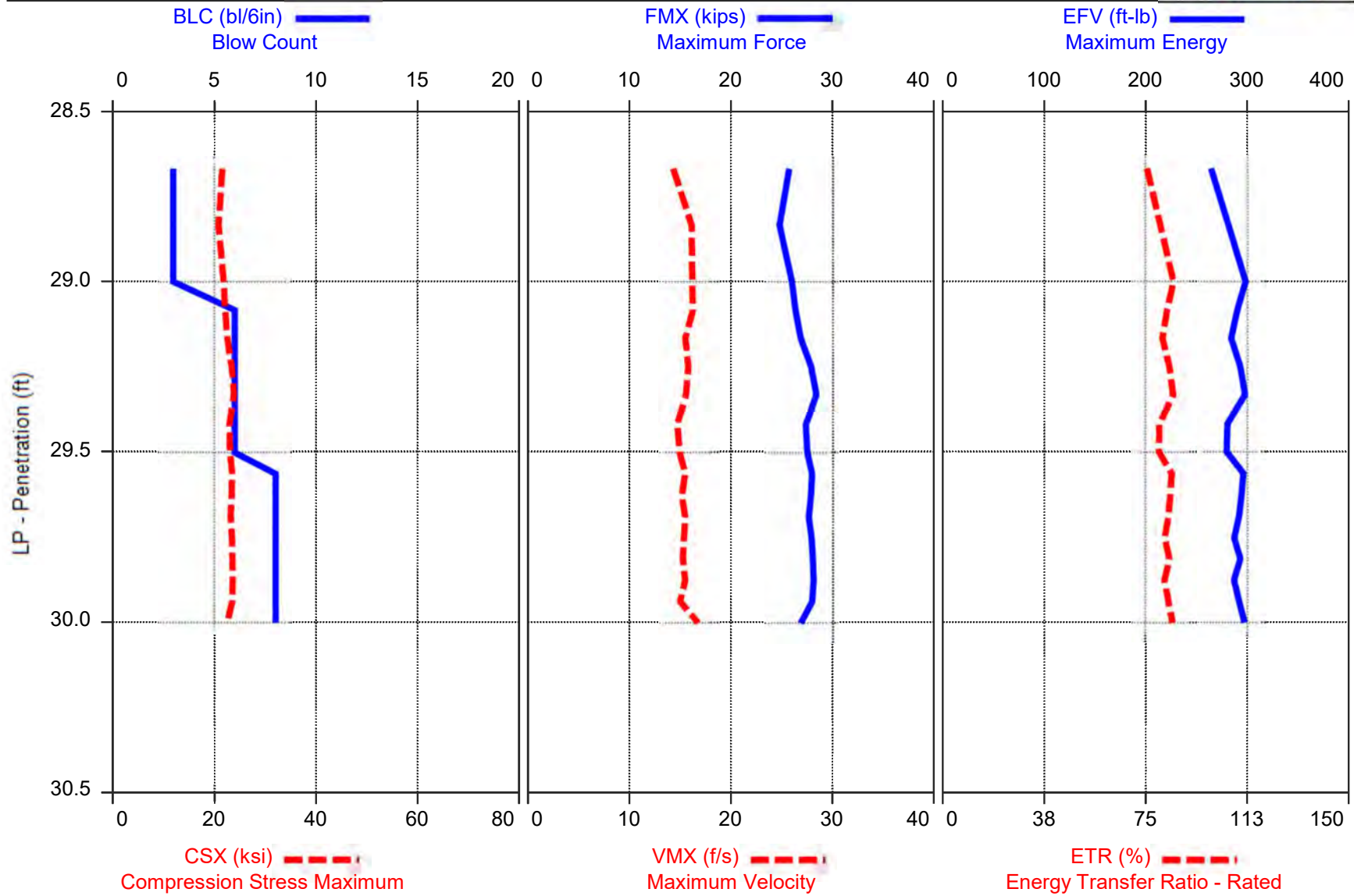
CSX: Compression Stress Maximum

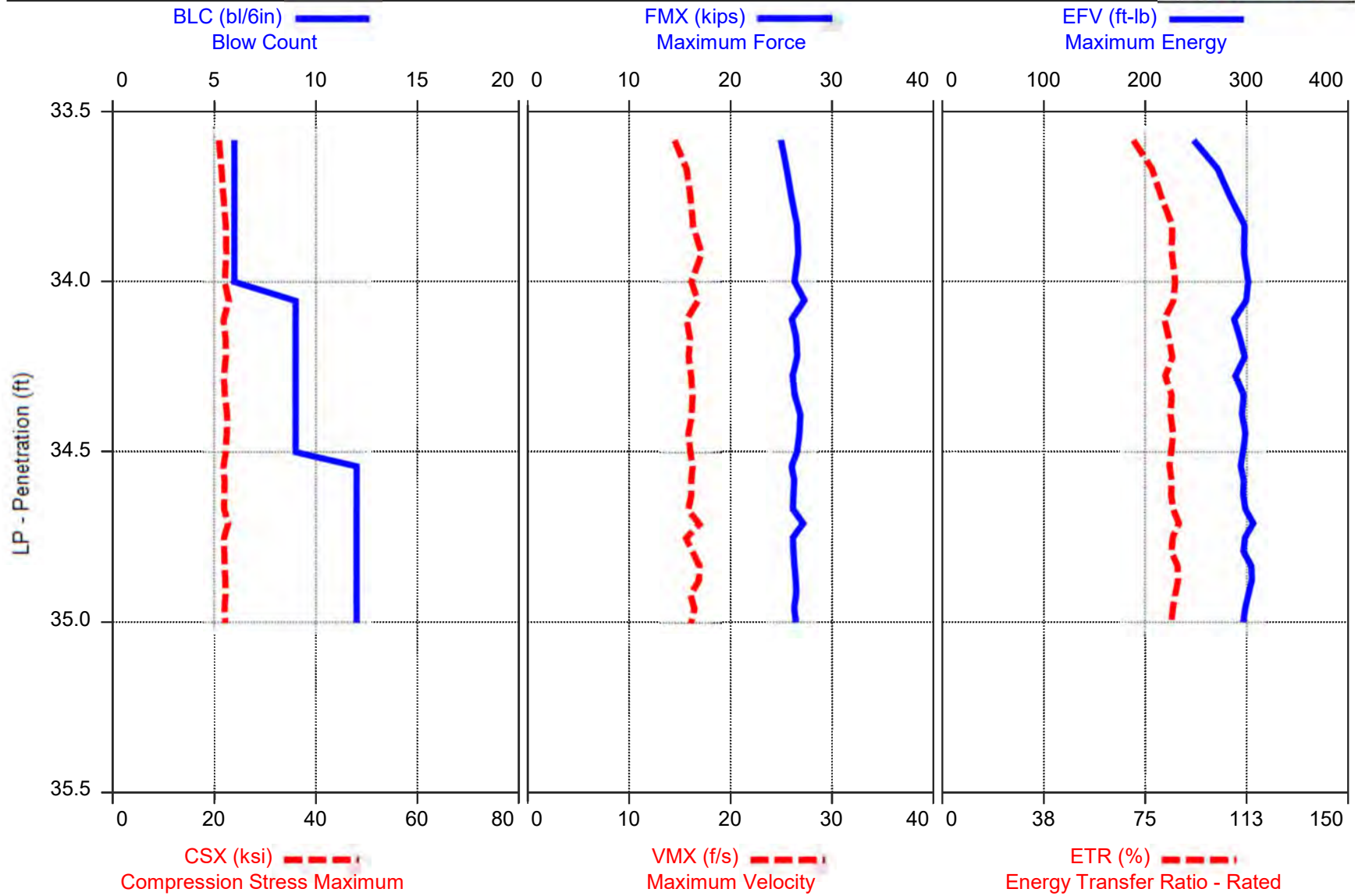
DFN: Final Displacement

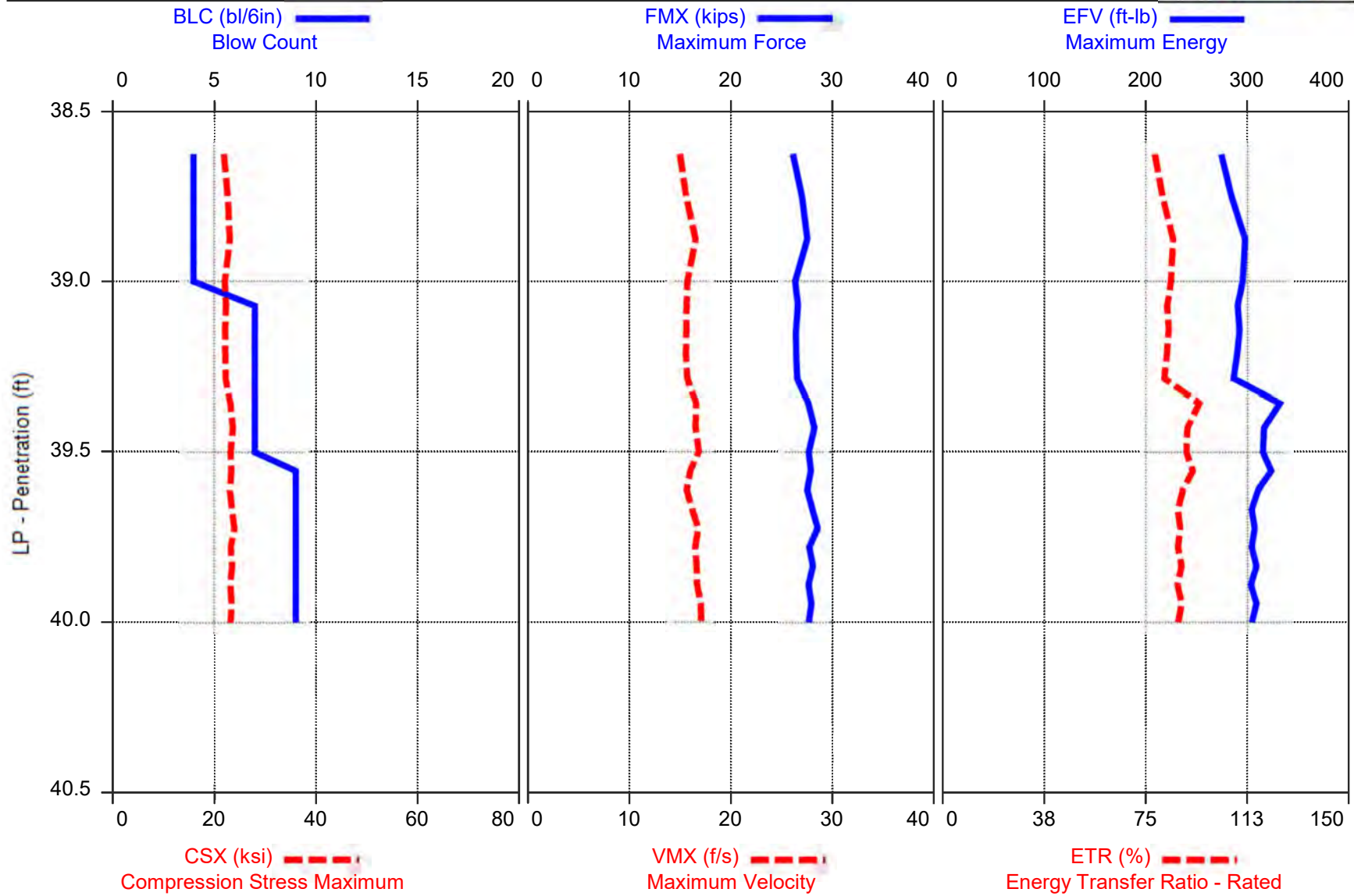
EFV: Maximum Energy

ETR: Energy Transfer Ratio - Rated

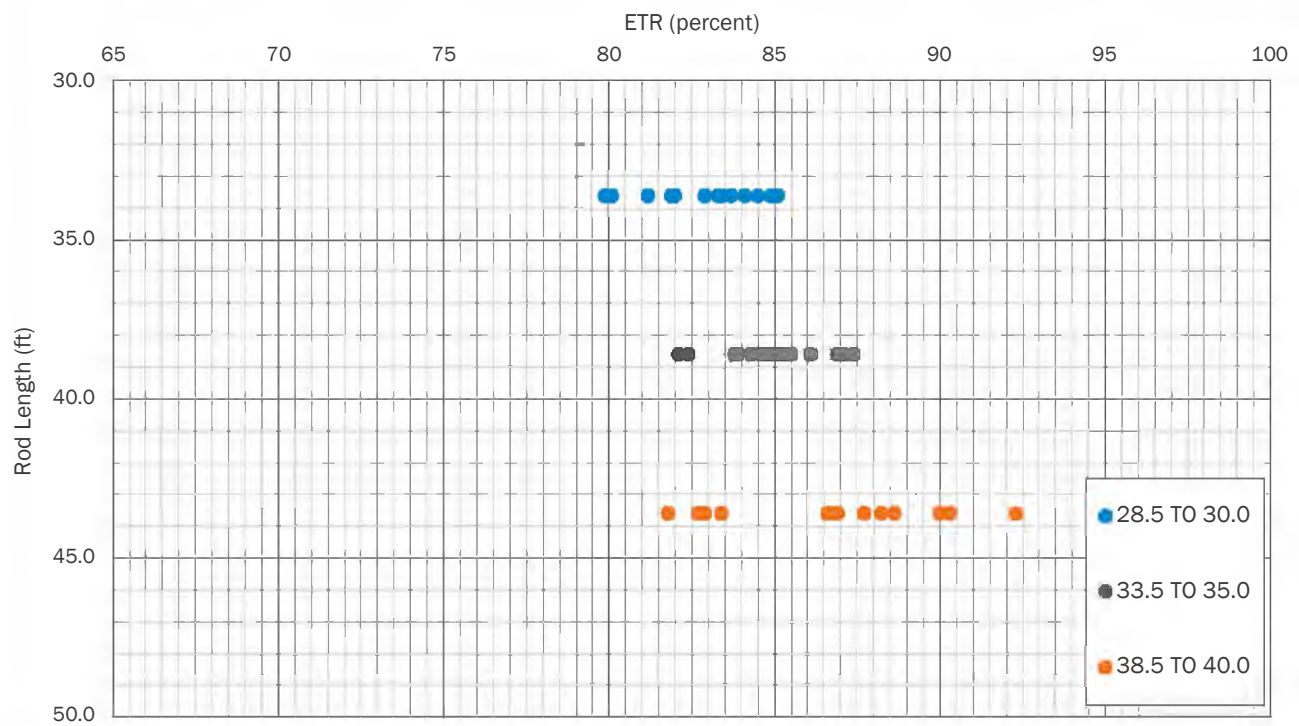
Instr. Length ft	Start Depth ft	Final Depth ft	Blows Applied /6"	N Value	N60 Value	Average BPM bpm	Average FMX kips	Average VMX ft/s	Average DMX in	Average CSX ksi	Average DFN in	Average EFV ft-lb	Average ETR %
33.60	28.50	30.00	3-6-8	14	19	51.3	27.6	15.5	1.1	23.2	0.9	290.2	82.9
38.60	33.50	35.00	6-9-12	21	29	54.7	26.4	16.2	0.6	22.2	0.6	297.2	84.9
43.60	38.50	40.00	4-7-9	16	22	54.2	27.5	16.3	1.0	23.1	0.7	305.8	87.4
Overall Average Values:						53.6	27.1	16.0	0.8	22.8	0.7	298.0	85.1
Standard Deviation:						3.1	0.8	0.6	0.3	0.6	0.2	9.9	2.8
Overall Maximum Value:						57.8	28.5	17.0	1.4	24.0	1.0	331.3	94.7
Overall Minimum Value:						45.9	26.0	14.8	0.5	21.9	0.5	279.8	79.9



