



GEOTECHNICAL SUBSURFACE DATA REPORT

S-24-230 over Townsend Creek
Greenwood 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: P043995

FME Project No.: G7100.007—Task 00003

November 7, 2024

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

Re: Geotechnical Subsurface Data Report
S-24-230 over Townsend Creek
Greenwood County, South Carolina
SCDOT Project ID: P043995
FME Project No.: G7100.007 – Task 00003

Mr. Harris:

Submitted herein is F&ME Consultants, Inc.'s (FME) Geotechnical Subsurface Data Report for the S-24-230 over Townsend Creek project. This report contains findings from our subsurface field exploration and laboratory testing program.

It has been a pleasure collaborating 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.
Materials Laboratory Manager

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

William J. Gieser, P.E.
Senior Project Engineer



TABLE OF CONTENTS

1. INTRODUCTION	3
1.1. GENERAL	3
1.2. SCOPE	3
2. SUBSURFACE EXPLORATION SUMMARY	3
2.1. SOIL TEST BORINGS	3
2.2. MANUAL AUGER BORING	4
2.3. GROUNDWATER	4
2.4. TEST LOCATION TABLE	4
3. LABORATORY TESTING SUMMARY	5

APPENDIX

Section 1	Site Location Plan
Section 2	Boring Location Plan
Section 3	Subsurface Exploration Logs
Section 3A	Soil Test Boring (STB) Logs
Section 3B	Manual Auger Boring (MAB) Log
Section 4	Laboratory Test Results
Section 4A	Split-Spoon Samples
Section 4B	Bulk Soil Sample
Section 4C	Rock Core Samples
Section 5	On Site Drill Rig Photos
Section 6	Pavement Core Photos
Section 7	SPT Hammer Calibration
Section 8	Geo-Scoping Form

1. INTRODUCTION

1.1. GENERAL

The project is located along S-24-230 (Townsend Road East) and is located approximately two (2) miles southwest of Cokesbury, South Carolina. We understand that this project will involve the demolition/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 Section 1 of the Appendix of this report.

1.2. SCOPE

FME performed a geotechnical subsurface exploration and laboratory testing for the project. The South Carolina Department of Transportation (SCDOT) Scope of Services was issued on October 18, 2024..

The field exploration consisted of Soil Test Borings (STB) with Standard Penetration Testing (SPT) and the collection of a Bulk Soil Sample (BS) via Manual Auger Boring (MAB) methodologies. Laboratory testing was performed on soil and rock samples collected from the Soil Test Borings and Bulk Soil Sample. 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).

2. SUBSURFACE EXPLORATION SUMMARY

From October 21, 2024, through October 23, 2024, eight (8) Soil Test Borings and one (1) Manual Auger Boring were performed on 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 Section 2 of the Appendix within to this report.

2.1. SOIL TEST BORINGS

Soil Test Borings were performed utilizing a CME 550X ATV mounted drill rig. The measured energy transfer ratio was 76% utilizing an automatic hammer. SPT hammer calibration records are provided within Section 7 of the Appendix of this report. Soil Test Borings utilized Rotary Wash drilling techniques to maintain a stable borehole. Borings were sampled continuously through the upper ten (10) feet, or to the termination depth, below the existing ground surface utilizing SPT testing. Following the continuous sampling, SPT testing was performed on standard five (5) foot intervals thereafter. Once Rollercone refusal was encountered within Soil Test Borings B-1 and B-2, NQ rock coring techniques were deployed to obtain rock core specimens for classification and laboratory testing purposes. 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.

Pavement Core samples from each Soil Test Boring were bagged and transported to FME's laboratory following boring completion. These cores were measured and photographed to document thickness, distress, and surface condition. These photos are presented in Section 6 in the Appendix of this report.

Copies of the Soil Test Boring Logs are contained within Section 3A in the Appendix of this report. The following table is a summary of the Soil Test Boring depths, locations, and surface elevations.

Table 1 – Field Exploration Summary Table – Soil Test Borings

Test ID	Test Type	Soil Depth (ft)	Rock Core Depth (ft)	Total Boring Depth (ft)	Latitude	Longitude	Elevation (ft-MSL)
B-1	STB	23.3	20.0	43.3	34.26933604	-82.22046421	581.8
B-2	STB	30.0	20.0	50.0	34.26909268	-82.22058897	584.6
P-1	STB	2.2	0.0	2.2	34.27027647	-82.21972048	589.4
P-2	STB	2.0	0.0	2.0	34.26995938	-82.22000254	584.5
P-3	STB	2.0	0.0	2.0	34.26961347	-82.22021413	581.3
P-4	STB	2.2	0.0	2.2	34.26877967	-82.22082977	592.6
P-5	STB	2.3	0.0	2.3	34.26840949	-82.22096602	602.1
P-6	STB	2.2	0.0	2.2	34.26805594	-82.22114245	613.6
TOTALS		66.2	40.0	106.2			

2.2. MANUAL AUGER BORING

One (1) Bulk Soil Sample, designated as BS-1 @ P-2, was collected on site via Manual Auger Boring methodologies. Copies of this Manual Auger Boring Log is contained within Section 3B in the Appendix of this report. The following table is a summary of the Bulk Soil Sample designation, depth, location, and surface elevation.

Table 2 – Field Exploration Summary Table – Manual Auger Borings

Test ID	Test Type	Test Depth (ft)	Latitude	Longitude	Elevation (ft-MSL)
BS-1 @ P-2	MAB/BS	2.0	34.26994997	-82.21998170	584.0
TOTAL		2.0			

2.3. GROUNDWATER

Groundwater depths were recorded at the time of boring (TOB) and twenty-four (24) hours following boring completion, where practical. Groundwater depth measurements are noted on the individual Subsurface Exploration Logs in Section 3 of the Appendix.

2.4. TEST LOCATION TABLE

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 3 – Geotechnical Exploration Summary Table

Test ID	Test Type	Test Depth (ft)	Latitude	Longitude	Elevation (ft-MSL)
B-1	STB	43.3	34.26933604	-82.22046421	581.8
B-2	STB	50.0	34.26909268	-82.22058897	584.6
BS-1 @ P-2	MAB	2.0	34.26994997	-82.21998170	584.0
P-1	STB	2.2	34.27027647	-82.21972048	589.4
P-2	STB	2.0	34.26995938	-82.22000254	584.5
P-3	STB	2.0	34.26961347	-82.22021413	581.3
P-4	STB	2.2	34.26877967	-82.22082977	592.6
P-5	STB	2.3	34.26840949	-82.22096602	602.1
P-6	STB	2.2	34.26805594	-82.22114245	613.6

3. LABORATORY TESTING SUMMARY

Following completion of FME's field exploration, draft boring logs were generated and reviewed internally by FME. Based on the data represented in these logs, FME was authorized to designate soil samples for laboratory testing on behalf of the SCDOT. 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 Section 4A and Section 4C within the Appendix of this report.

Table 4 – Laboratory Testing Summary Table – Soil Test Boring Samples

Type of Test	Quantity	Procedure
Moisture Content	8	AASHTO T265 (ASTM D2216)
Atterberg Limits	8	AASHTO T89/T90 (ASTM D4318)
Grain-size Distribution w/ Wash 200	5	ASTM D6913/AASHTO T11 (ASTM D1140)
Hydrometer and Grain Size	3	ASTM D7928/ASTM D6913
pH	1	AASHTO T289 (ASTM G51)
Soil Sulfate Content	1	AASHTO T290 (ASTM C1580)
Soil Chloride Content	1	AASHTO T291
Soil Resistivity	1	AASHTO T288
Compressive Strength of Rock Cores	6	ASTM D7012

Laboratory testing performed on the Bulk Soil Sample is summarized in the table below. The data sheets containing the results from this testing are provided in Section 4B of the Appendix attached to this report.

Table 5 – Laboratory Testing Summary Table – Bulk Soil Sample

Type of Test	Quantity	Procedure
Moisture Content	1	AASHTO T265 (ASTM D2216)
Atterberg Limits	1	AASHTO T89/T90 (ASTM D4318)
Grain-size Distribution w/ Wash 200	1	ASTM D6913/AASHTO T11 (ASTM D1140)
California Bearing Ratio	1	AASHTO T193 (ASTM D1883)

S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

APPENDIX

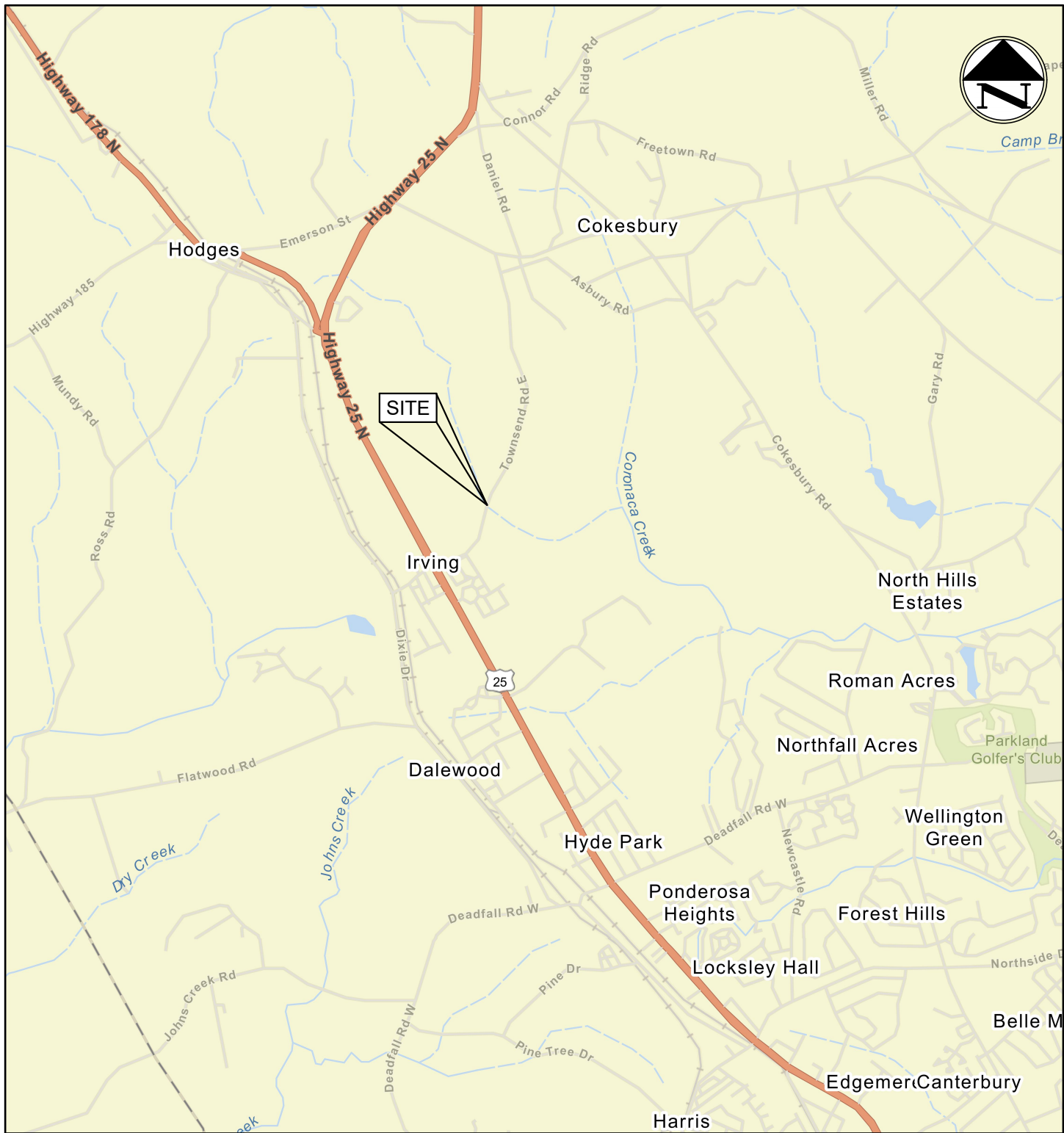
SECTION 1	SITE LOCATION PLAN
SECTION 2	BORING LOCATION PLAN
SECTION 3	SUBSURFACE EXPLORATION LOGS
SECTION 3A	SOIL TEST BORING (STB) LOGS
SECTION 3B	MANUAL AUGER BORING (MAB) LOG
SECTION 4	LABORATORY TEST RESULTS
SECTION 4A	SPLIT-SPOON SAMPLES
SECTION 4B	BULK SOIL SAMPLE
SECTION 4C	ROCK CORE SAMPLES
SECTION 5	ON SITE DRILL RIG PHOTOS
SECTION 6	PAVEMENT CORE PHOTOS
SECTION 7	SPT HAMMER CALIBRATION
SECTION 8	GEO-SCOPING FORM

S-24-230 over Townsend Creek

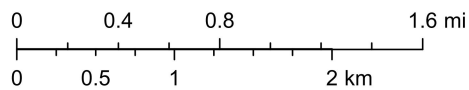
Geotechnical Subsurface Data Report

APPENDIX

SECTION 1 SITE LOCATION PLAN



1:58,000



F&ME CONSULTANTS, INC.
COLUMBIA, SC

4			
3			
2			
1			
REV.	BY	DATE	DESCRIPTION OF REVISION
TOPO.		DATE	
DWG.	CTC	DATE 10.25.24	GROUP -- --
R/W		DATE	

S-24-230 OVER TOWNSEND CREEK
GREENWOOD COUNTY, SOUTH CAROLINA

SITE LOCATION PLAN

SCDOT PROJECT ID: P043995

FME JOB NO. G7100.007 task 003

SCALE: AS NOTED

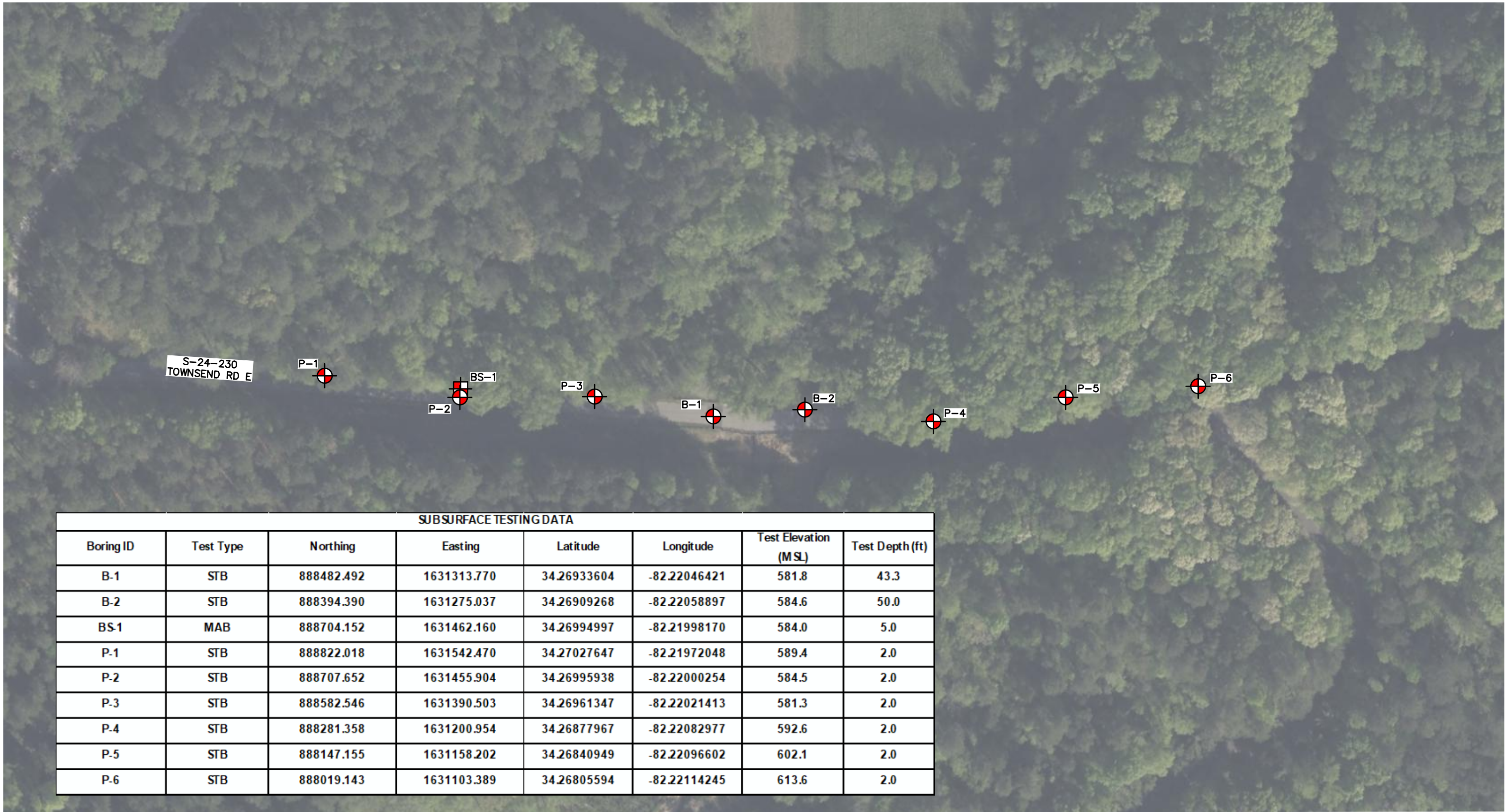
FIGURE 1

S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

APPENDIX

SECTION 2 BORING LOCATION PLAN



SUBSURFACE TESTING DATA							
Boring ID	Test Type	Northing	Easting	Latitude	Longitude	Test Elevation (MSL)	Test Depth (ft)
B-1	STB	888482.492	1631313.770	34.26933604	-82.22046421	581.8	43.3
B-2	STB	888394.390	1631275.037	34.26909268	-82.22058897	584.6	50.0
BS-1	MAB	888704.152	1631462.160	34.26994997	-82.21998170	584.0	5.0
P-1	STB	888822.018	1631542.470	34.27027647	-82.21972048	589.4	2.0
P-2	STB	888707.652	1631455.904	34.26995938	-82.22000254	584.5	2.0
P-3	STB	888582.546	1631390.503	34.26961347	-82.22021413	581.3	2.0
P-4	STB	888281.358	1631200.954	34.26877967	-82.22082977	592.6	2.0
P-5	STB	888147.155	1631158.202	34.26840949	-82.22096602	602.1	2.0
P-6	STB	888019.143	1631103.389	34.26805594	-82.22114245	613.6	2.0



LEGEND:

SOIL TEST BORING LOCATION

MANUAL AUGER BORING LOCATION

4			
3			
2			
1			
REV.	BY	DATE	DESCRIPTION OF REVISION
TOPO.		DATE	
DWG.	CTC	DATE 10.25.24	GROUP -
R/W		DATE	

F&ME CONSULTANTS, INC.
COLUMBIA, SC

S-24-230 OVER TOWNSEND CREEK
GREENWOOD COUNTY, SOUTH CAROLINA

BORING LOCATION PLAN

SCDOT PROJECT ID: P043995 FME JOB NO. G7100.007 task 003

SCALE: 1" = 100' FIGURE 2

S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

APPENDIX

SECTION 3 SUBSURFACE EXPLORATION LOGS

Soil Test Boring Log Descriptors

Correlation of Penetration Resistance with Relative Density and Consistency














Coarse Grained Soils (Sands/Gravel)		Fine Grained Soils (Silt/Clay)	
SPT Blow Count	Relative Density	SPT Blow Count	Consistency
≤ 4	Very Loose	≤ 2	Very Soft
5 – 10	Loose	3 – 4	Soft
11 – 30	Medium Dense	5 – 8	Firm
31 – 50	Dense	9 – 15	Stiff
≥ 51	Very Dense	16 – 30	Very Stiff
		≥ 31	Hard