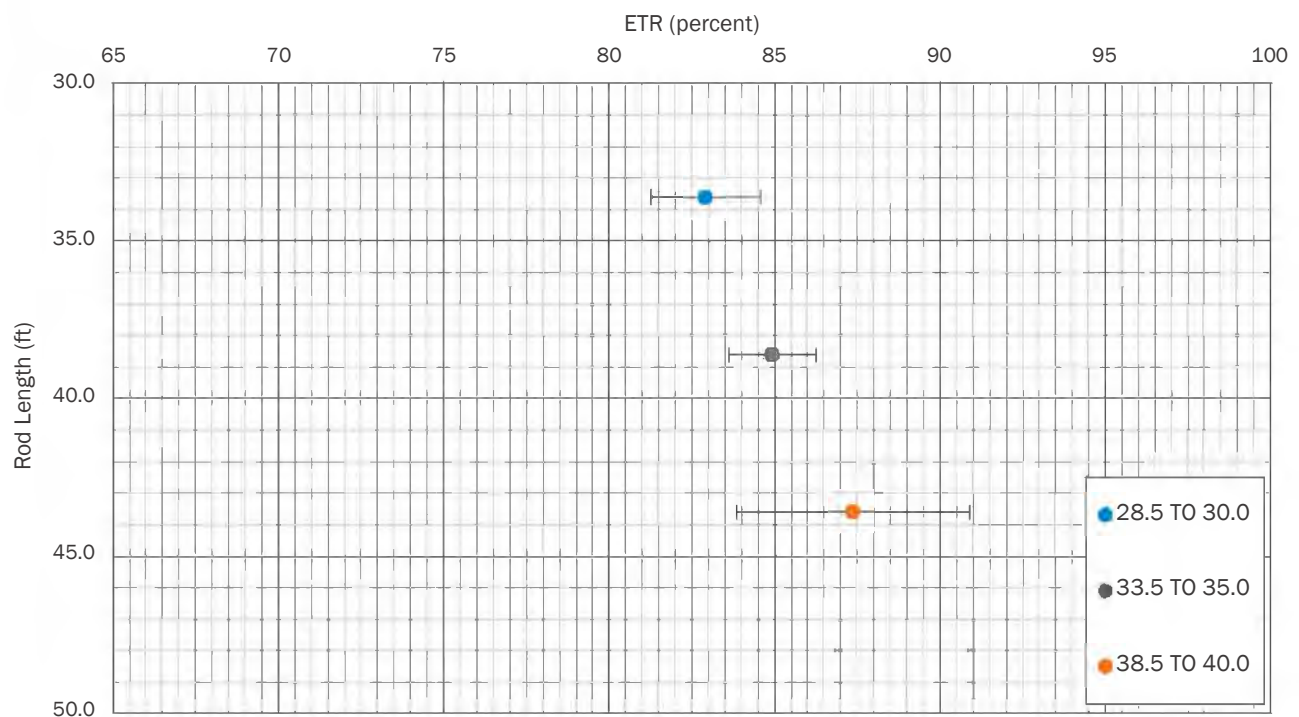




**ETR versus Rod Length
CME 550X ATV (SN 269553)**



**Average ETR versus Rod Length \pm 1 Standard Deviation
CME 550X ATV (SN 269553)**



APPENDIX II

SPT Hammer Energy Field Form

Project: SPT HAMMER ENERGY
Project No.: 240021095
Boring No.: B-3

Date: 3/11/2022
Weather: 50's CLOUDY
Drill Rod Type: AWJ

On-site Personnel

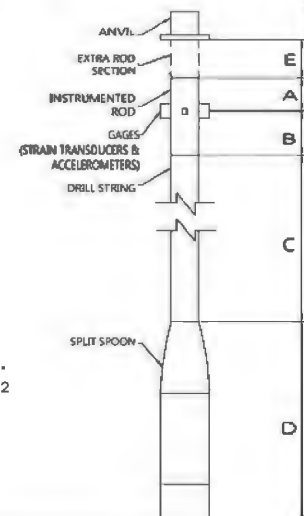
Drilling Company: BRECCIA CONSTRUCTION, LLC
 Rig Operator: J. PHILLIPS
 Engr/Geologist: N/A
 Client Rep.: N/A
 Analyzer Oper.: R. KRAL