Particle Size Identification
















Gravel	Sieve Size
Fine	#4 to ¾ inch
Coarse	¾ inch to 3 inch

Sand	Sieve Size
Fine	#200 to #40
Medium	#40 to #10
Coarse	#10 to #4

Gravel	Sieve Size
Fines Content	< #200

SYMBOL	PRINT CODE*	TYPICAL DESCRIPTION
	SCCT	CONCRETE
	SCAT	ASPHALT
	SCTS	TOPSOIL/PEAT
	SCSAND	SAND
	SCSTSAND	SILTY SAND/SANDY SILT
	SCCLSAND	CLAYEY SAND/SANDY CLAY
	SCCLAY	CLAY
	SCSILT	SILT
	SCSTCLAY	SILTY CLAY/CLAYEY SILT
	SCSAP	SAPROLITE
	SCLS	LIMESTONE
	SCBR	GRANITE (BEDROCK)
	SCMARL	MARL

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
	SAND AND SANDY SOILS	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
		CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
FINE GRAINED SOILS	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)			SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
				ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
				MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
HIGHLY ORGANIC SOILS	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

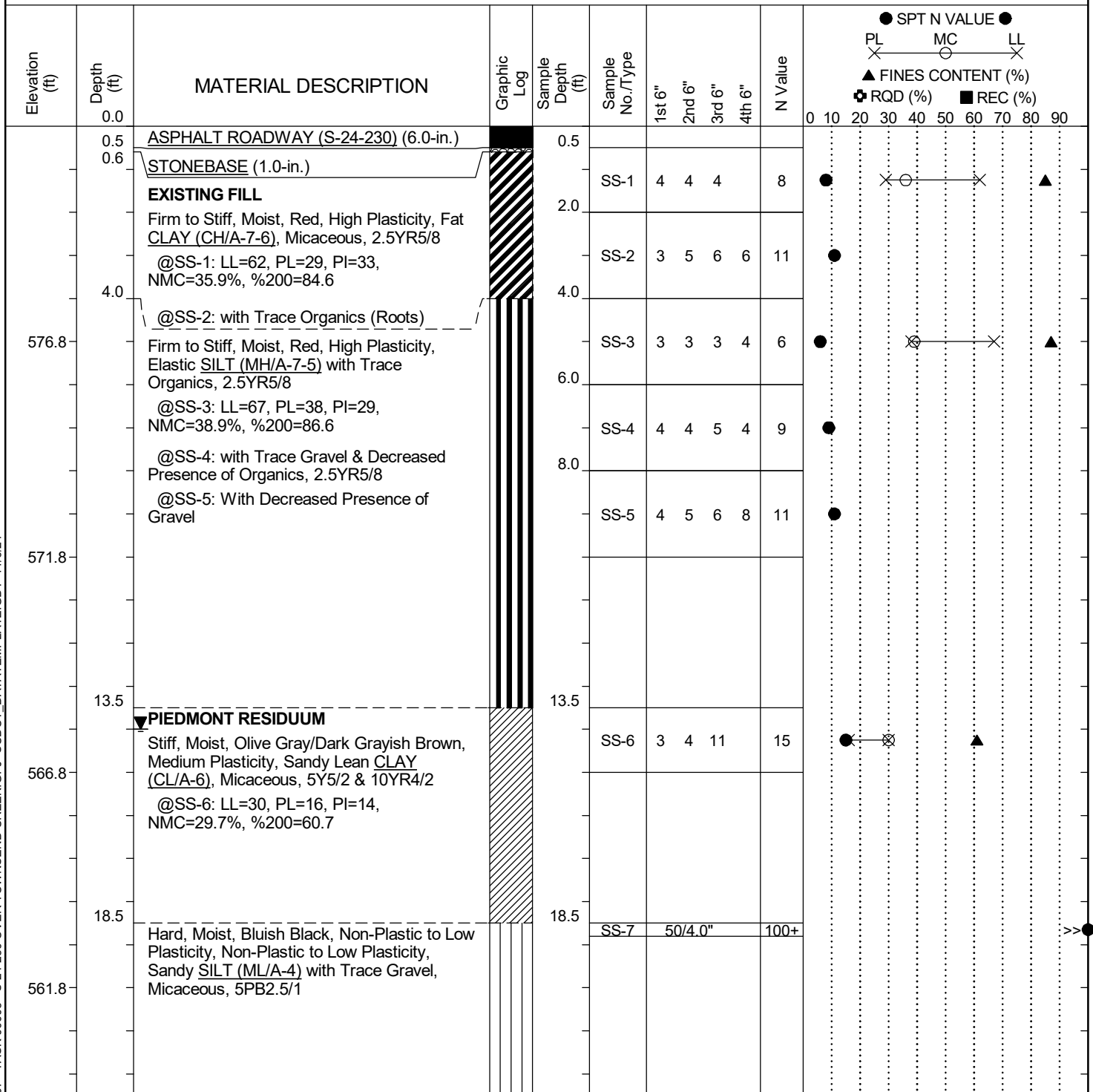
APPENDIX

SECTION 3 SUBSURFACE EXPLORATION LOGS

SECTION 3A SOIL TEST BORING (STB) LOGS

SCDOT Soil Test Log

Project ID:	P043995	County:	Greenwood	Boring No.:	B-1
Site Description:	S-24-230 over Townsend Creek			Route:	
Eng./Geo.:	B. Vogel	Boring Location:	N/A	Offset:	N/A
Elev.:	581.8 ft	Latitude:	34.26933604	Longitude:	-82.22046421
Date Started:	10/21/2024				
Total Depth:	43.3 ft	Soil Depth:	23.3 ft	Core Depth:	20 ft
Date Completed:	10/21/2024				
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	76.1%				
Core Size:	NQ	Driller:	C. Taylor	Groundwater:	TOB 14(cave@16) 24HR 14(cave@18)



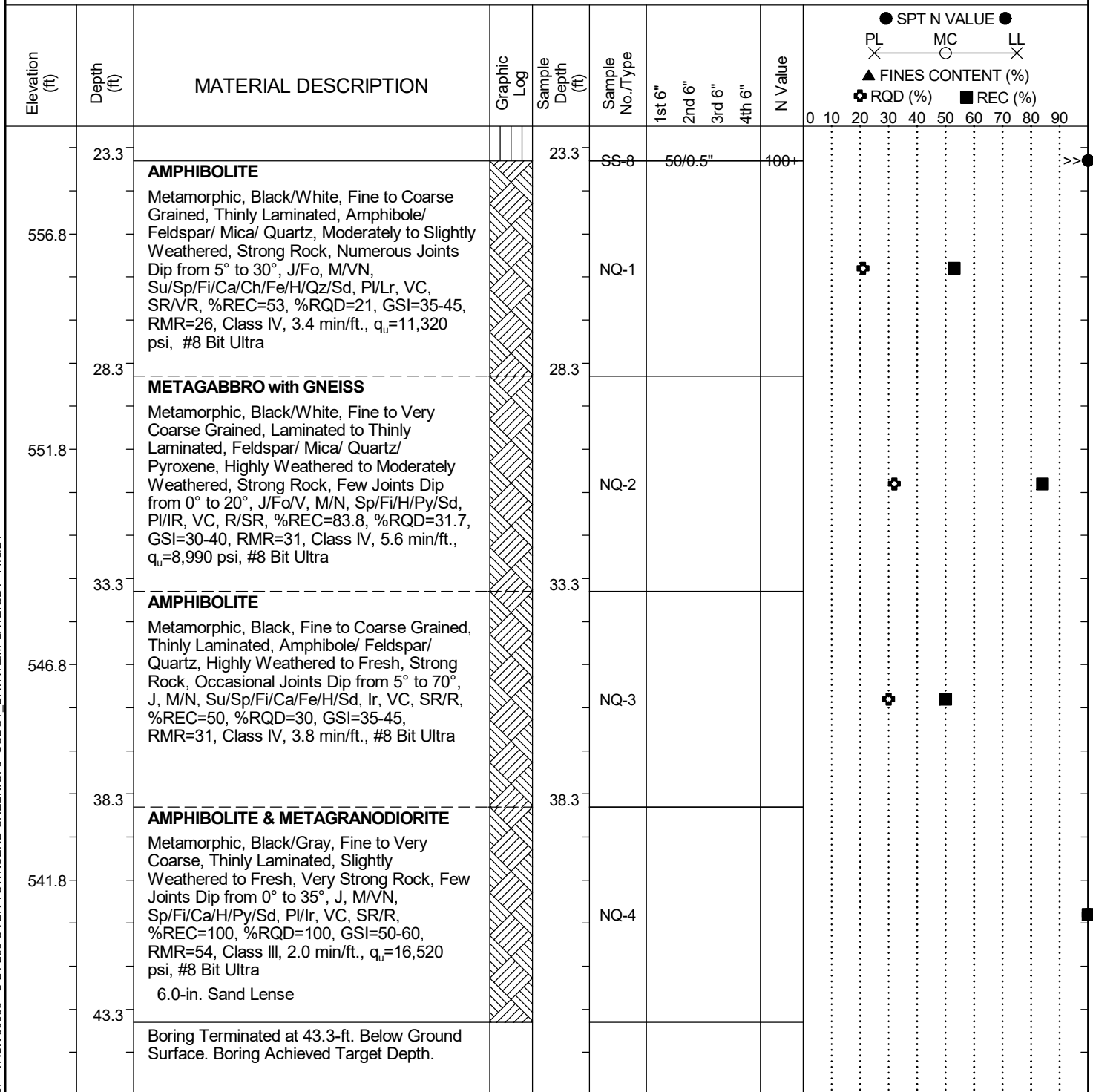
LEGEND

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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:	P043995	County:	Greenwood	Boring No.:	B-1
Site Description:	S-24-230 over Townsend Creek			Route:	
Eng./Geo.:	B. Vogel	Boring Location:	N/A	Offset:	N/A
Elev.:	581.8 ft	Latitude:	34.26933604	Longitude:	-82.22046421
Date Started:	10/21/2024				
Total Depth:	43.3 ft	Soil Depth:	23.3 ft	Core Depth:	20 ft
Date Completed:	10/21/2024				
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	76.1%				
Core Size:	NQ	Driller:	C. Taylor	Groundwater:	TOB 14(cave@16) 24HR 14(cave@18)



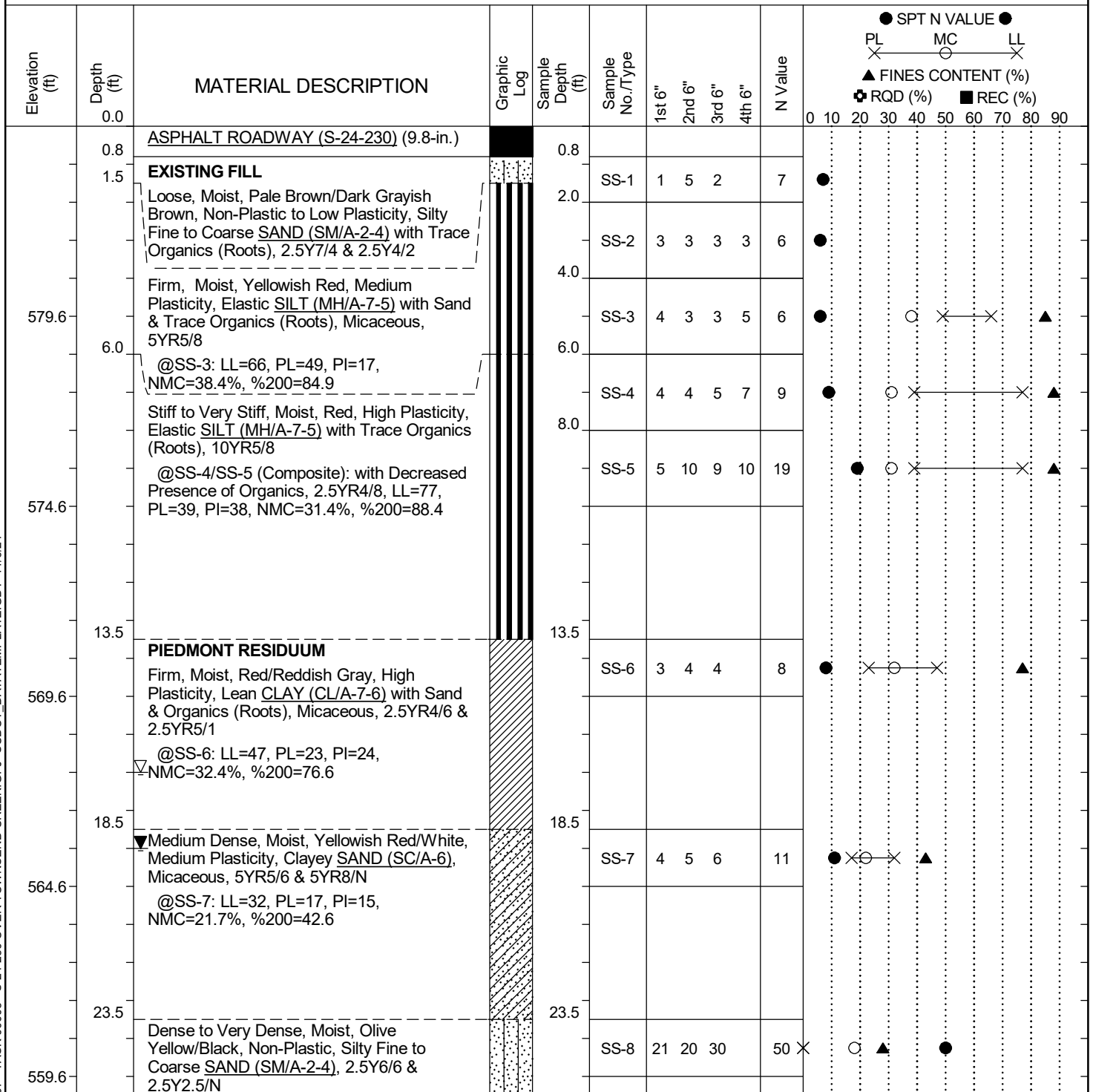
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SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving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

SC.DOT G7100.007 - TASK 00003 - S-24-230 OVER TOWNSEND CREEK.GPJ SCDOT_DATATEMPLATE.GDT 11/6/24

SCDOT Soil Test Log

Project ID:	P043995	County:	Greenwood	Boring No.:	B-2
Site Description:	S-24-230 over Townsend Creek			Route:	
Eng./Geo.:	B. Vogel	Boring Location:	N/A	Offset:	N/A
Elev.:	584.6 ft	Latitude:	34.26909268	Longitude:	-82.22058897
Date Started:	10/22/2024				
Total Depth:	50 ft	Soil Depth:	30 ft	Core Depth:	20 ft
Date Completed:	10/22/2024				
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	76.1%				
Core Size:	NQ	Driller:	C. Taylor	Groundwater:	TOB 17(cave@50) 24HR 19(cave@47.5)



LEGEND

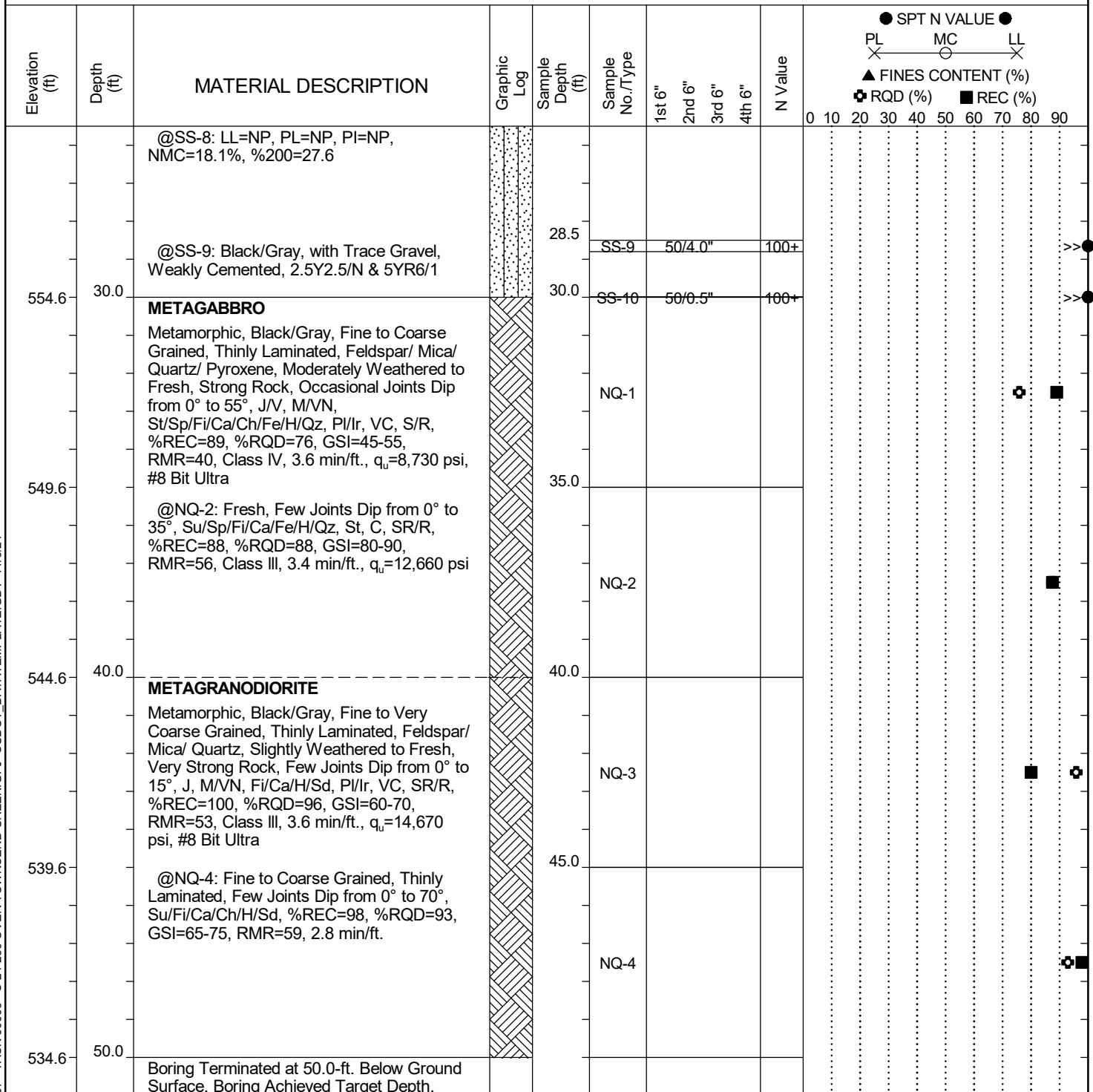
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SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving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

SC.DOT G7100.007 - TASK 00003 - S-24-230 OVER TOWNSEND CREEK.GPJ SCDOT_DATATEMPLATE.GDT 11/6/24

SCDOT Soil Test Log

Project ID:	P043995	County:	Greenwood	Boring No.:	B-2
Site Description:	S-24-230 over Townsend Creek			Route:	
Eng./Geo.:	B. Vogel	Boring Location:	N/A	Offset:	N/A
Elev.:	584.6 ft	Latitude:	34.26909268	Longitude:	-82.22058897
Date Started:	10/22/2024				
Total Depth:	50 ft	Soil Depth:	30 ft	Core Depth:	20 ft
Date Completed:	10/22/2024				
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	76.1%				
Core Size:	NQ	Driller:	C. Taylor	Groundwater:	TOB 17(cave@50) 24HR 19(cave@47.5)