Rig/Hammer Info

Drill Rig Make/Model: CME 550X
 Carrier Type: ATV
 Rig Serial No.: 269553 (DR-3)
 Hammer Type/Model: CME
 Hammer Serial No.: N/A
 Hammer Drop System: AUTO
 Lubrication Condition: PER MANUFACTURER
 Manufacturer Recommended
 Operation Rate (bpm): 55
 Drop Height (in.): 30
 Hammer Weight (lbs): 140
 Anvil Dimension (in.): 11.5
 Drilling Method: 2.25 HSA

Rod Info

(A + E) Impact Surface
 to Gages Length: 1.36 ft
(B) Instr. Rod Length
 below Gages: 0.70 ft
(A) + (B) Instr. Rod Length: 2.00 ft
(D) Spoon Length: 2.85 ft
(E) Rod Length Above
 Instr. Rod (if applicable): 0.06 ft
 Instr. Rod S/N: 528AWJ
 Instr. Rod Outside Dia.: 1.75 in.
 Instr. Rod Area: 1.19 in²
 PDA Make/Model: SPT
 PDA Serial No.: 4549 TB
 Calib. Pulse Test (y/n): Y



Gage Info


Gage		Serial No.	Calibration No.
Accel.	A3	K11957	407.00
	A4	K10959	417.30
Strain	F3	528AWJ-1	205.26
	F4	528AWJ-2	205.86

Date of Test	Test Depth Increment (ft to ft)	Test Time Start / Stop (military)	Length of Drill String (ft) (C)	(LE) Length below Gages (ft) (B) + (C) + (D)	Avg. Meas. Hammer Rate (BPM)	SPT Blow Counts				Drop Height in Tolerance (y/n)	Soil Class.
						6"	12"	18"	N-Value		
11-Mar	28.5 TO 30.0	0848/0848	30	33.6	50	3	6	8	14	Y	SA SI
11-Mar	33.5 TO 35.0	0857/0858	35	38.6	54	6	9	12	21	Y	SA SI
11-Mar	38.5 TO 40.0	0905/0906	40	43.6	56	4	7	9	16	Y	SA SI

Notes:

TESTING PERFORMED AT 1817 LOWRYS HIGHWAY IN CHESTER, SOUTH CAROLINA (CHESTER COUNTY). THE APPROXIMATE COORDINATES ARE 34.770590, -81.245583. THROTTLE WAS LOW TO BEGIN 33.5 TO 35.0 SAMPLE AND INCREASED BETWEEN BN 8 AND BN 10.

NOTE: (1) Note any unusual hammer operating conditions that affect the hammer performance, or changes in operating conditions (e.g. verticality, weather, or lubrication between trials). (2) Note any changes in rod diameter along drill string and record locations of short rod sections.


 Digitally signed by: Robert E. Kral
 Prepared By (print/signature)