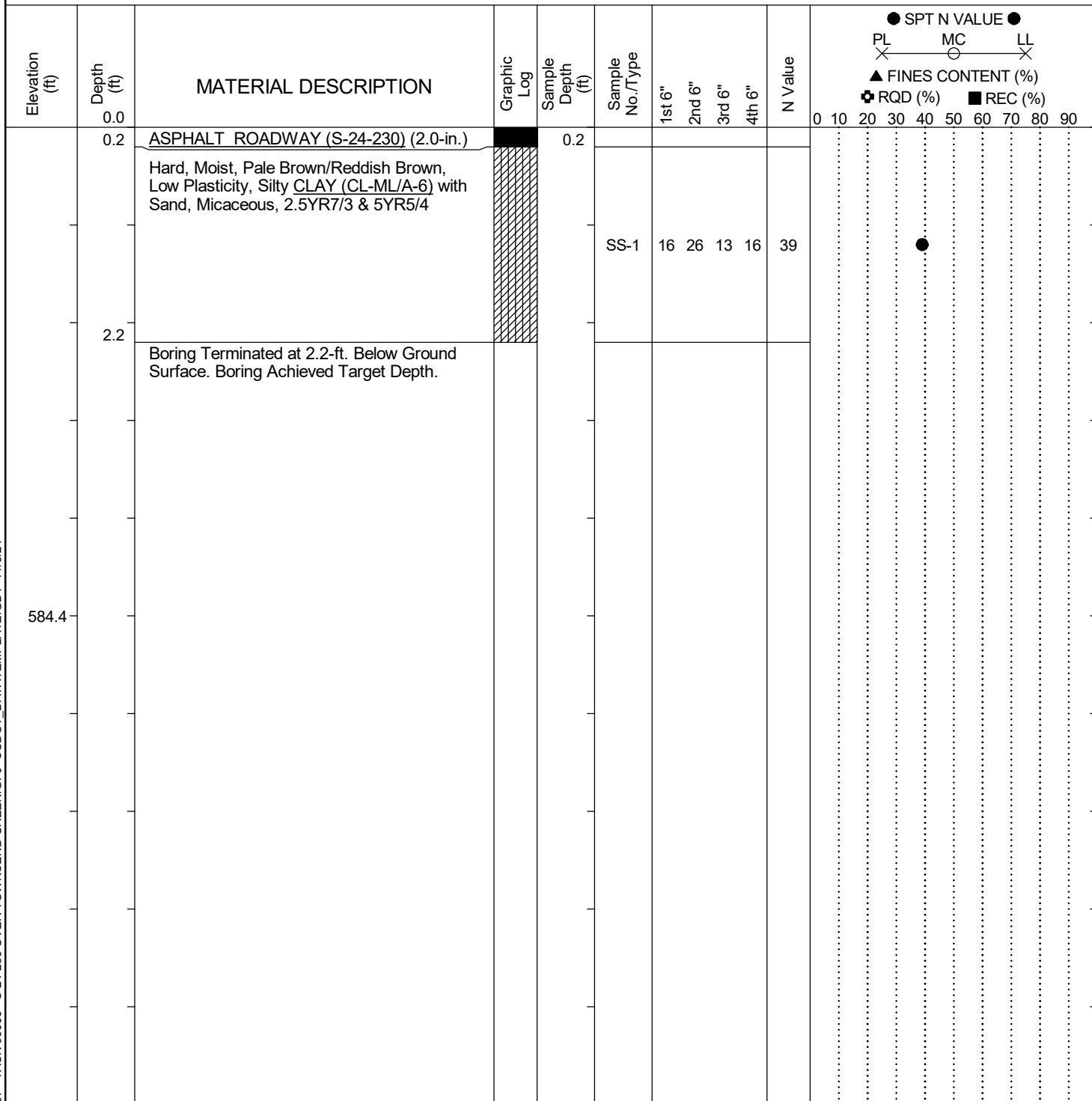
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SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving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

SC.DOT G7100.007 - TASK 00003 - S-24-230 OVER TOWNSEND CREEK.GPJ SCDOT_DATATEMPLATE.GDT 11/6/24

SCDOT Soil Test Log

Project ID:	P043995	County:	Greenwood	Boring No.:	P-1
Site Description:	S-24-230 over Townsend Creek			Route:	
Eng./Geo.:	B. Vogel	Boring Location:	N/A	Offset:	N/A
Elev.:	589.4 ft	Latitude:	34.27027647	Longitude:	-82.21972048
Date Started:	10/23/2024				
Total Depth:	2.2 ft	Soil Depth:	2.2 ft	Core Depth:	N/A ft
Date Completed:	10/23/2024				
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	76.1%				
Core Size:	N/A	Driller:	C. Taylor	Groundwater:	TOB N/A
24HR	Backfilled				



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 G7100.007 - TASK 00003 - S-24-230 OVER TOWNSEND CREEK.GPJ SCDOT_DATATEMPLATE.GDT 11/5/24

SCDOT Soil Test Log

Project ID:	P043995	County:	Greenwood	Boring No.:	P-2
Site Description:	S-24-230 over Townsend Creek			Route:	
Eng./Geo.:	B. Vogel	Boring Location:	N/A	Offset:	N/A
Elev.:	584.5 ft	Latitude:	34.26995938	Longitude:	-82.22000254
Date Started:	10/23/2024				
Total Depth:	2 ft	Soil Depth:	2 ft	Core Depth:	N/A ft
Date Completed:	10/23/2024				
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	76.1%				
Core Size:	N/A	Driller:	C. Taylor	Groundwater:	TOB N/A
24HR	Backfilled				

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 ○ LL X </div> <div> ▲ FINES CONTENT (%) </div> <div> ⊕ RQD (%) ■ REC (%) </div> </div>
	0.0	ASPHALT ROADWAY (S-24-230) (7.0-in.)									
	0.6	Very Stiff, Moist, Light Red/Pale Brown, Medium Plasticity to High Plasticity, Sandy CLAY (CL/A-6) with Trace Gravel & Silty Sand Lenses, Micaceous, 2.5YR6/6 & 2.5Y7/4		0.6	SS-1	4	6	21		27	
	2.0	Boring Terminated at 2.0-ft. Below Ground Surface. Boring Achieved Target Depth.									
579.5											

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 G7100.007 - TASK 00003 - S-24-230 OVER TOWNSEND CREEK.GPJ SCDOT_DATATEMPLATE.GDT 11/5/24

SCDOT Soil Test Log

Project ID:	P043995	County:	Greenwood	Boring No.:	P-3
Site Description:	S-24-230 over Townsend Creek			Route:	
Eng./Geo.:	B. Vogel	Boring Location:	N/A	Offset:	N/A
Elev.:	581.3 ft	Latitude:	34.26961347	Longitude:	-82.22021413
Date Started:	10/23/2024				
Total Depth:	2 ft	Soil Depth:	2 ft	Core Depth:	N/A ft
Date Completed:	10/23/2024				
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	76.1%				
Core Size:	N/A	Driller:	C. Taylor	Groundwater:	TOB N/A
24HR	Backfilled				

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 X — MC — LL X ▲ FINES CONTENT (%) + RQD (%) ■ REC (%)
	0.0										0 10 20 30 40 50 60 70 80 90
	0.3	ASPHALT ROADWAY (S-24-230) (3.0-in.)									
	0.4	STONEBASE (1.5-in.)		0.4							
		Stiff, Moist, Red, Low Plasticity to Medium Plasticity, Sandy SILT (ML/A-4), 10R5/6			SS-1	4	4	7		11	●
	2.0	Boring Terminated at 2.0-ft. Below Ground Surface. Boring Achieved Target Depth.									
576.3											

LEGEND

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

SC.DOT G7100.007 - TASK 00003 - S-24-230 OVER TOWNSEND CREEK.GPJ SCDOT_DATATEMPLATE.GDT 11/5/24

SCDOT Soil Test Log

Project ID: P043995				County: Greenwood		Boring No.: P-4	
Site Description: S-24-230 over Townsend Creek			Route:				
Eng./Geo.: B. Vogel		Boring Location: N/A		Offset: N/A		Alignment: Existing CL	
Elev.: 592.6 ft	Latitude: 34.26877967		Longitude: -82.22082977		Date Started: 10/23/2024		
Total Depth: 2.2 ft		Soil Depth: 2.2 ft		Core Depth: N/A ft		Date Completed: 10/23/2024	
Bore Hole Diameter (in): 3		Sampler Configuration		Liner Required: Y (N)		Liner Used: Y (N)	
Drill Machine: CME 550X		Drill Method: RW/RC		Hammer Type: Automatic		Energy Ratio: 76.1%	
Core Size: N/A		Driller: C. Taylor		Groundwater: TOB N/A		24HR Backfilled	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type					N Value	<div> ● SPT N VALUE ● PL — MC — LL X — X — X ▲ FINES CONTENT (%) + RQD (%) ■ REC (%) </div>									
						1st 6"	2nd 6"	3rd 6"	4th 6"		0	10	20	30	40	50	60	70	80	90
587.6	0.0																			
	0.2	ASPHALT ROADWAY (S-24-230) (2.5-in.)		0.2																
	0.6	Medium Dense, Moist, Light Yellowish Brown, Non-Plastic to Low Plasticity, Silty Fine to Coarse SAND (SM/A-2-4) with Trace Gravel, 10YR6/4																		
		Very Stiff, Moist, Red, Low Plasticity to Medium Plasticity, Sandy SILT (ML/A-6) with Trace Organics (Roots), Micaceous, 10R5/6			SS-1	8	9	10	12	19										
	2.2	Boring Terminated at 2.2-ft. Below Ground Surface. Boring Achieved Target Depth.																		

LEGEND

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		

SCDOT Soil Test Log

Project ID:	P043995	County:	Greenwood	Boring No.:	P-5
Site Description:	S-24-230 over Townsend Creek			Route:	
Eng./Geo.:	B. Vogel	Boring Location:	N/A	Offset:	N/A
Elev.:	602.1 ft	Latitude:	34.26840949	Longitude:	-82.22096602
Date Started:	10/23/2024				
Total Depth:	2.3 ft	Soil Depth:	2.3 ft	Core Depth:	N/A ft
Date Completed:	10/23/2024				
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	76.1%				
Core Size:	N/A	Driller:	C. Taylor	Groundwater:	TOB N/A
24HR	Backfilled				

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 X — MC — LL X ▲ FINES CONTENT (%) + RQD (%) ■ REC (%)
	0.0										0 10 20 30 40 50 60 70 80 90
	0.2	ASPHALT ROADWAY (S-24-230) (2.0-in.)		0.3							
	0.3	STONEBASE (1.5-in.)									
	0.5	Loose, Moist, Light Yellowish Brown, Non-Plastic to Low Plasticity, Silty Fine to Coarse SAND (SM/A-2-4), 2.5Y6/3									
		Stiff, Moist, Red, Low Plasticity to Medium Plasticity, Sandy SILT (ML/A-4), Micaceous, 10R5/6			SS-1	3	4	5	8	9	●
	2.3	Boring Terminated at 2.3-ft. Below Ground Surface. Boring Achieved Target Depth.									
597.1											

LEGEND

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

SCDOT Soil Test Log

Project ID:	P043995	County:	Greenwood	Boring No.:	P-6
Site Description:	S-24-230 over Townsend Creek			Route:	
Eng./Geo.:	B. Vogel	Boring Location:	N/A	Offset:	N/A
Elev.:	613.6 ft	Latitude:	34.26805594	Longitude:	-82.22114245
Date Started:	10/23/2024				
Total Depth:	2.2 ft	Soil Depth:	2.2 ft	Core Depth:	N/A ft
Date Completed:	10/23/2024				
Bore Hole Diameter (in):	3	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 550X	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	76.1%				
Core Size:	N/A	Driller:	C. Taylor	Groundwater:	TOB N/A
24HR	Backfilled				

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 X — X — X ▲ FINES CONTENT (%) + RQD (%) ■ REC (%)
	0.0										0 10 20 30 40 50 60 70 80 90
	0.2	ASPHALT ROADWAY (S-24-230) (2.5-in.)		0.2							
	0.8	Medium Dense, Moist, Very Pale Brown, Non-Plastic to Low Plasticity, Silty Fine to Coarse SAND (SM/A-2-4), 10YR7/3									
		Stiff, Moist, Red, Low Plasticity to Medium Plasticity, Sandy SILT (ML/A-4), Micaceous, 2.5YR4/8			SS-1	14	7	8	12	15	●
	2.2	Boring Terminated at 2.2-ft. Below Ground Surface. Boring Achieved Target Depth.									
608.6											

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 G7100.007 - TASK 00003 - S-24-230 OVER TOWNSEND CREEK.GPJ SCDOT_DATATEMPLATE.GDT 11/5/24

S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

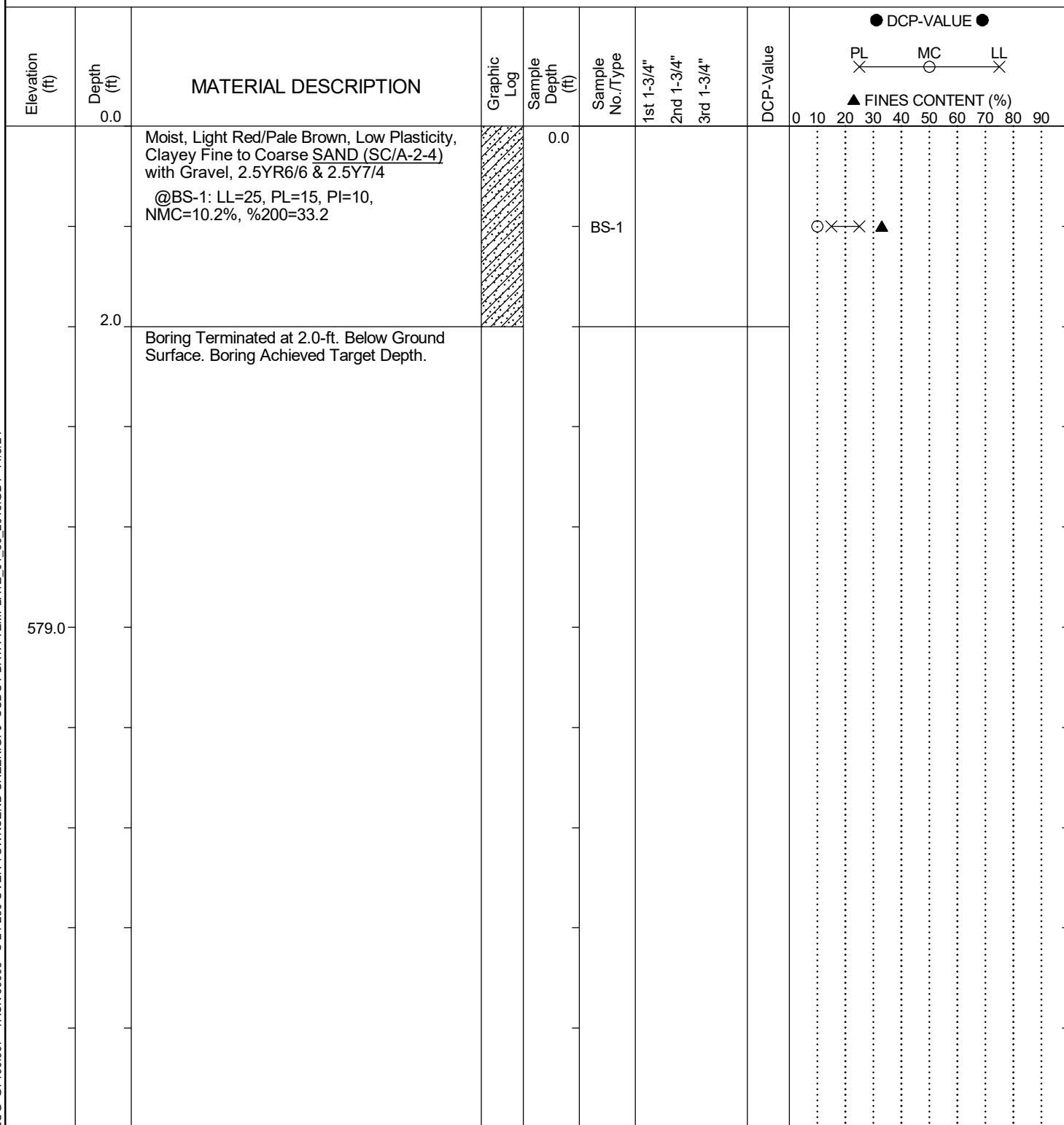
APPENDIX

SECTION 3 SUBSURFACE EXPLORATION LOGS

SECTION 3B MANUAL AUGER BORING (MAB) LOG

SCDOT Manual Auger Log

Project ID:	P043995			County:	Greenwood		Boring No.:	BS-1 @ P-2		
Site Description:	S-24-230 over Townsend Creek						Route:			
Driller:	C. Taylor		Boring Location:	N/A		Offset:	N/A		Alignment:	Existing CL
Elev.:	584.0 ft		Latitude:	34.26994997		Longitude:	-82.2199817		Date Started:	10/23/2024
Total Depth:	2 ft		Groundwater:	TOB		N/A	24 hr Backfilled		Date Completed:	10/23/2024
Dynamic Cone Penetrometer Test Procedure:				ASTM D6951						



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	DCP Dynamic Cone Penetrometer	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	

S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

APPENDIX

SECTION 4 LABORATORY TEST RESULTS

S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

APPENDIX

SECTION 4 LABORATORY TEST RESULTS

SECTION 4A SPLIT-SPOON SAMPLES



SUMMARY OF LABORATORY RESULTS

PROJECT ID P043995 PROJECT NAME S-24-230 over Townsend Creek
PROJECT COUNTY Greenwood

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-1	2.0	62	29	33	9.51	85	CH	35.9			
B-1	6.0	67	38	29	9.51	87	MH	38.9			
B-1	15.0	30	16	14	9.51	61	CL	29.7			
B-2	4.0	66	49	17	4.76	85	MH	38.4			
B-2	10.0	77	39	38	9.51	88	MH	31.4			
B-2	15.0	47	23	24	4.76	77	CL	32.4			
B-2	20.0	32	17	15	9.51	43	SC	21.7			
B-2	25.0	NP	NP	NP	4.76	28	SM	18.1			



CORROSION SERIES SUMMARY (SPLIT-SPOON)

PAGE 1 OF 1

PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood

Borehole	Sample No.	Sample Depth (ft.)	pH of Soil in Distilled Water	Electrical Resistivity (Ω -cm)	Chloride Content (mg/kg (ppm))	Sulfate Content (mg/kg (ppm))
B-1	SS-1/SS-2/ SS-3/SS-4/SS-5	2.0 – 10.0 (Composite)	6.2	5,146	33.87	50.2



INDEX PROPERTIES VERSUS DEPTH

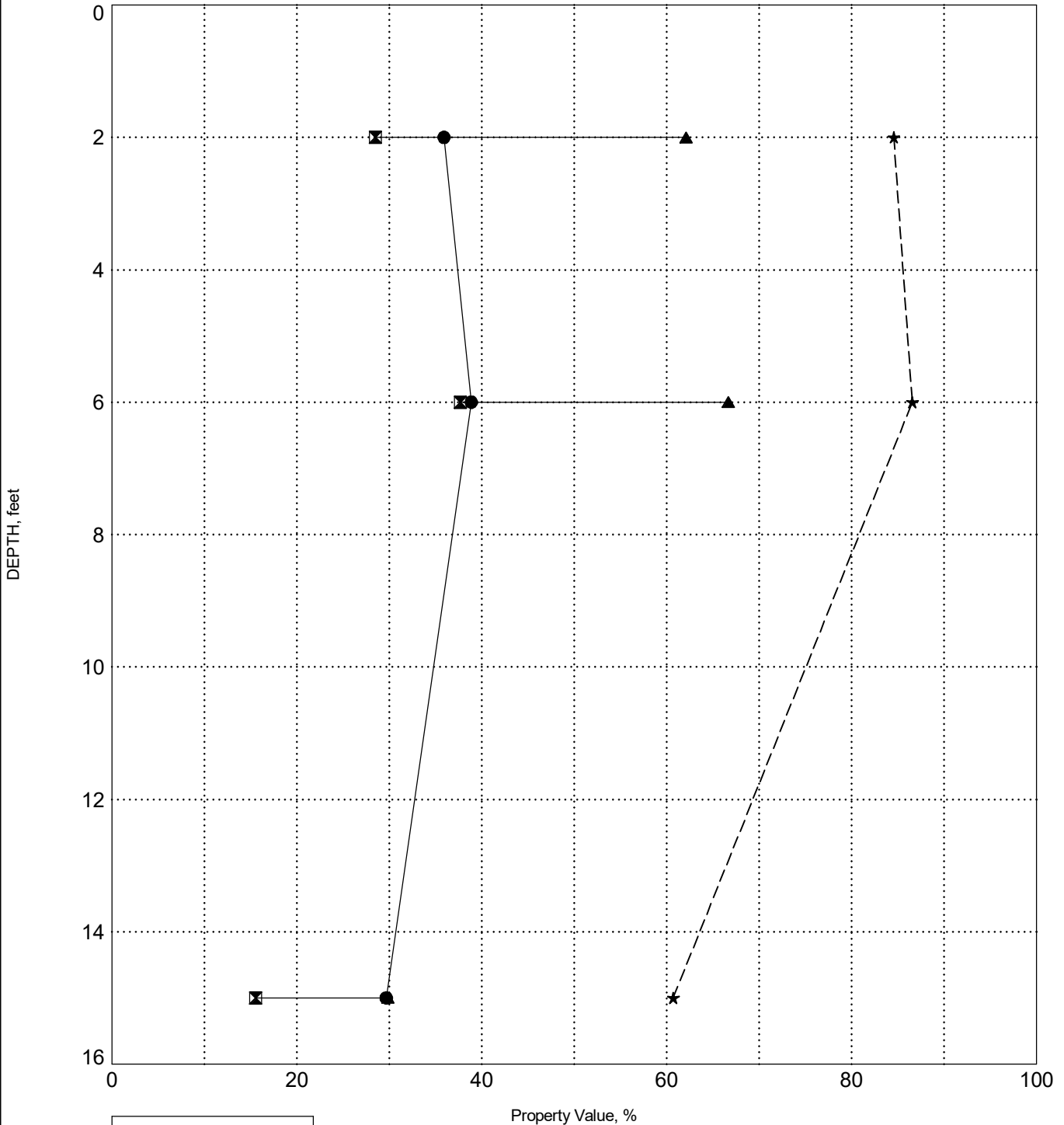
PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood

SURFACE ELEVATION: 581.8

BORING B-1



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

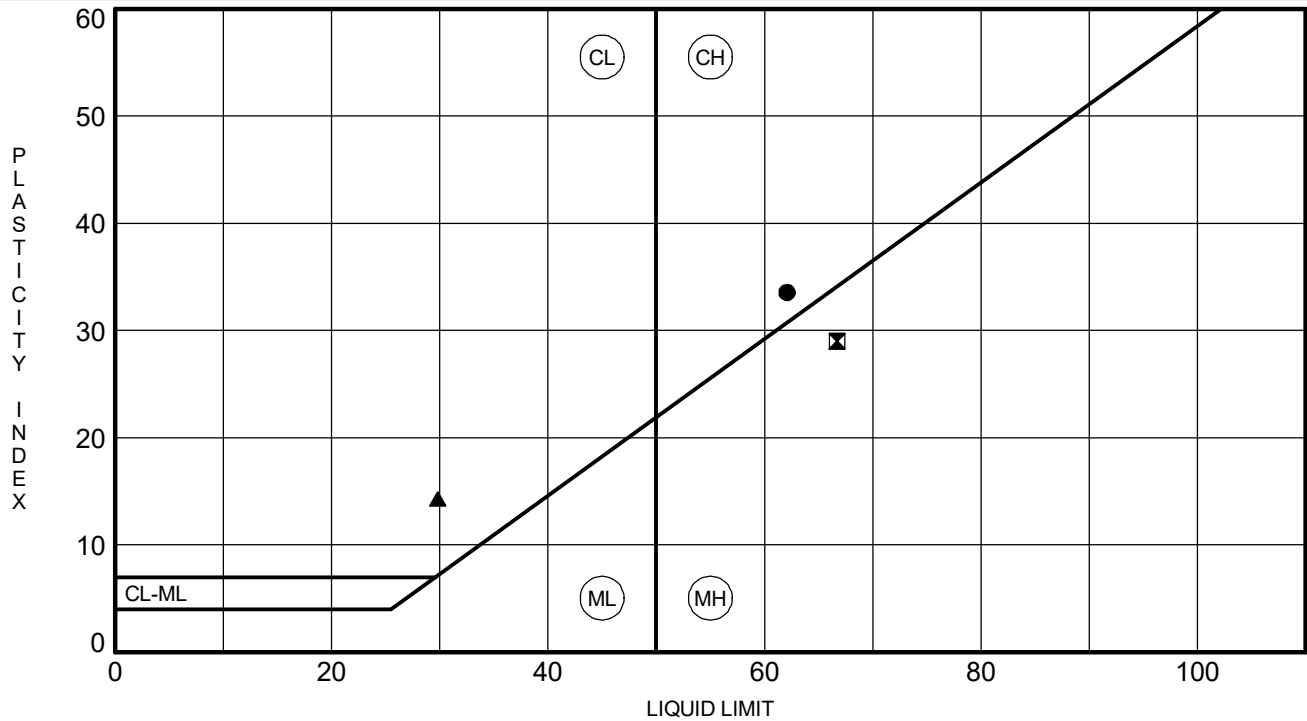


ATTERBERG LIMITS' RESULTS

PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood



ATTERBERG LIMITS G7100.007 - TASK 00003 - S-24-230 OVER TOWNSEND CREEK.GPJ SCDOT DATA TEMPLATE 01_30_2015.GDT 10/31/24

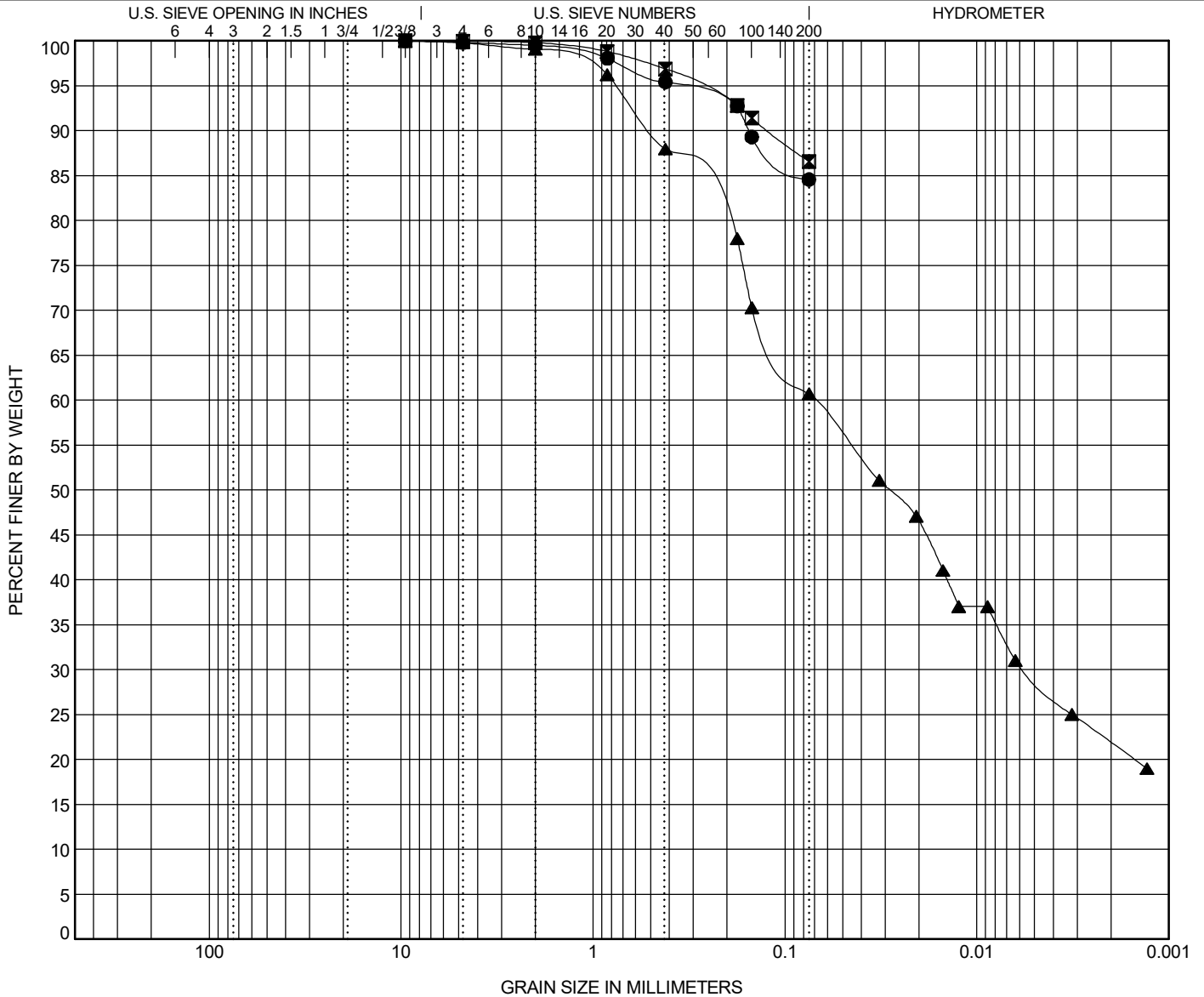


GRAIN SIZE DISTRIBUTION

PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-1	2.0	FAT CLAY with SAND (CH/A-7-6)					62	29	33		
▣ B-1	6.0	ELASTIC SILT (MH/A-7-5)					67	38	29		
▲ B-1	15.0	SANDY LEAN CLAY (CL/A-6)					30	16	14		
BOREHOLE	DEPTH	D90	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● B-1	2.0	0.154				0.2	15.2	84.6			
▣ B-1	6.0	0.122				0.0	13.4	86.6			
▲ B-1	15.0	0.498	0.071	0.006		0.2	39.1	31.7		29.0	

F&ME CONSULTANTS, INC
211 Business Park Blvd.
Columbia, SC 29203

MOISTURE CONTENT DETERMINATION
(AASHTO T265)

PROJECT:	S-24-230 over Townsend Creek	SCDOT PROJECT ID:	P043995
SAMPLE NUMBER:	24-3838	DATE REQUESTED:	10/24/2024
DESCRIPTION OF SOIL:	Various		
TESTED BY:	DH	DATE OF TESTING:	10/25/2024
WEIGHED BY:	AC	DATE OF WEIGHING:	10/28/2024

BORING NO.	B-1	B-1	B-1		
SAMPLE NO.	SS-1	SS-3	SS-6		
SAMPLE DEPTH	0.0 - 2.0	4.0 - 6.0	13.5 - 15.0		
WATER CONTENT, W%	35.9	38.9	29.7		

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

**pH DETERMINATION
(AASHTO T289)**

Project Name:	S-24-230 over Townsend Creek	SCDOT Project ID.:	P043996
Sample Location:	B-1	Sample Elevation/Depth:	2.0 - 10.0
Description of Sample:	Soil (Composite)	Date Received	10/24/2024
Tested By:	L. Johnson	Date Tested:	10/30/2024

SCDOT Sample ID	B-1			
Boring Depth (ft.)	2.0 - 10.0			
FME Lab ID No.	24-3836			
pH Value	6.15			
Temperature (°C)	21.1			

Date Reviewed: 11/4/2024Reviewed By: J.Hiers

**SOIL RESISTIVITY
(AASHTO T288)**

Project Name:	S-24-230 over Townsend Creek	Project ID:	P043995
Location:	B-1	FME Lab ID No.:	24-3836
Sampled By:	BV	Date Sampled:	10/24/2024
Soil Description:	Soil (Composite)	Date Received:	10/24/2024
Tested By:	JM	Date Tested:	10/31/2024

Boring No.	Sample Depth (ft.)	Minimum Soil Resistivity, Ω -cm
B-1	2.0 - 10.0	5,146

Date Reviewed: 11/5/2024 Reviewed By: J. Hiers

CHLORIDE ION CONTENT IN SOILS

AASHTO T 291 - 94 (2018) (Method B)

Client: F&ME Consultants, Inc.
 Client Reference: Townsend Cr. G7100.007
 Project No.: 2024-798-001
 Lab ID: 2024-798-001-001

Boring No.: B-1
 Depth (ft): 6.0-10.0'
 Sample No.: SS-4/SS5
 Description: Brown Soil

(- # 10 Sieve material)

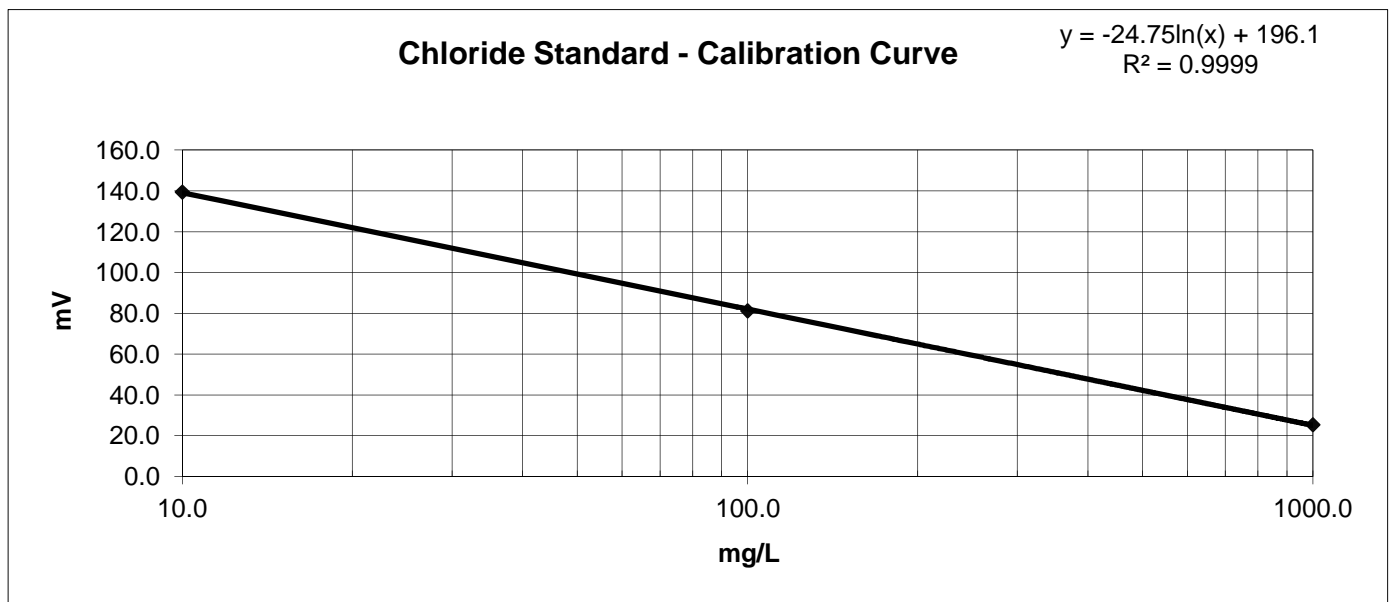
CHLORIDE STANDARD: CALIBRATION CURVE

STANDARD	MILLIVOLTS (mV)
10.0 mg/L	139.5
100.0 mg/L	81.3
1000.0 mg/L	25.5

MEASUREMENT OF CHLORIDES

Sample Weight (g):	100.0	CONCENTRATION	CONCENTRATION
Water added to Sample (ml):	100.0	(mg/L)	(mg/kg)
Size of Sample Aliquot (ml):	25.0		
Sample Reading (mV):	108.9	33.87	33.87

Notes: 1) Samples and standards were buffered by the addition of an equal volume of the 0.2 M KNO₃ solution (1:1 volume).
 2) Samples were dried for a minimum of 12 hours at 110 ± 5°C.



Notes:

Tested By JAM Date 11/1/24 Checked By JLK Date 11/1/24

Water-Soluble Sulfate Ion Content in Soil

AASHTO T 290-95 (2020)

Client: F&ME Consultants, Inc.
 Client Reference: Townsend Cr. G7100.007
 Project No.: 2024-798-001
 Lab ID: 2024-798-001-001

Boring No.: B-1
 Depth (ft): 6.0-10.0'
 Sample No.: SS-4/SS5
 Soil Description: Brown Soil

Sulfate Standard - Calibration Curve Spectrophotometer Readings

<u>Sulfate Ion Concentrations (mg/L)</u>								
0.0	4.0	10.0	20.0	30.0	40.0	60.0	80.0	100.0
<u>Spectrophotometer Readings (FAU)</u>								
Underrange	Underrange	7	20	42	63	112	163	243

Measurement of Barium Chloride Turbidity

(Sample contains 5.0 mL NaCl solution and 0.3 g BaCl₂·2H₂O)

Sample Weight (g): 100.0
 Water added to Sample (mL): 300.0
 Size of Sample Aliquot (mL): 50.0
 Sample Reading (FAU): 11

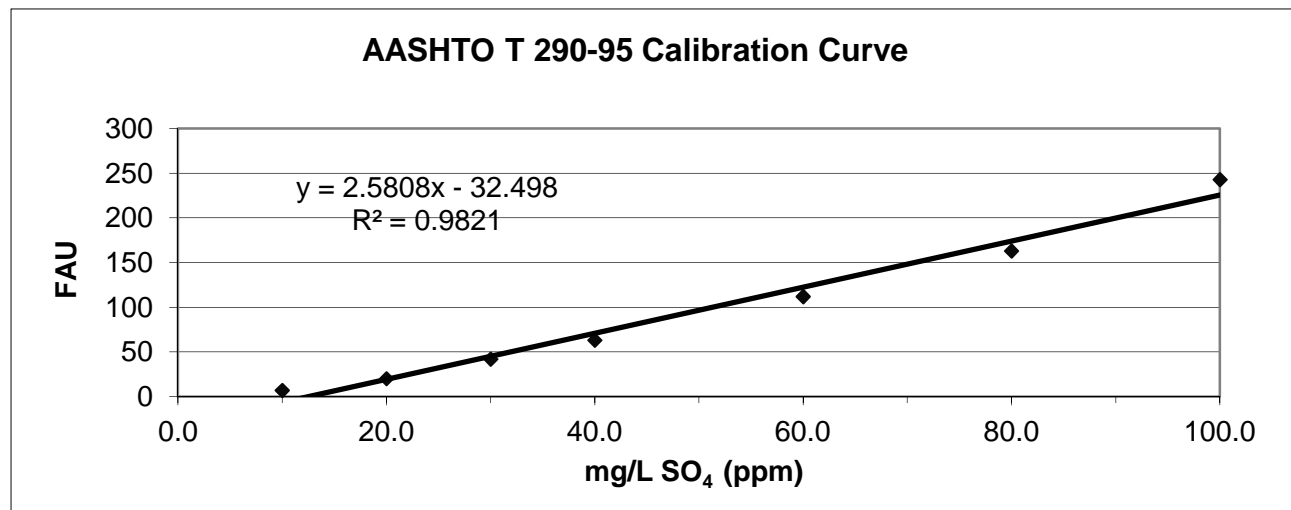
Sample Diluted: No

Sulfate Solution Added (ml): 5

Sample Moisture Content

Tare Number: 424
 Weight of Tare & Wet Sample (g): 198.92
 Weight of Tare & Dry Sample (g): 196.49
 Weight of Tare (g): 91.33
 Weight of Water (g): 2.43
 Weight of Dry Sample (g): 105.16
 Moisture Content (%): 2.31

Sample Sulfate Ion Concentration:	16.35	mg/L SO ₄ (ppm)
Sample Sulfate Ion Content:	49.1	mg/Kg SO ₄ (not corrected for moisture)
Sample Sulfate Ion Content:	50.2	mg/Kg SO ₄ (corrected for moisture)