3/11/2022
 Date



Figure No. 1: Rear View of Drill Rig



Figure No. 2: Side View of Drill Rig



Figure No. 3: Serial Number Plate



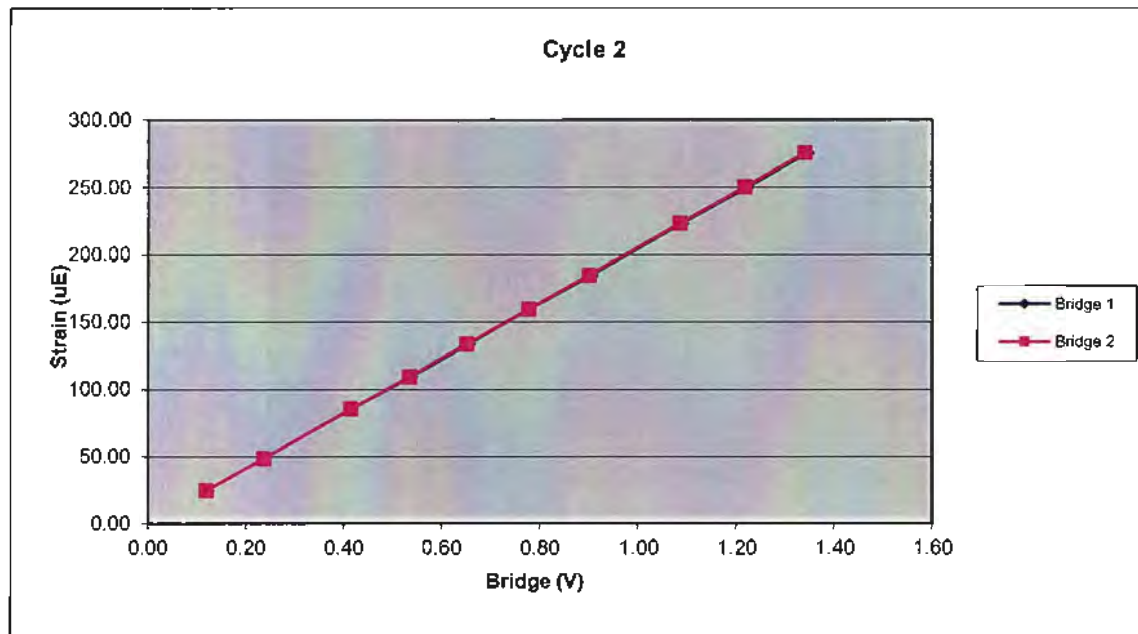
Figure No. 4: Automatic Hammer

APPENDIX III

528AWJ		Cycle 2		
Sample	Force (lb)	Strain (μE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	905.16	24.61	0.12	0.12
3	1753.20	48.18	0.24	0.24
4	3064.74	84.99	0.42	0.41
5	3947.87	108.99	0.54	0.53
6	4813.36	133.40	0.65	0.65
7	5727.49	159.02	0.78	0.78
8	6643.67	184.17	0.90	0.90
9	8004.82	222.89	1.09	1.09
10	8980.07	249.70	1.22	1.22
11	9885.91	275.04	1.35	1.34

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7340.27	Force Calibration (lb/V)	7362.32
Offset	12.98	Offset	13.21
Correlation	1.000000	Correlation	0.999999
Strain Calibration ($\mu\text{E}/\text{V}$)	204.74	Strain Calibration ($\mu\text{E}/\text{V}$)	205.35
Offset	-0.39	Offset	-0.39
Correlation	0.999993	Correlation	0.999995

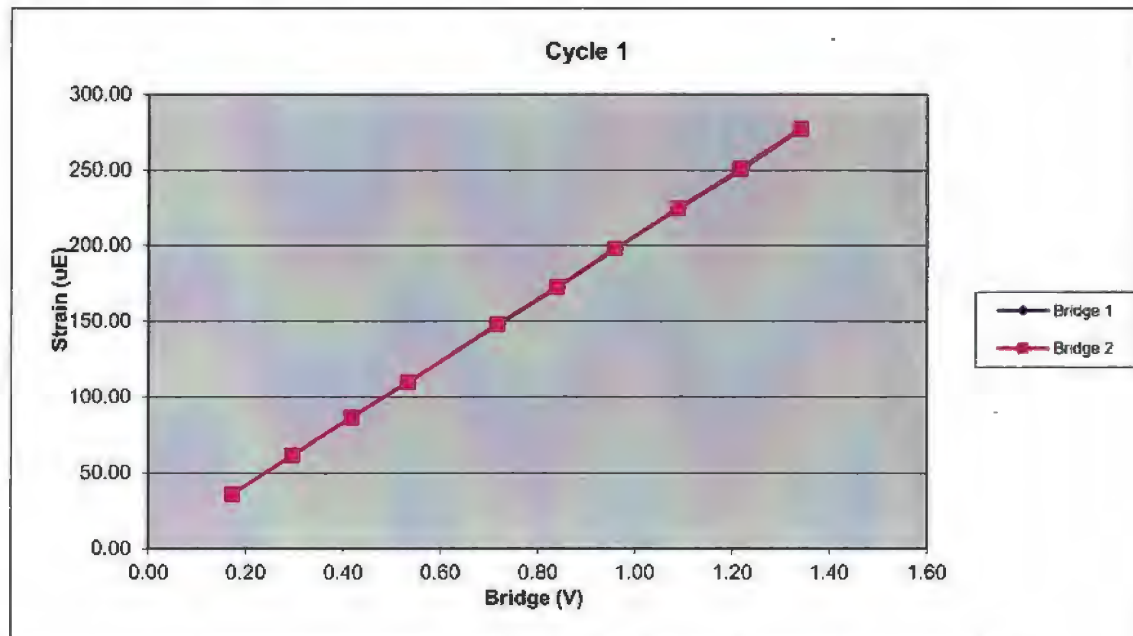
Force Strain Calibration	
EA (Kips)	35851.72
Offset	27.08
Correlation	0.999996



528AWJ		Cycle 1		
Sample	Force (lb)	Strain (μ E)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1278.49	35.63	0.17	0.17
3	2188.92	61.59	0.30	0.30
4	3085.11	86.16	0.42	0.42
5	3944.56	110.01	0.53	0.54
6	5284.17	147.69	0.72	0.72
7	6199.57	172.59	0.84	0.84
8	7071.20	197.80	0.96	0.96
9	8023.54	224.47	1.09	1.09
10	8958.62	250.45	1.22	1.22
11	9876.55	276.81	1.34	1.34

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7346.16	Force Calibration (lb/V)	7359.87
Offset	9.71	Offset	6.72
Correlation	0.999998	Correlation	0.999999
Strain Calibration (μ E/V)	205.65	Strain Calibration (μ E/V)	206.03
Offset	0.08	Offset	-0.01
Correlation	0.999990	Correlation	0.999993

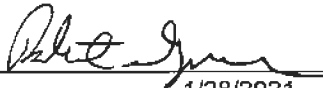
Force Strain Calibration	
EA (Kips)	35721.25
Offset	7.11
Correlation	0.999990