Tested by: JAM Date: 10/31/24 Checked by: JLK Date: 11/1/24

page 1 of 1 DCN: CT-S87 DATE: 3/5/2020 REVISION: 1



INDEX PROPERTIES VERSUS DEPTH

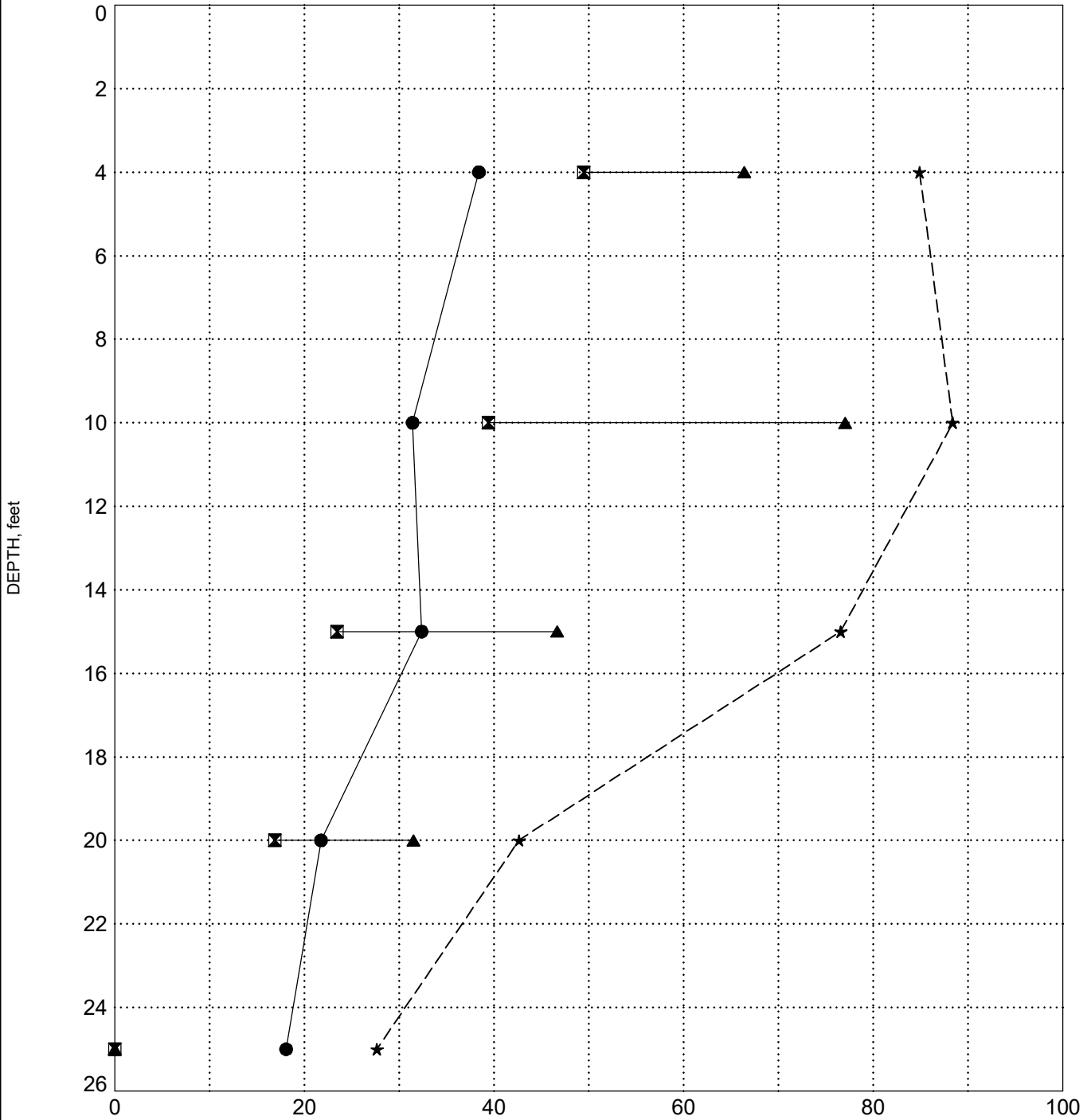
PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood

SURFACE ELEVATION: 584.6

BORING B-2



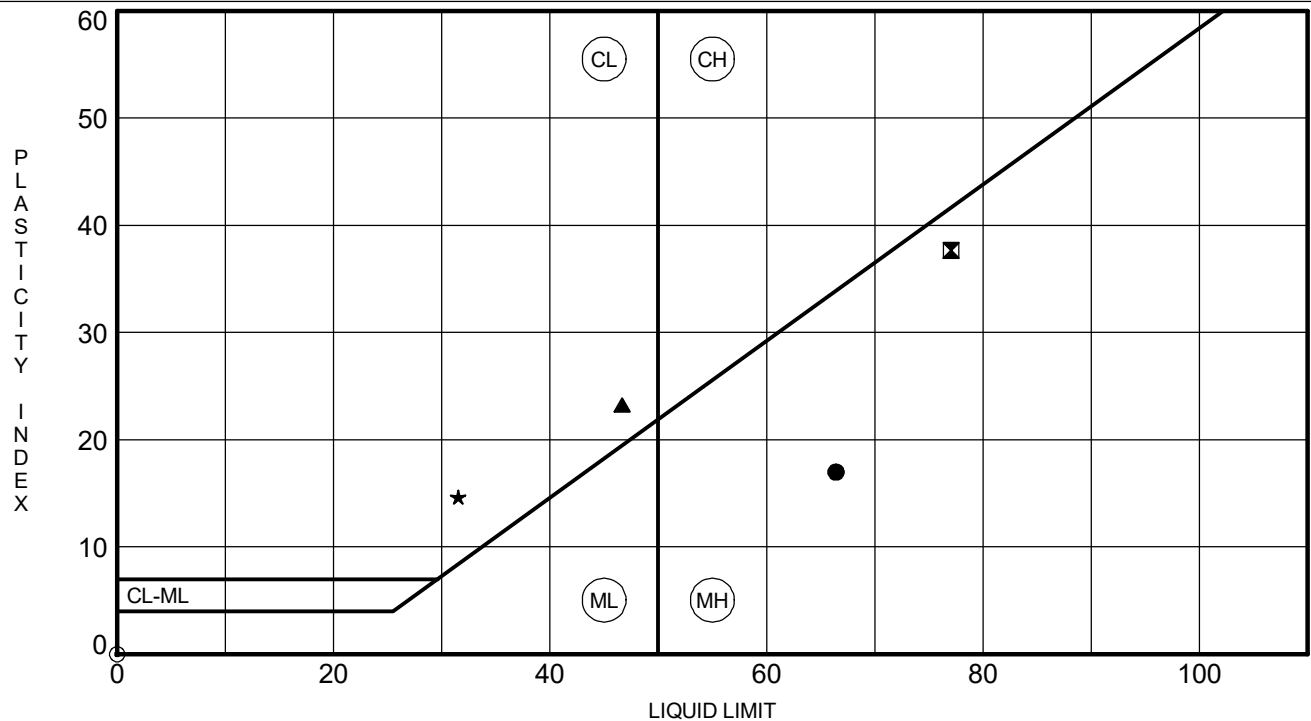
LEGEND	
●	Water Content
⊠	Plastic Limit
▲	Liquid Limit
★	Fines



PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood

[illegible]

ATTENBERG LIMITS G7100.007 - TASK 00003 - S-24-230 OVER TOWNSEND CREEK.GPJ SCDOT DATA TEMPLATE 01 30 2015.GDT 11/1/24

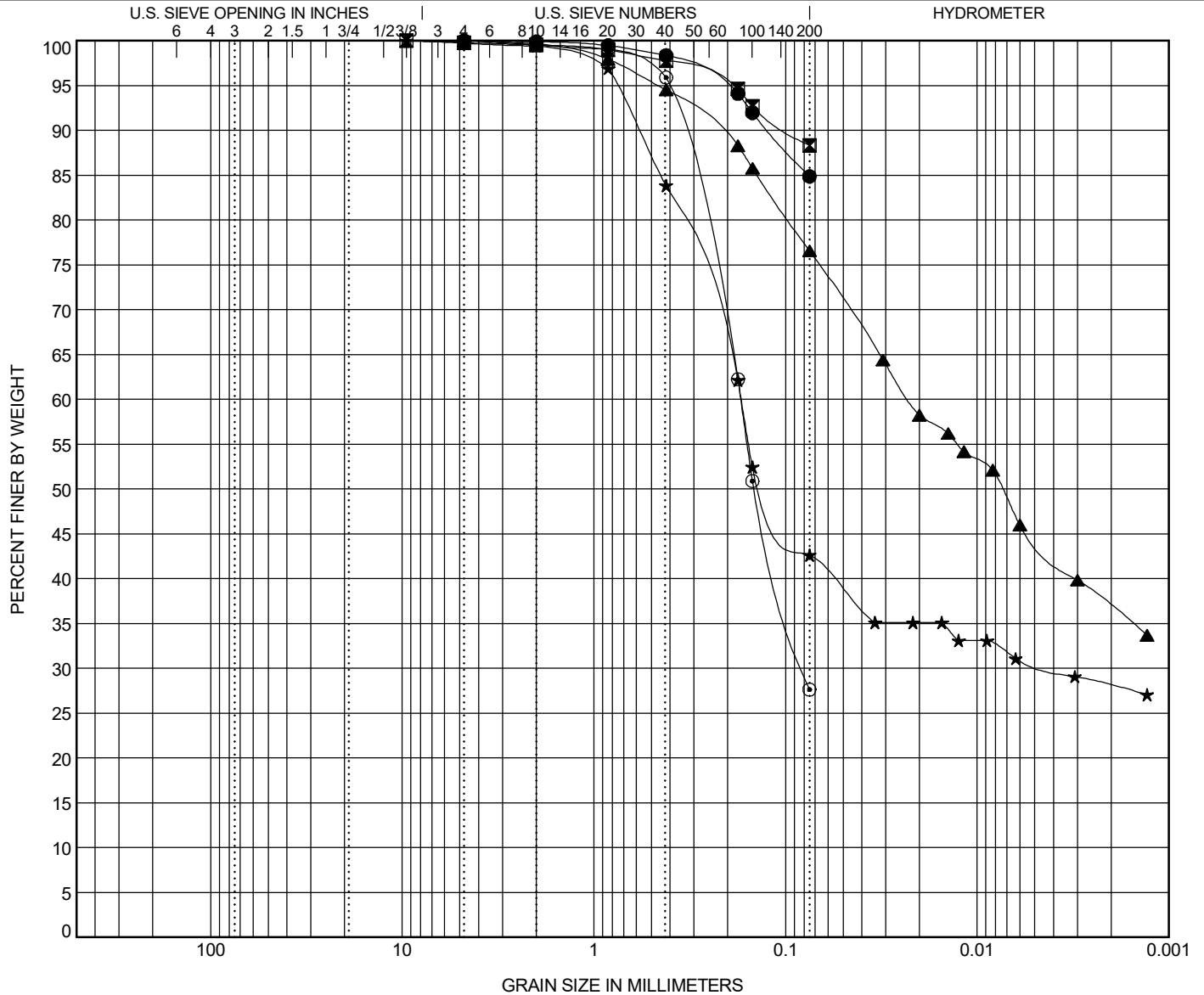


GRAIN SIZE DISTRIBUTION

PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood



BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-2	4.0	ELASTIC SILT with SAND (MH/A-7-5)					66	49	17		
▣ B-2	10.0	ELASTIC SILT (MH/A-7-5)					77	39	38		
▲ B-2	15.0	LEAN CLAY with SAND (CL/A-7-6)					47	23	24		
★ B-2	20.0	CLAYEY SAND (SC/A-6)					32	17	15		
◎ B-2	25.0	SILTY SAND (SM/A-2-4)					NP	NP	NP		
BOREHOLE	DEPTH	D90	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● B-2	4.0	0.123				0.0	15.1	84.9			
▣ B-2	10.0	0.097				0.2	11.4	88.4			
▲ B-2	15.0	0.224	0.023			0.0	23.4	32.2		44.4	
★ B-2	20.0	0.583	0.17	0.004		0.3	57.1	12.2		30.4	
◎ B-2	25.0	0.361	0.171	0.08		0.0	72.4	27.6			

F&ME CONSULTANTS, INC
211 Business Park Blvd.
Columbia, SC 29203

MOISTURE CONTENT DETERMINATION
(AASHTO T265)

PROJECT:	S-24-230 over Townsend Creek	SCDOT PROJECT ID:	P043995
SAMPLE NUMBER:	24-3838	DATE REQUESTED:	10/24/2024
DESCRIPTION OF SOIL:	Various		
TESTED BY:	AAB	DATE OF TESTING:	10/25/2024
WEIGHED BY:	AC	DATE OF WEIGHING:	10/28/2024

BORING NO.	B-2	B-2	B-2	B-2	B-2
SAMPLE NO.	SS-2	SS-4/SS-5	SS-6	SS-7	SS-8
SAMPLE DEPTH	2.0 - 4.0	6.0 - 10.0	13.5 - 15.0	18.5 - 20.0	23.5 - 25.0
WATER CONTENT, W%	38.4	31.4	32.4	21.7	18.1

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

APPENDIX

SECTION 4 LABORATORY TEST RESULTS

SECTION 4B BULK SOIL SAMPLE



SUMMARY OF LABORATORY RESULTS

PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood

Boring No.	Sample Depth (ft.)	Liquid Limit	Plastic Limit	Plasticity Index	%<#200 Sieve	Soil Classification	Moisture Content (%)	Max Dry Density (PCF)	Optimum Moisture Content (%)	C (psi)	ϕ (Degrees)	C' (psi)	ϕ' (Degrees)
BS-1 @ P-2	0.0 – 2.0	25	15	10	33	SC	10.2	118.8	12.5	--	--	--	--



INDEX PROPERTIES VERSUS DEPTH

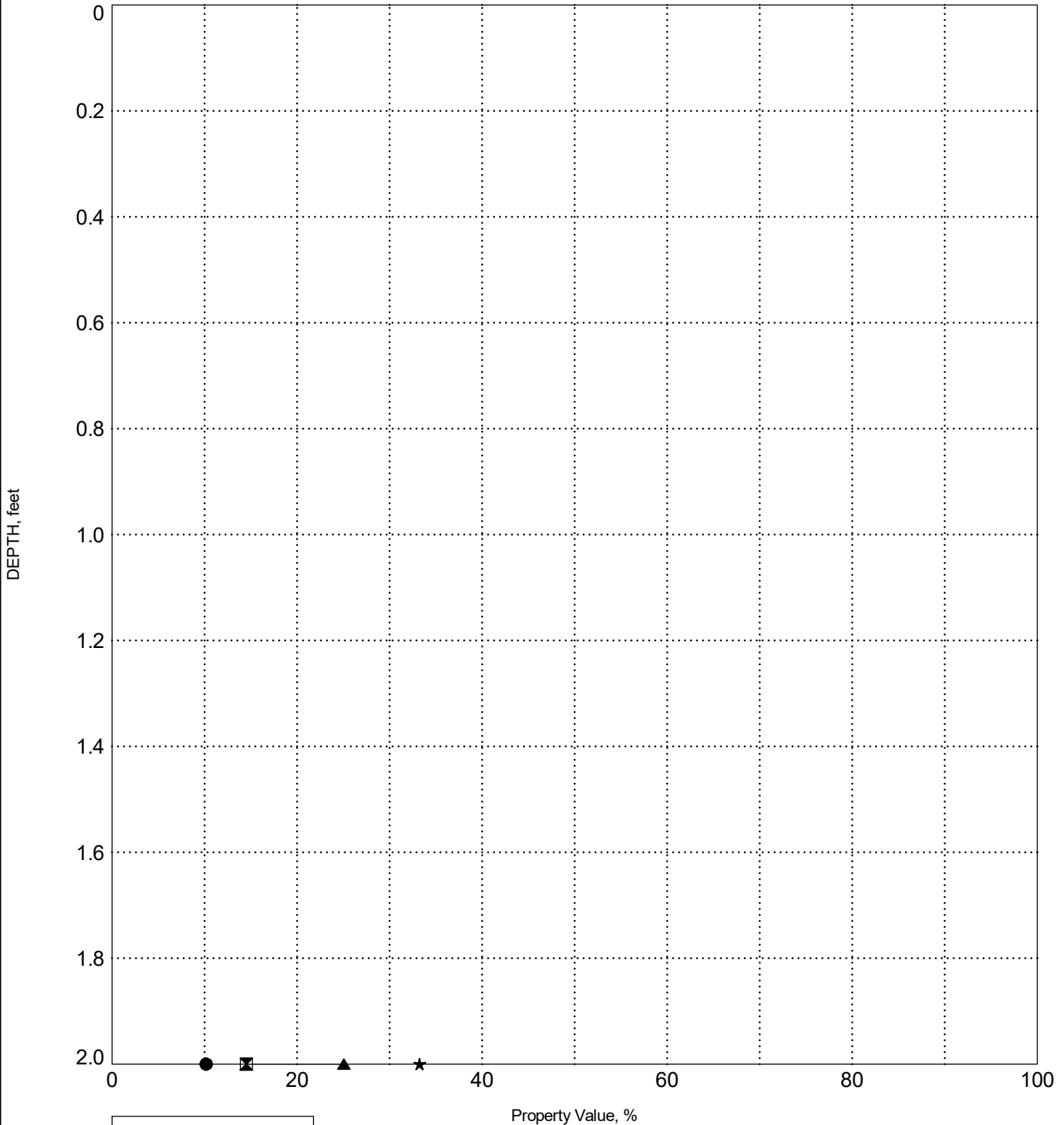
PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood

SURFACE ELEVATION: 584.0

BORING BS-1 @ P-2



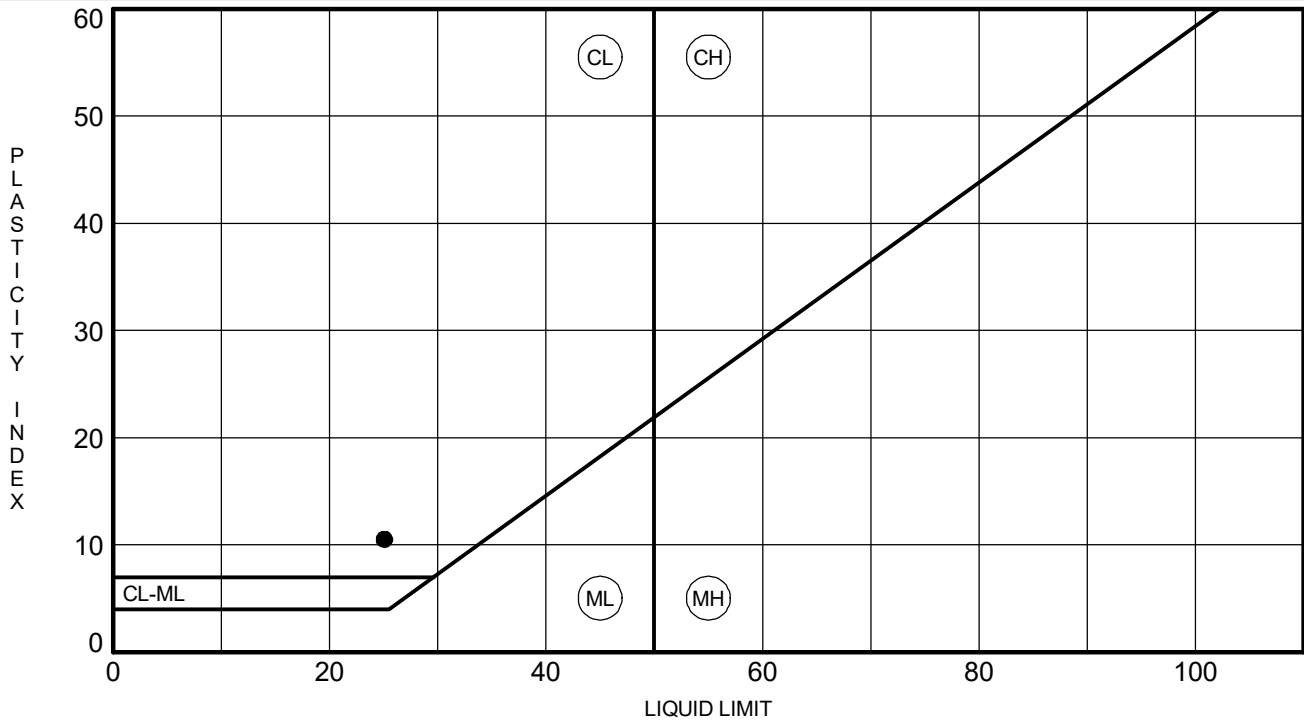
LEGEND	
●	Water Content
☒	Plastic Limit
▲	Liquid Limit
★	Fines

ATTERBERG LIMITS' RESULTS

PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood

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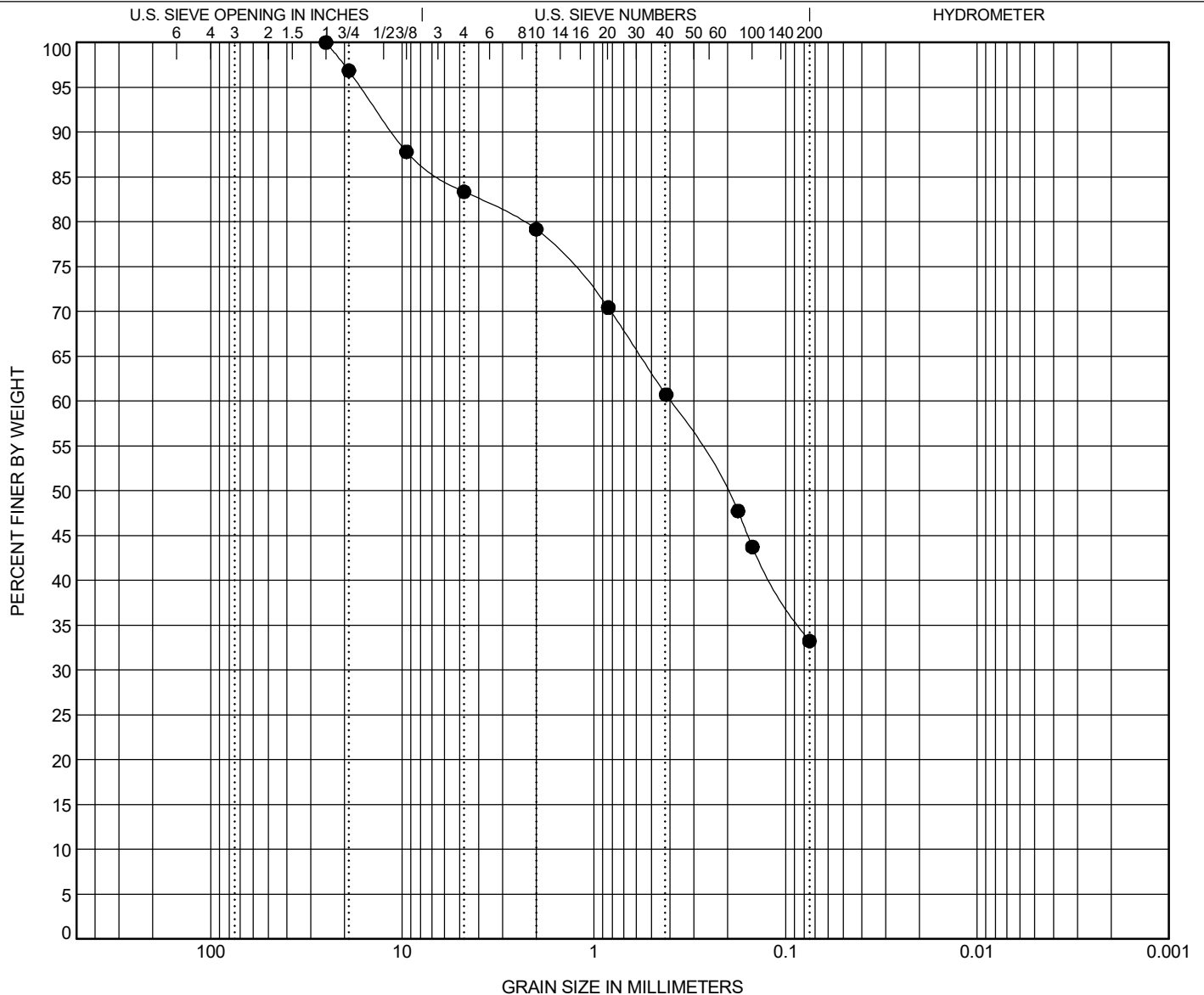


GRAIN SIZE DISTRIBUTION

PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● BS-1 @ P-2	2.0	CLAYEY SAND with GRAVEL (SC/A-2-4)					25	15	10		
BOREHOLE	DEPTH	D90	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● BS-1 @ P-2	2.0	11.24	0.4			16.7	50.1	33.2			

GRAIN SIZE G7100.007 - TASK 00003 - S-24-230 OVER TOWNSEND CREEK.GPJ SCDOT DATA TEMPLATE_01_30_2015.GDT 10/31/24

F&ME CONSULTANTS, INC
211 Business Park Blvd.
Columbia, SC 29203

MOISTURE CONTENT DETERMINATION
(AASHTO T265)

PROJECT:	S-24-230 over Townsend Creek	SCDOT PROJECT ID:	P043995
SAMPLE NUMBER:	24-3834	DATE REQUESTED:	10/24/2024
DESCRIPTION OF SOIL:	CLAYEY SAND with GRAVEL (SC/A-2-4)		
TESTED BY:	AAB/AGB	DATE OF TESTING:	10/25/2024
WEIGHED BY:	JM	DATE OF WEIGHING:	10/28/2024

BORING NO.	BS-1 @ P-2				
SAMPLE NO.	--				
SAMPLE DEPTH	0.0 - 2.0				
WATER CONTENT, W%	10.2				

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

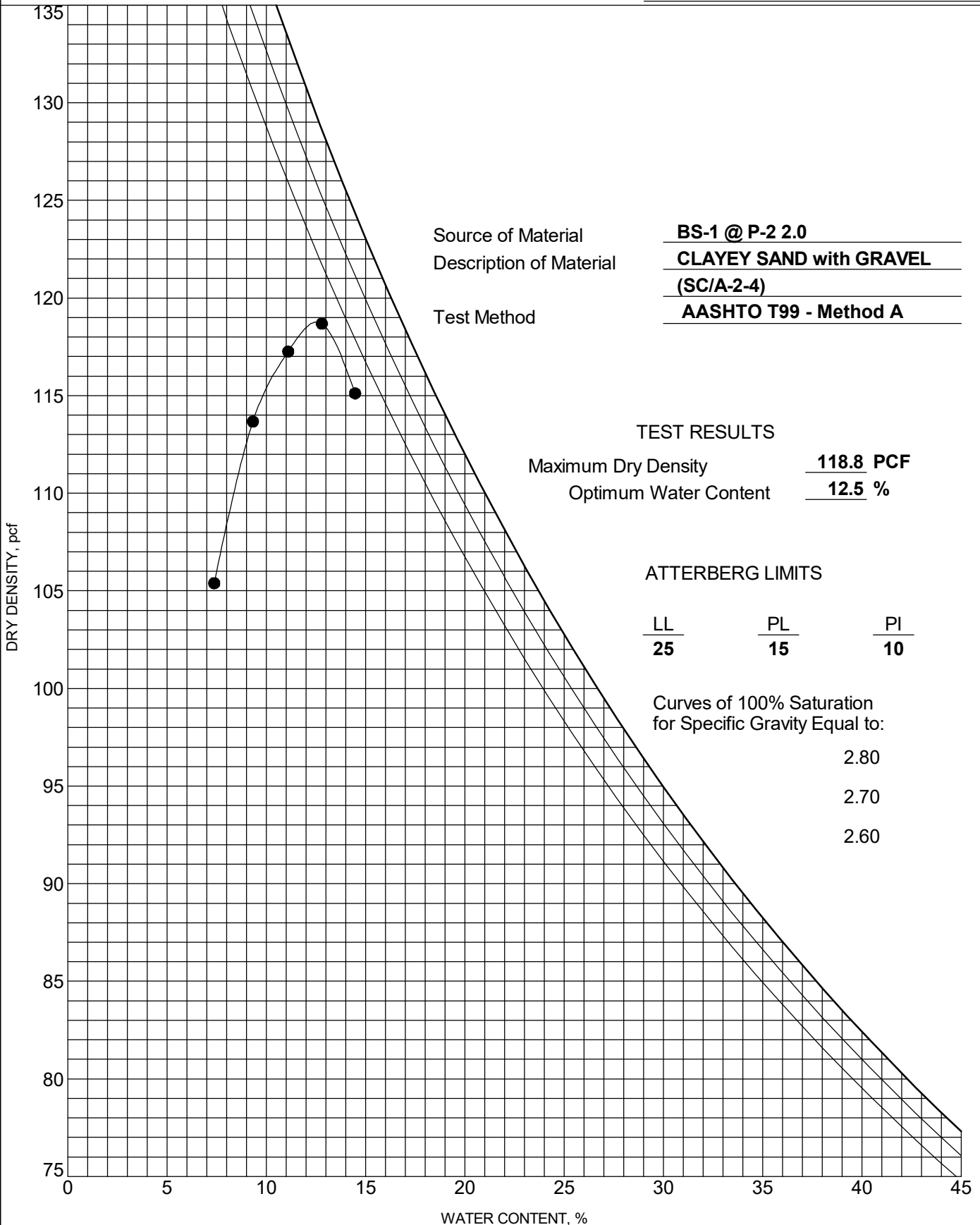


MOISTURE-DENSITY RELATIONSHIP

PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood



CALIFORNIA BEARING RATIO (CBR)
AASHTO T193

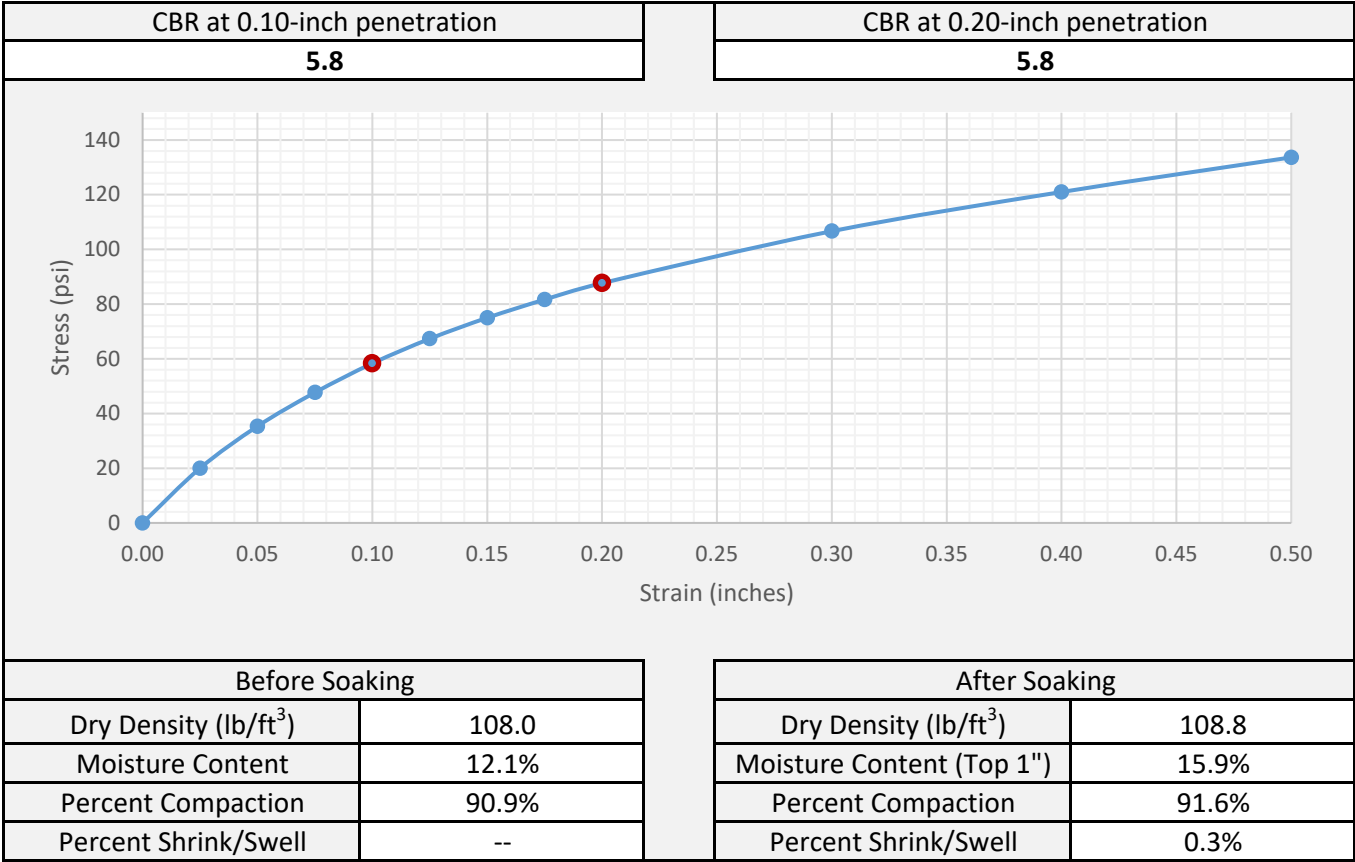
SAMPLE INFORMATION

Project Name	S-24-230 over Townsend Creek			Project No.	G7100.007 - Task 00003
Sample Location	BS-1			FME Lab ID	24-3836
Soil Description	Clayey SAND with Gravel (SC/A-2-4)			Depth/Elev.	0.0 - 2.0
Date Sampled	--	Sampled By:	F&ME	Date Received	10/24/2024
Date Test Began	11/1/2024	Date Completed	11/5/24	Tested By	DH

MOLDING CHARACTERISTICS

Method	AASHTO T99 - Method A	% Retained on 3/4" Sieve	0%
Max Dry Density (lb/ft ³)	118.8	Optimum Moisture Content (%)	12.5
Soak Time (hr)	96	Surcharge Weight (lb)	10.0

TESTING RESULTS



ADDITIONAL COMMENTS

Target %Compaction = 90%

 <div>F&ME Consultants, Inc. 211 Business Park Blvd., Columbia, South Carolina 29203</div>		11/6/24
	Reviewed By	Date

CALIFORNIA BEARING RATIO (CBR)
AASHTO T193

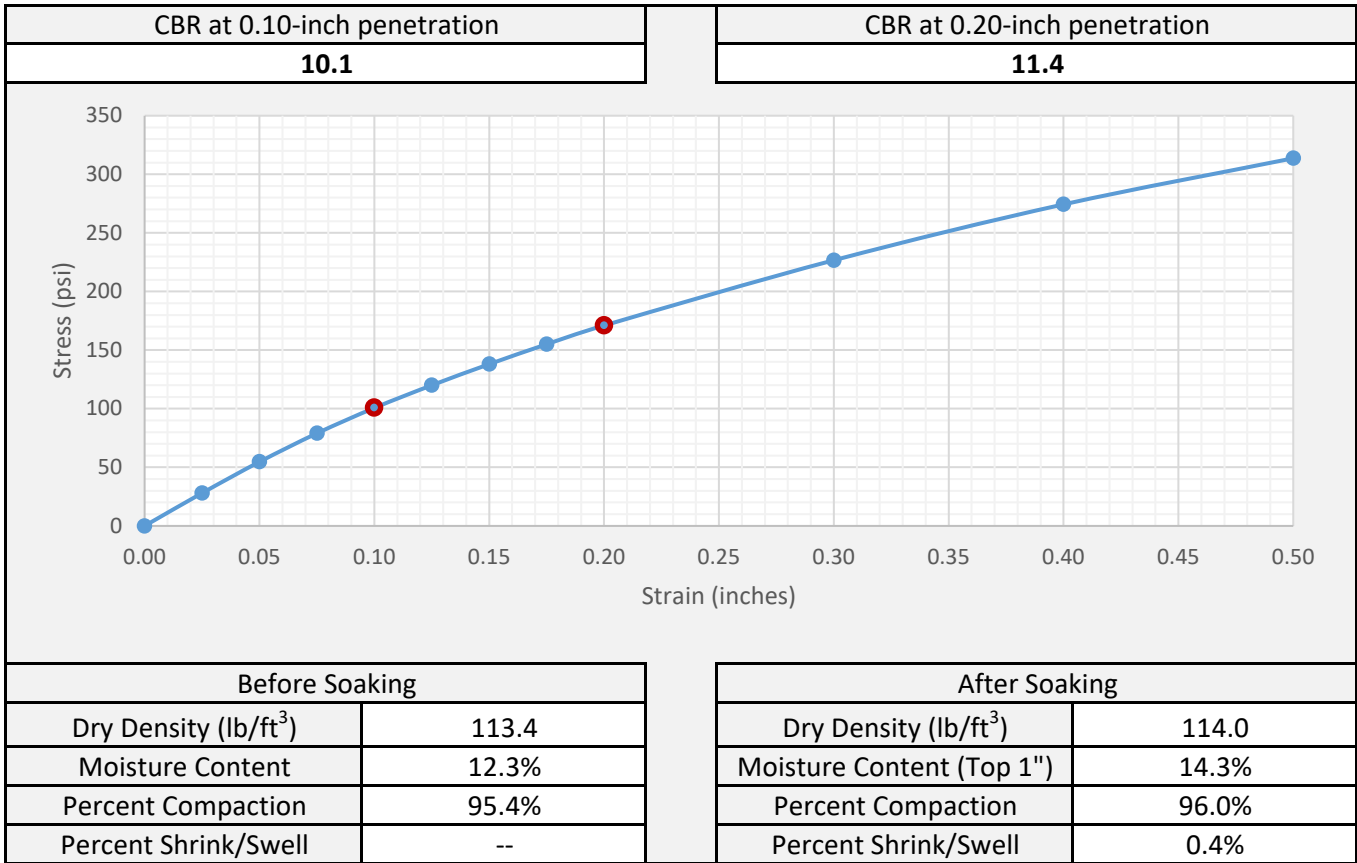
SAMPLE INFORMATION

Project Name	S-24-230 over Townsend Creek			Project No.	G7100.007 - Task 00003
Sample Location	BS-1			FME Lab ID	24-3836
Soil Description	Clayey SAND with Gravel (SC/A-2-4)			Depth/Elev.	0.0 - 2.0
Date Sampled	--	Sampled By:	F&ME	Date Received	10/24/2024
Date Test Began	11/1/2024	Date Completed	11/5/24	Tested By	DH

MOLDING CHARACTERISTICS

Method	AASHTO T99 - Method A	% Retained on 3/4" Sieve	0%
Max Dry Density (lb/ft ³)	118.8	Optimum Moisture Content (%)	12.5
Soak Time (hr)	96	Surcharge Weight (lb)	10.0

TESTING RESULTS



ADDITIONAL COMMENTS

Target %Compaction = 95%

 F&ME Consultants, Inc. 211 Business Park Blvd., Columbia, South Carolina 29203		11/6/24
	Reviewed By	Date