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

Calibration Factors	528AWJ		
Bridge 1 ($\mu\text{E/V}$)	205.26	Bridge 2 ($\mu\text{E/V}$)	205.86
EA Factor (Kips)	35777.05	Area (in^2)	1.19

Calibrated by:



Calibrated Date:

1/28/2021

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 19Apr2021

Serial No: K10959 Temperature: 21.0 °C

Model: PR Humidity: 38%

Calibrated on: Channel 3 on 8G 5161 LE

PDA CALIBRATION FACTOR

417.3 mv/5000g

(83.5 μ v/g)

R²: 0.999987 [Chip programmed]

Operator: William Johnson

Ref Acc 1: 69096! Cal on: 27Jan2021

978 g's/volt

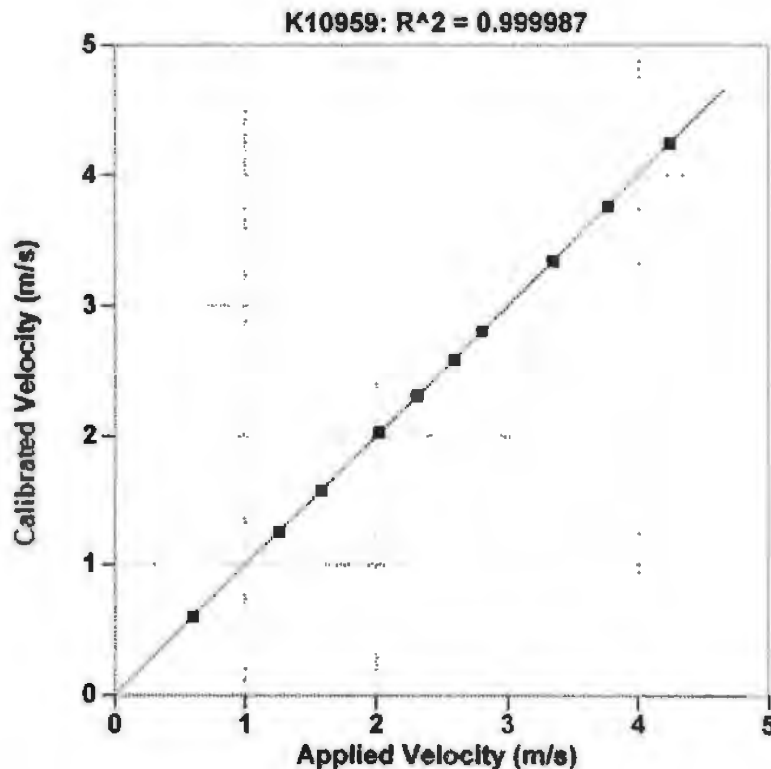
Ref Acc 2: 69132! Cal on: 09Feb2021

960 g's/volt

William Johnson

Signed

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



Reference Velocity	S/N K10959 Velocity
m/s	m/s
0.600	0.600
1.260	1.255
1.578	1.577
2.021	2.028
2.306	2.311
2.590	2.590
2.801	2.806
3.346	3.344
3.767	3.762
4.241	4.241
Maximum Acceleration: 938 g's	

Accelerometer Calibration Certificate

Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.
Calibration performed on 22Jan2021

Serial No: K10960 Temperature: 20.0 °C

Model: PR Humidity: 28%

Calibrated on: Channel 4 on 8G 5161 LE

PDA CALIBRATION FACTOR

425.7 mv/5000g

(85.1 μ v/g)

R²: 0.999987 [Chip programmed]

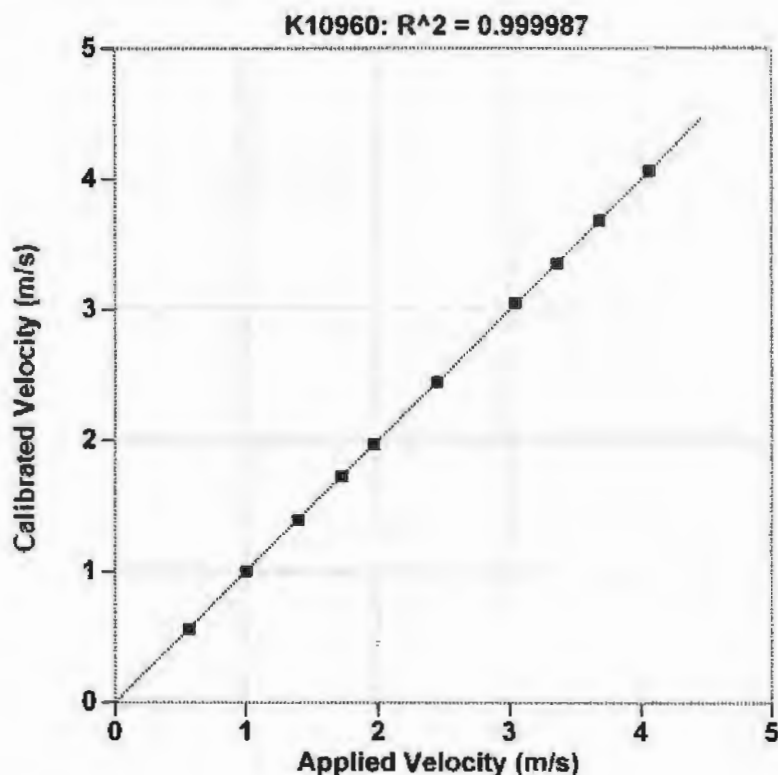
Ref Acc 1: 63479! Cal on: 09Sep2020
1080 g's/volt