CALIFORNIA BEARING RATIO (CBR)
AASHTO T193

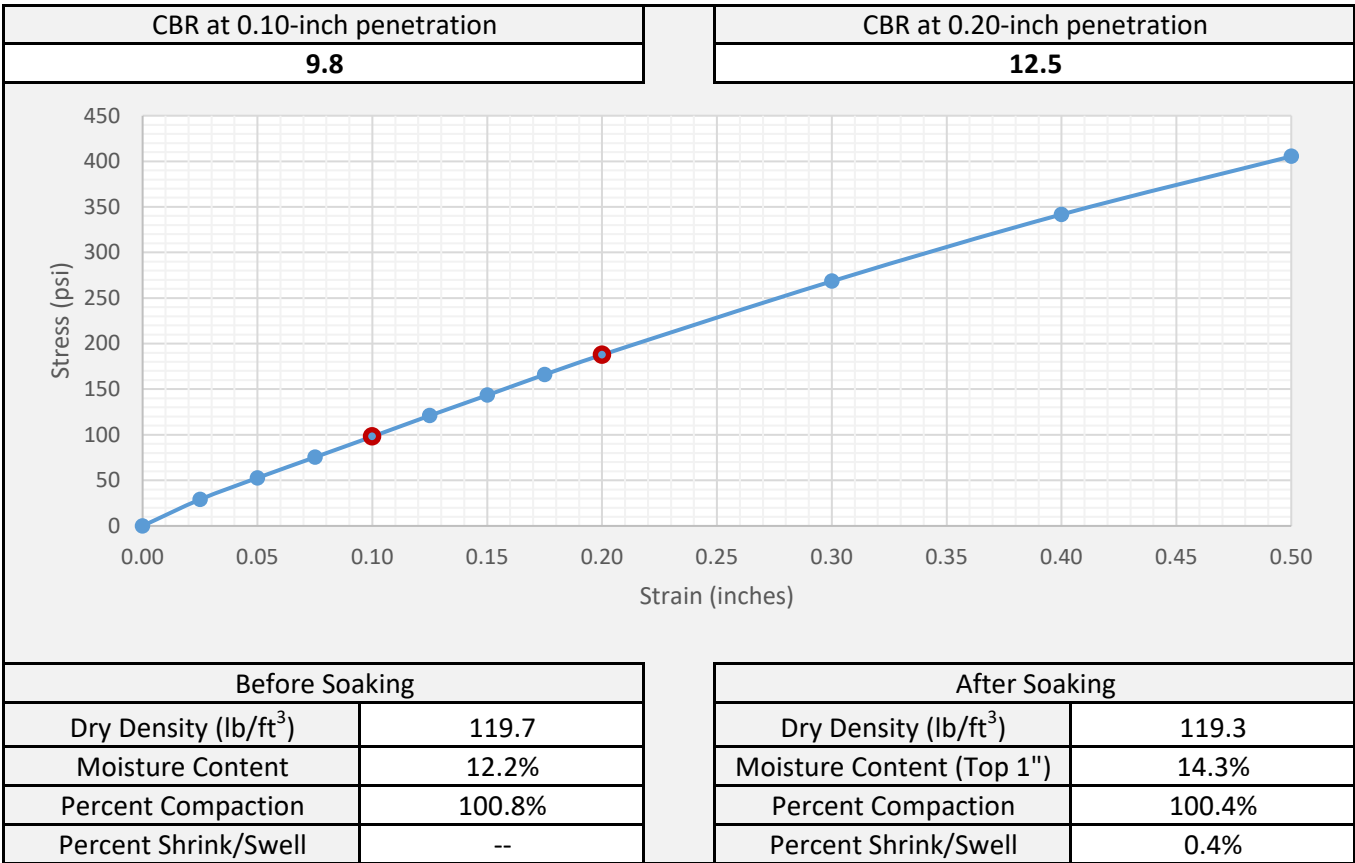
SAMPLE INFORMATION

Project Name	S-24-230 over Townsend Creek			Project No.	G7100.007 - Task 00003
Sample Location	BS-1			FME Lab ID	24-3836
Soil Description	Clayey SAND with Gravel (SC/A-2-4)			Depth/Elev.	0.0 - 2.0
Date Sampled	--	Sampled By:	F&ME	Date Received	10/24/2024
Date Test Began	11/1/2024	Date Completed	11/5/24	Tested By	DH

MOLDING CHARACTERISTICS

Method	AASHTO T99 - Method A	% Retained on 3/4" Sieve	0%
Max Dry Density (lb/ft ³)	118.8	Optimum Moisture Content (%)	12.5
Soak Time (hr)	96	Surcharge Weight (lb)	10.0

TESTING RESULTS



ADDITIONAL COMMENTS

Target %Compaction = 100%

 <div>F&ME Consultants, Inc. 211 Business Park Blvd., Columbia, South Carolina 29203</div>		11/6/24
	Reviewed By	Date

S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

APPENDIX

SECTION 4 LABORATORY TEST RESULTS

SECTION 4C ROCK CORE SAMPLES



Rock Coring Summary

PAGE 1 OF 1

PROJECT ID P043995

PROJECT NAME S-24-230 over Townsend Creek

PROJECT COUNTY Greenwood

Borehole	Core Run Number	Core Run Top Depth	REC (%)	RQD (%)	q _u (psi)	Poisson's Ratio	Elastic Modulus (ksi)	Unit Weight (pcf)	RMR	GSI
B-1	NQ-1	23.3	53	21	11,320	0.56 ¹	7,790	184	26	40
B-1	NQ-2	28.3	84	32	8,990	0.15 ²	3,900	182	31	35
B-1	NQ-3	33.3	50	30	N/A	N/A	N/A	N/A	31	40
B-1	NQ-4	38.3	100	100	16,520	1.23 ³	7,320	185	54	55
B-2	NQ-1	30.0	89	76	8,730	0.59 ⁴	3,840	178	40	50
B-2	NQ-2	35.0	88	88	12,660	0.29 ¹	9,920	181	56	85
B-2	NQ-3	40.0	80	96	14,670	0.43 ¹	10,600	181	53	65
B-2	NQ-4	45.0	98	93	N/A	N/A	N/A	N/A	59	70

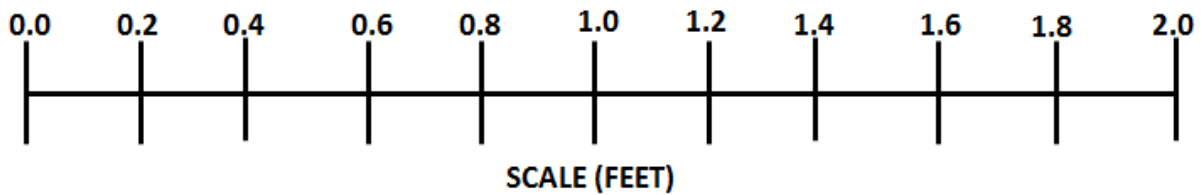
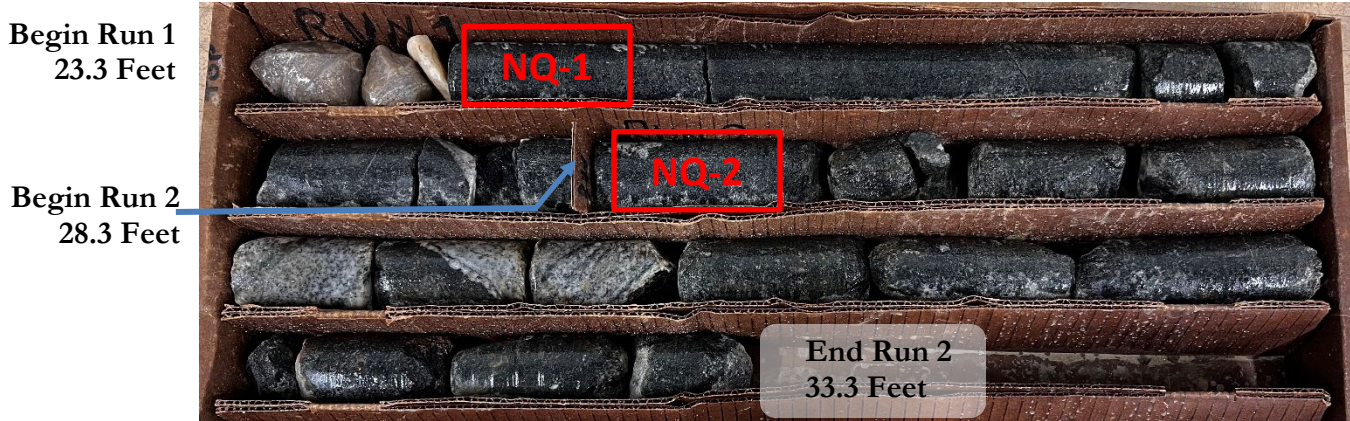
¹Elastic range was taken as between 0.0005 and 0.002 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.

²Elastic 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.

³Elastic range was taken as between 0.0005 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. Please note that Poisson's Ratio is abnormally high and should consider further evaluation.

⁴Elastic range was taken as between 0.0015 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.

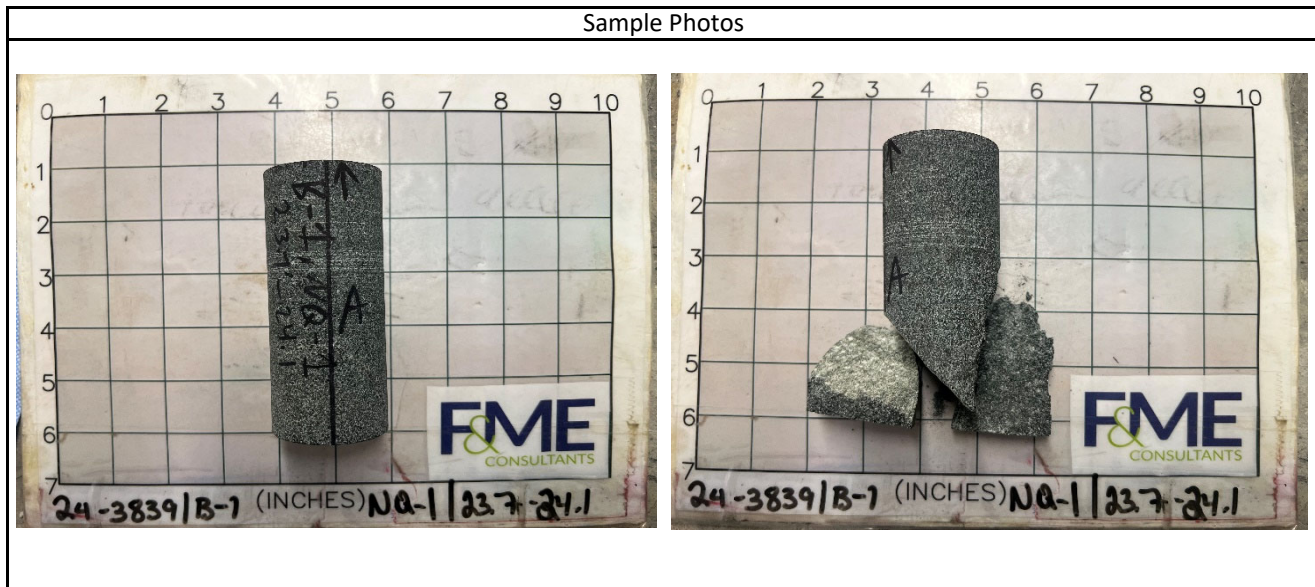
S-24-230 over Townsend Creek CORE PHOTOGRAPHS: B-1



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

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.833	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	4.205	Reviewed By	WJG
Boring	B-1	Unit Weight (pcf)	183.7	Core Size	NQ
Sample No.	NQ-1 / 24-3839	L/D Ratio	2.29	Recovery	53%
Depth	23.7' - 24.1'	Load Rate (psi/sec)	20	RQD	21%
Description	Black/White Amphibolite				

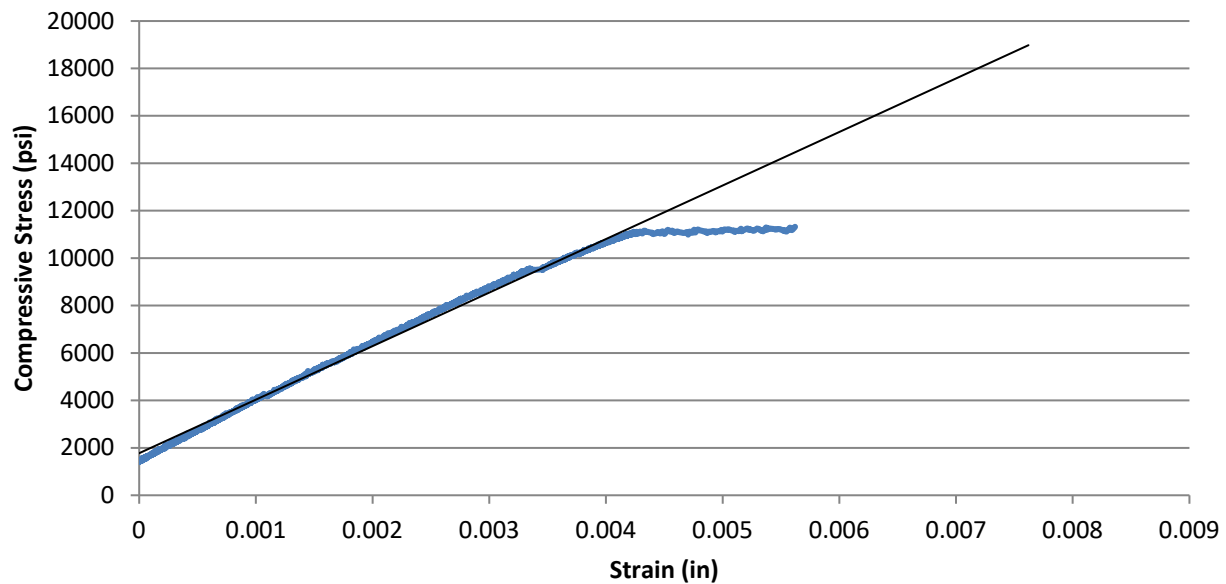
Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	124	-7	2,980	1,129	18.21	-0.06
20%	-316	98	5,971	2,263	14.33	0.31
30%	-745	328	8,964	3,397	9.12	0.44
40%	-1220	741	11,952	4,529	7.42	0.61
50%	-1689	1138	14,936	5,660	6.70	0.67
60%	-2132	1417	17,919	6,790	6.37	0.66
70%	-2613	1923	20,919	7,927	6.07	0.74
80%	-3110	2558	23,888	9,052	5.82	0.82
90%	-3770	3663	26,886	10,189	5.40	0.97
100%	-5620	6278	29,871	11,320		



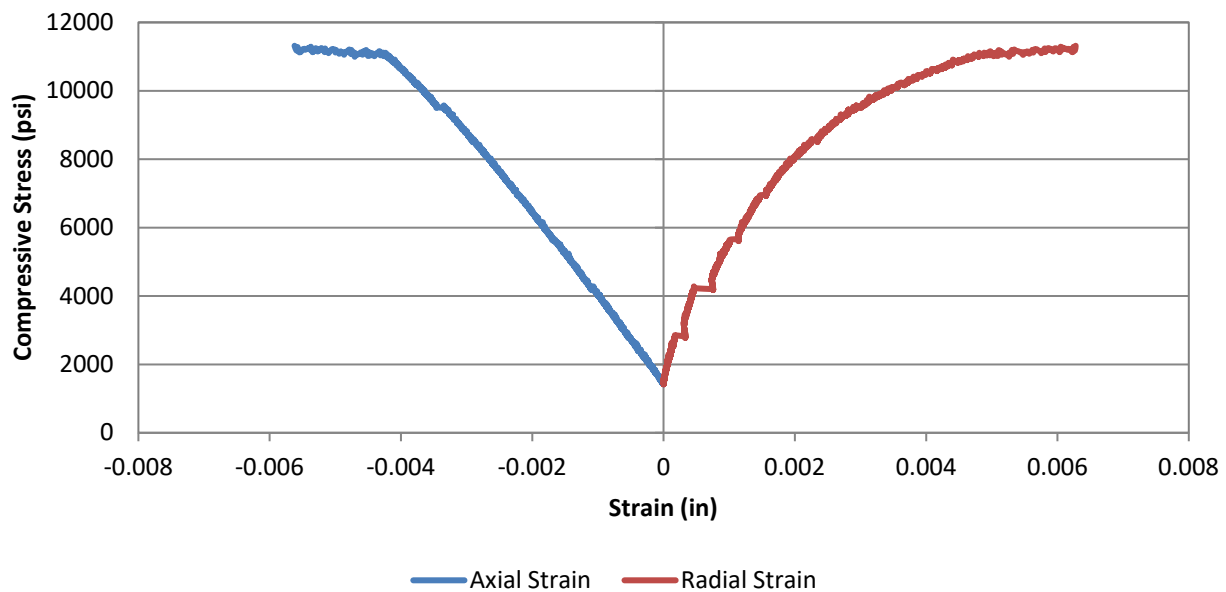
Test Results			
Unconfined Compressive Strength (psi)	11,320	Elastic Modulus (psi)	7.79E+06
		Poisson's Ratio in Elastic Range	0.56
Comments	Elastic range was taken as between 0.0005 and 0.002 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.		

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.833	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	4.205	Reviewed By	WJG
Boring	B-1	Unit Weight (pcf)	183.7	Core Size	NQ
Sample No.	NQ-1 / 24-3839	L/D Ratio	2.29	Recovery	53%
Depth	23.7' - 24.1'	Load Rate (psi/sec)	20	RQD	21%
Description	Black/White Amphibolite				

Axial Stress vs. Strain



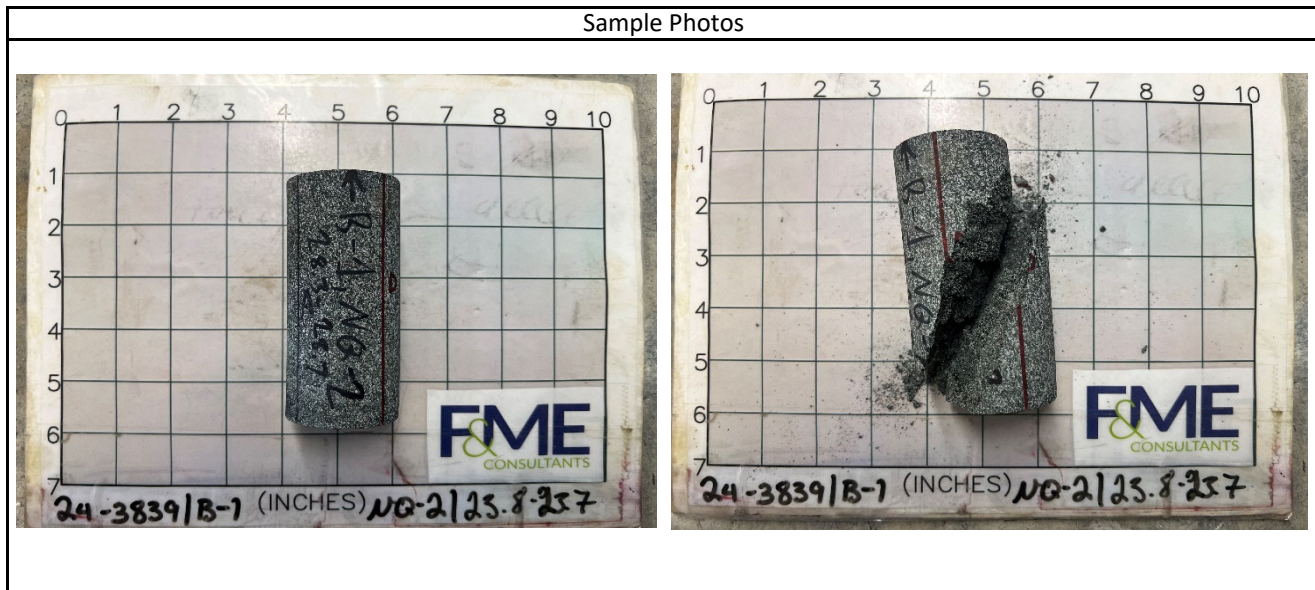
Stress vs. Strain



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

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.834	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	3.955	Reviewed By	WJG
Boring	B-1	Unit Weight (pcf)	181.7	Core Size	NQ
Sample No.	NQ-2 / 24-3839	L/D Ratio	2.16	Recovery	84%
Depth	28.3' - 28.7'	Load Rate (psi/sec)	20	RQD	32%
Description	Black/White Metagabbro				