Ref Acc 2: 65538! Cal on: 27Jan2020
1040 g's/volt

Operator: William Johnson


Signed

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



Reference Velocity	S/N K10960 Velocity
m/s	m/s
0.568	0.564
1.006	1.001
1.400	1.393
1.728	1.726
1.969	1.970
2.447	2.448
3.043	3.051
3.359	3.356
3.683	3.684
4.063	4.062
Maximum Acceleration: 889 g's	

Accelerometer Calibration Certificate

Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.
Calibration performed on

MAR 2 2021

Serial No: K11957 Temperature: 20.0 °C

Model: PR Humidity: 27%

Calibrated on: Channel 4 on 8G 5161 LE

PDA CALIBRATION FACTOR

407.0 mv/5000g

(81.4 μ v/g)

R²: 0.999989 [Chip programmed]

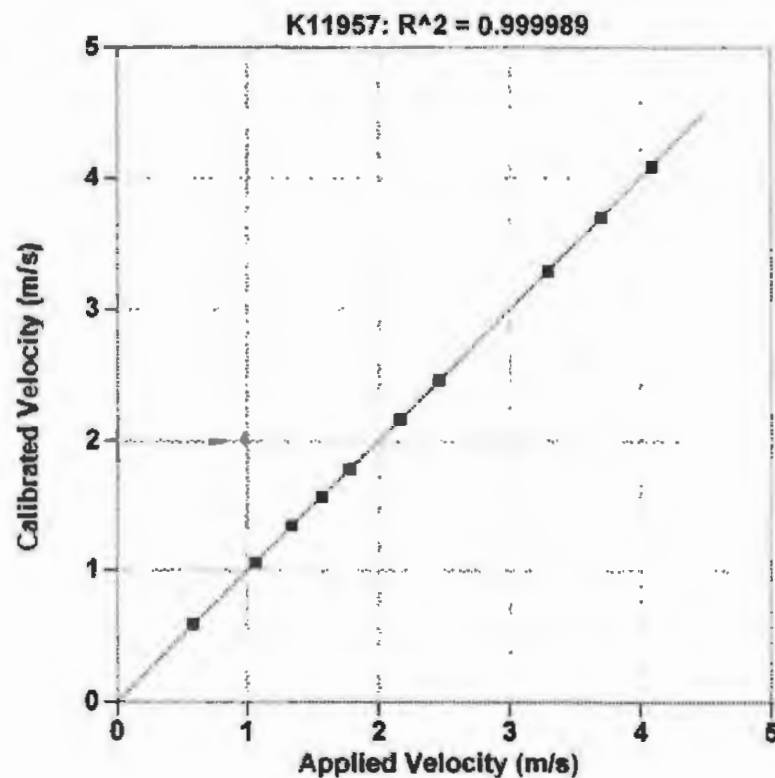
Operator: William Johnson

Ref Acc 1: 63479! Cal on: 22Jan2021
1079 g's/volt

Ref Acc 2: 65538! Cal on: 22Jan2021
1043 g's/volt

William Johnson
Signed

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



Reference Velocity m/s	S/N K11957 Velocity m/s
0.588	0.589
1.066	1.061
1.344	1.345
1.571	1.570
1.779	1.783
2.161	2.164
2.458	2.465
3.294	3.291
3.701	3.700
4.089	4.086
Maximum Acceleration: 894 g's	

APPENDIX IV

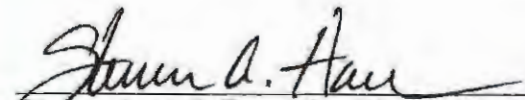


This documents that
Robert E. Kral
Carolinas Geotechnical Group
has on May 20, 2016 achieved the rank of
ADVANCED

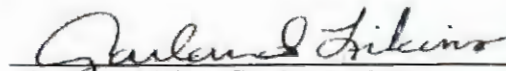
on the Dynamic Measurement and Analysis Proficiency Test.

The individual identified on this document demonstrated to the degree granted above an understanding of theory, data quality evaluation, interpretation and signal matching for high strain dynamic testing of deep foundations. ***It is recommended that individuals at the Advanced level seek Master or Expert levels through additional study within six years of the date of this document.***

The ability of the individual named to provide appropriate knowledge and advice on a specific project is not implied or warranted by the Pile Driving Contractors Association or Pile Dynamics, Inc. **This certificate can be verified at www.PDAproficiencytest.com.** The Pile Driving Contractors Association or Pile Dynamics, Inc. assumes no liability for foundation testing and analysis work performed by the bearer of this certificate.


Steven A. Hall, Executive Director
Pile Driving Contractors Association




Garland Likins, Senior Partner
Pile Dynamics, Inc.

No. 2072