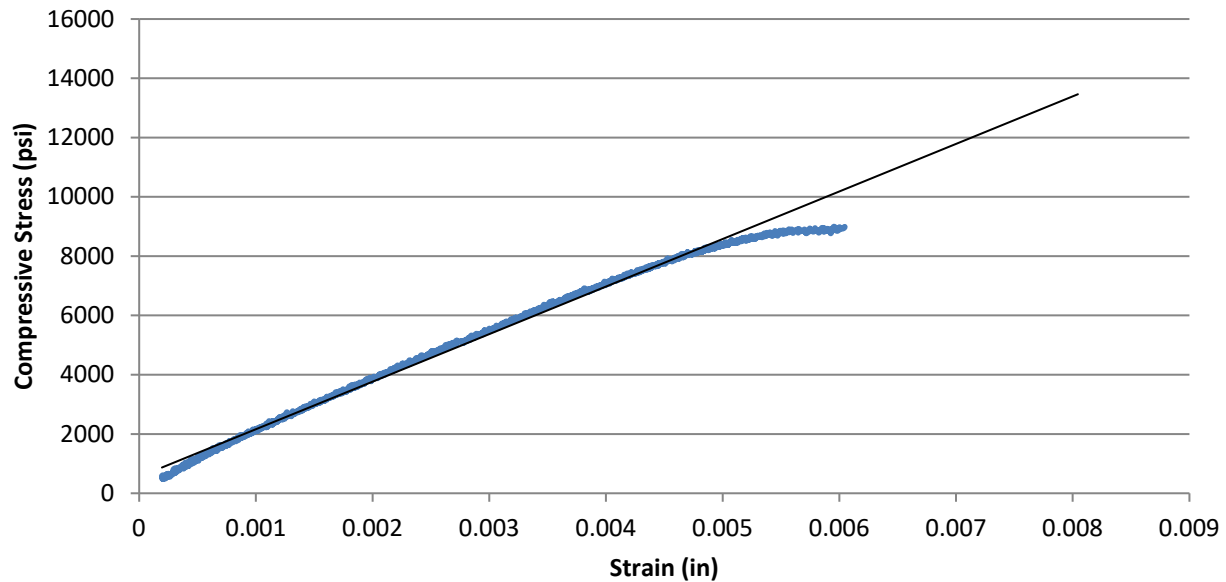
Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	-374	123	2,374	899	4.80	0.33
20%	-823	183	4,749	1,798	4.37	0.22
30%	-1319	217	7,125	2,697	4.09	0.16
40%	-1869	238	9,498	3,595	3.85	0.13
50%	-2380	283	11,877	4,496	3.78	0.12
60%	-2935	557	14,232	5,387	3.67	0.19
70%	-3471	757	16,623	6,293	3.63	0.22
80%	-4085	1170	18,997	7,191	3.52	0.29
90%	-4735	2228	21,377	8,092	3.42	0.47
100%	-6045	7907	23,745	8,989		



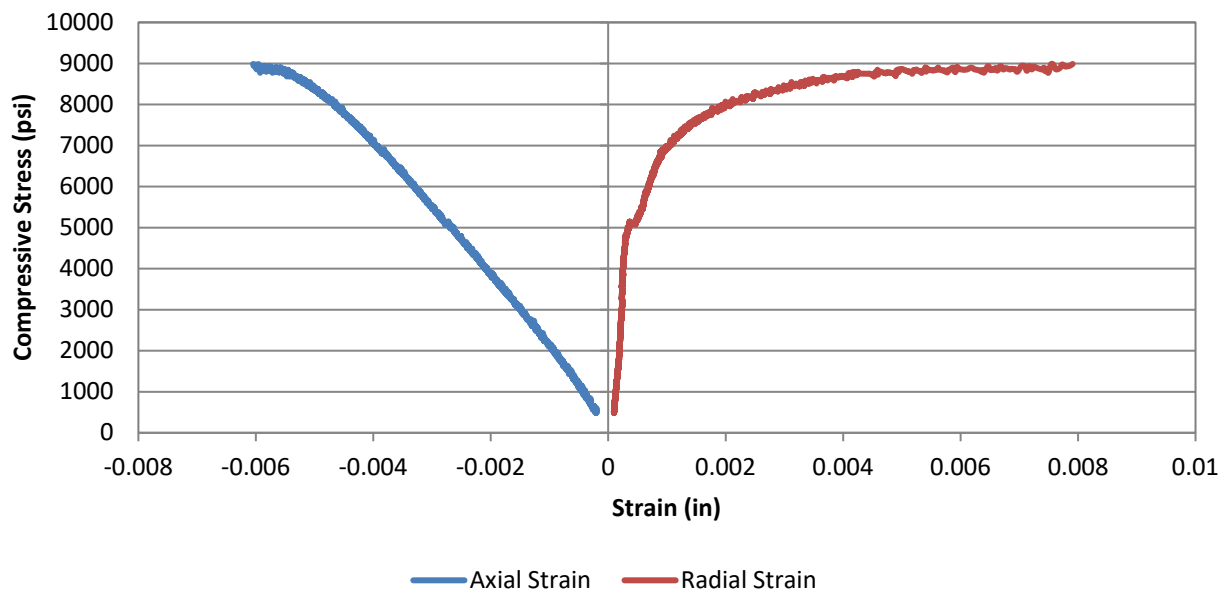
Test Results			
Unconfined Compressive Strength (psi)		8,990	Elastic Modulus (psi)
			3.90E+06
			Poisson's Ratio in Elastic Range
			0.15
Comments	Elastic range was taken as between 0.001 and 0.003 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.		

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.834	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	3.955	Reviewed By	WJG
Boring	B-1	Unit Weight (pcf)	181.7	Core Size	NQ
Sample No.	NQ-2 / 24-3839	L/D Ratio	2.16	Recovery	84%
Depth	28.3' - 28.7'	Load Rate (psi/sec)	20	RQD	32%
Description	Black/White Metagabbro				

Axial Stress vs. Strain



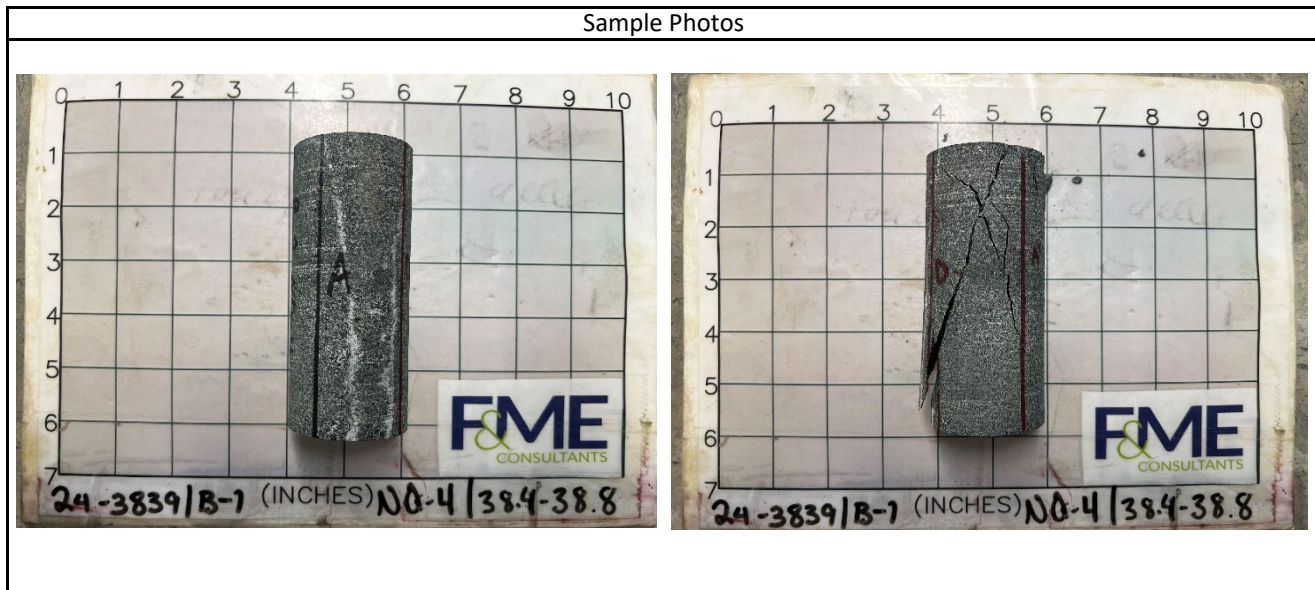
Stress vs. Strain



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

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.828	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	4.477	Reviewed By	WJG
Boring	B-1	Unit Weight (pcf)	185.0	Core Size	NQ
Sample No.	NQ-4 / 24-3839	L/D Ratio	2.45	Recovery	100%
Depth	38.4' - 38.8'	Load Rate (psi/sec)	20	RQD	100%
Description	Black/Gray Amphibolite/Metagranodiorite				

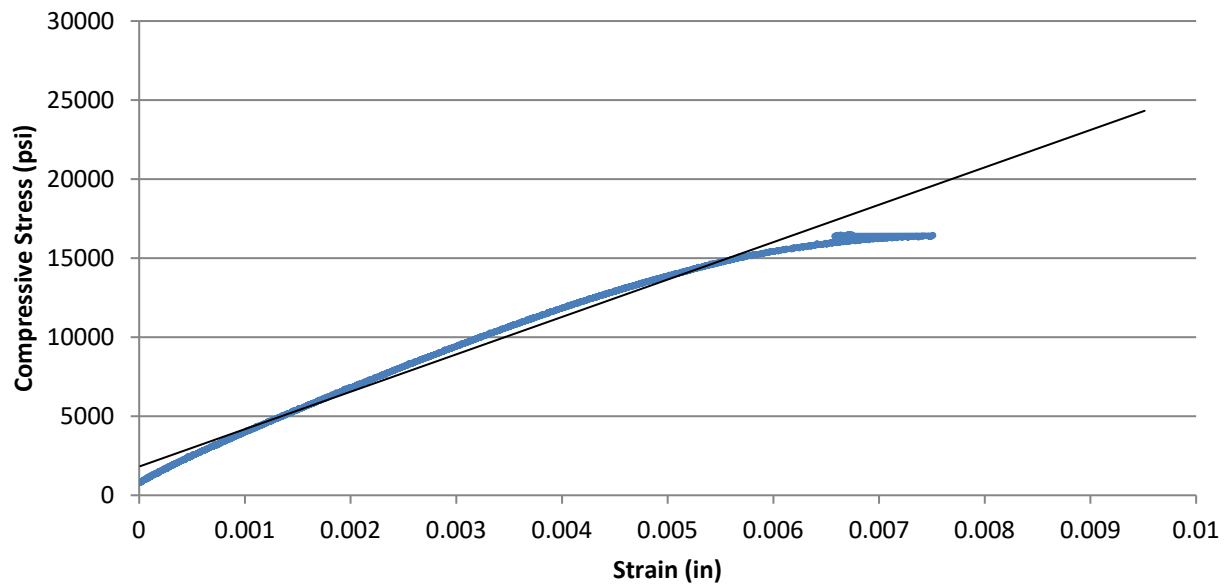
Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	-243	288	4,329	1,649	13.58	1.19
20%	-762	792	8,675	3,306	8.67	1.04
30%	-1332	1816	12,999	4,953	7.44	1.36
40%	-1915	2481	17,320	6,599	6.89	1.30
50%	-2534	3179	21,682	8,261	6.52	1.25
60%	-3195	3984	26,012	9,911	6.20	1.25
70%	-3866	4966	30,349	11,564	5.98	1.28
80%	-4650	6490	34,678	13,213	5.68	1.40
90%	-5565	9219	39,013	14,865	5.34	1.66
100%	-6703	15833	43,351	16,518		



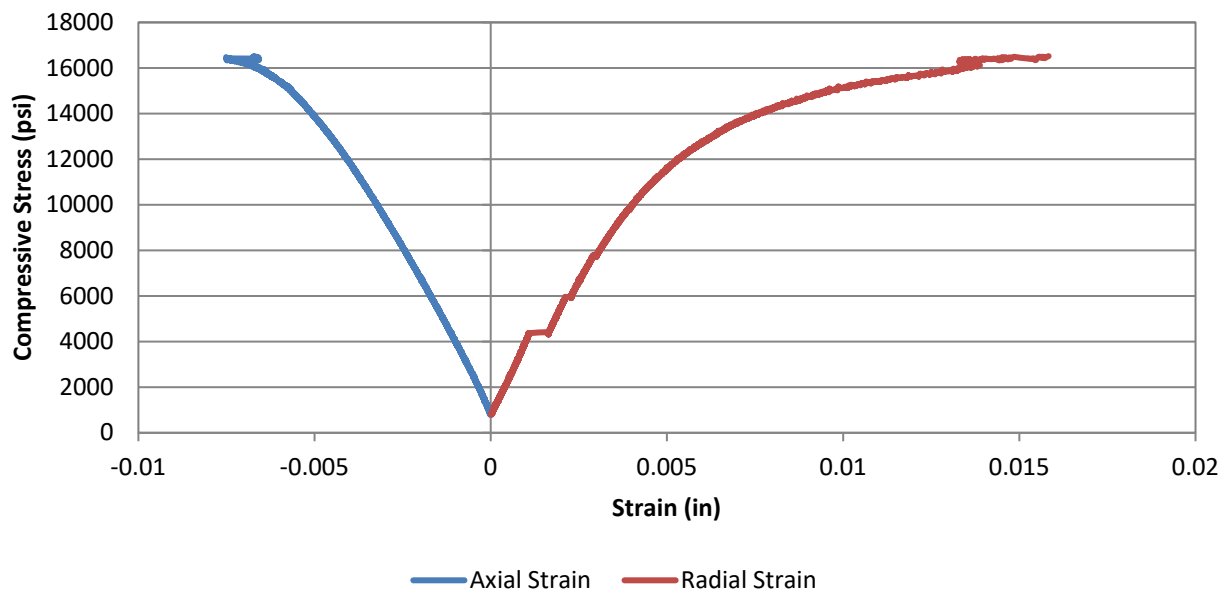
Test Results				
Unconfined Compressive Strength (psi)		16,520	Elastic Modulus (psi)	7.32E+06
			Poisson's Ratio in Elastic Range	1.23
Comments	Elastic range was taken as between 0.0005 and 0.003 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range. Please note that Poisson's Ratio is abnormally high and should consider futher evaluation.			

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.828	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	4.477	Reviewed By	WJG
Boring	B-1	Unit Weight (pcf)	185.0	Core Size	NQ
Sample No.	NQ-4 / 24-3839	L/D Ratio	2.45	Recovery	100%
Depth	38.4' - 38.8'	Load Rate (psi/sec)	20	RQD	100%
Description	Black/Gray Amphibolite/Metagranodiorite				

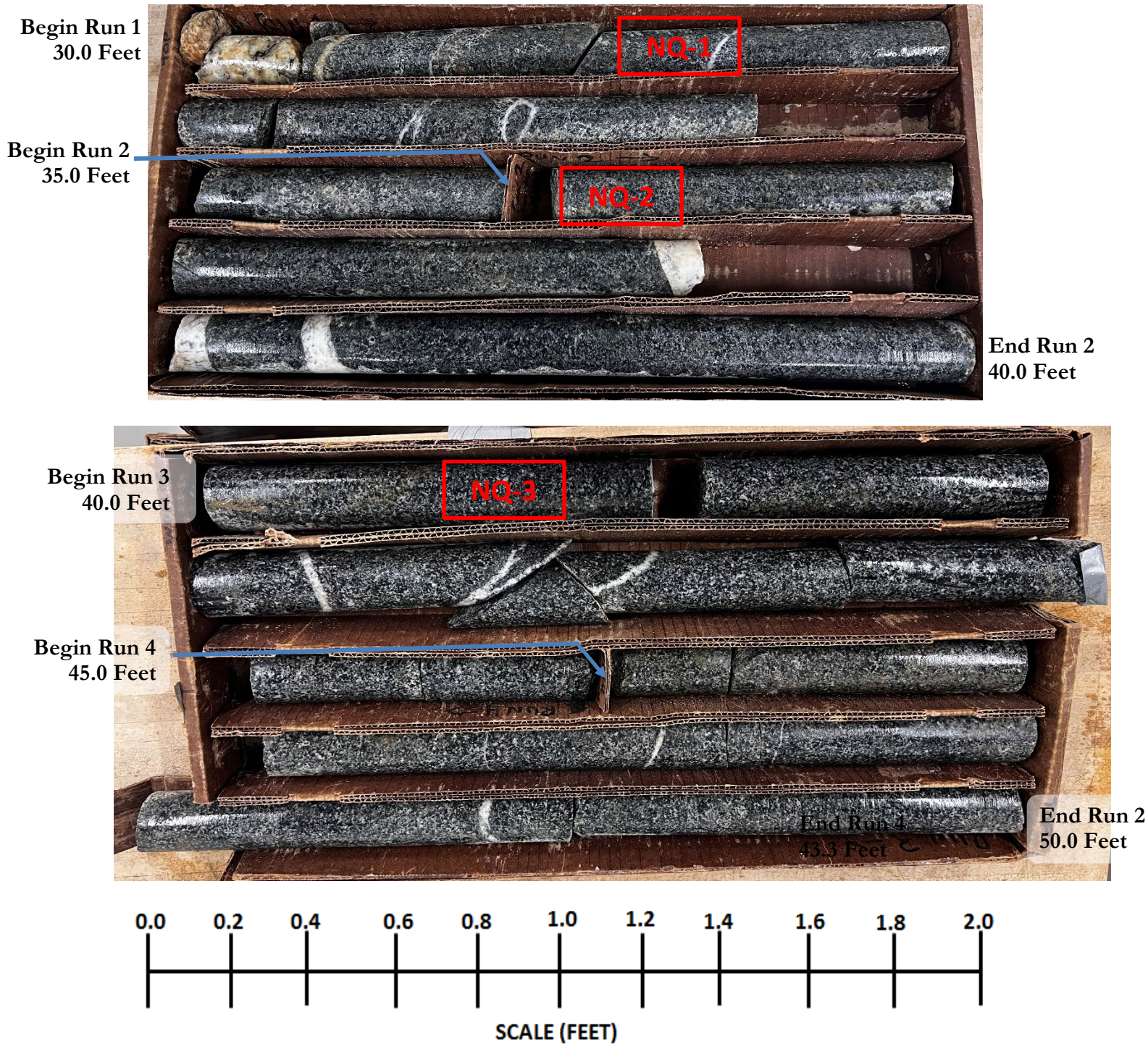
Axial Stress vs. Strain



Stress vs. Strain



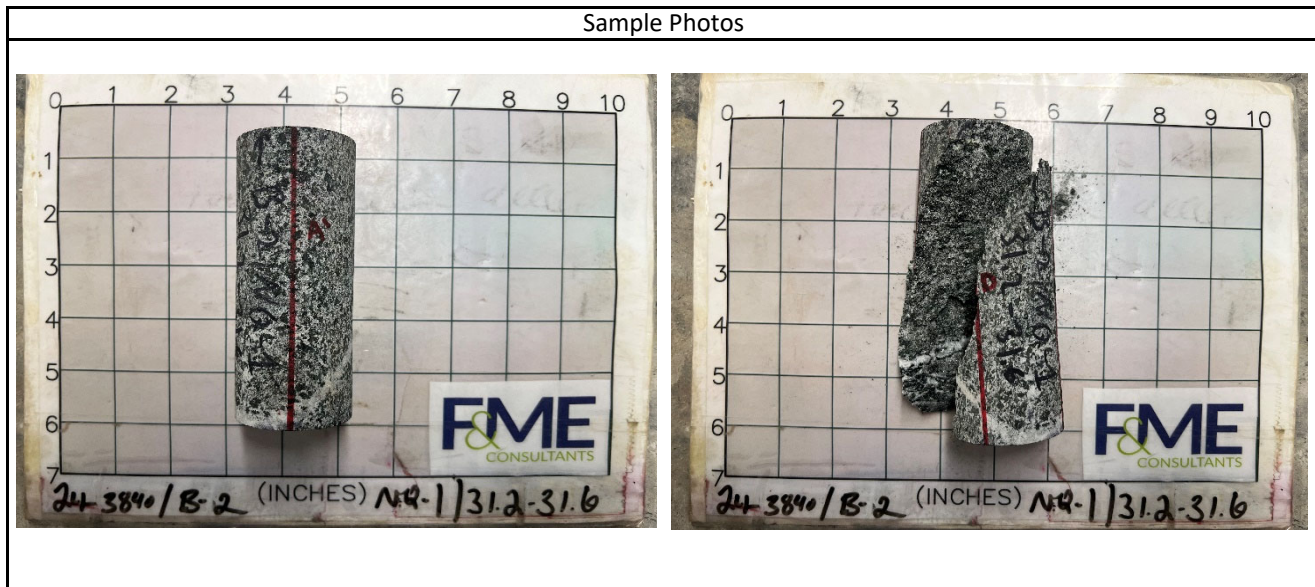
S-24-230 over Townsend Creek CORE PHOTOGRAPHS: B-2



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

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.844	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	4.491	Reviewed By	WJG
Boring	B-2	Unit Weight (pcf)	177.5	Core Size	NQ
Sample No.	NQ-1 / 24-3840	L/D Ratio	2.44	Recovery	89%
Depth	31.2' - 31.6'	Load Rate (psi/sec)	20	RQD	76%
Description	Black/Gray Metagabbro				

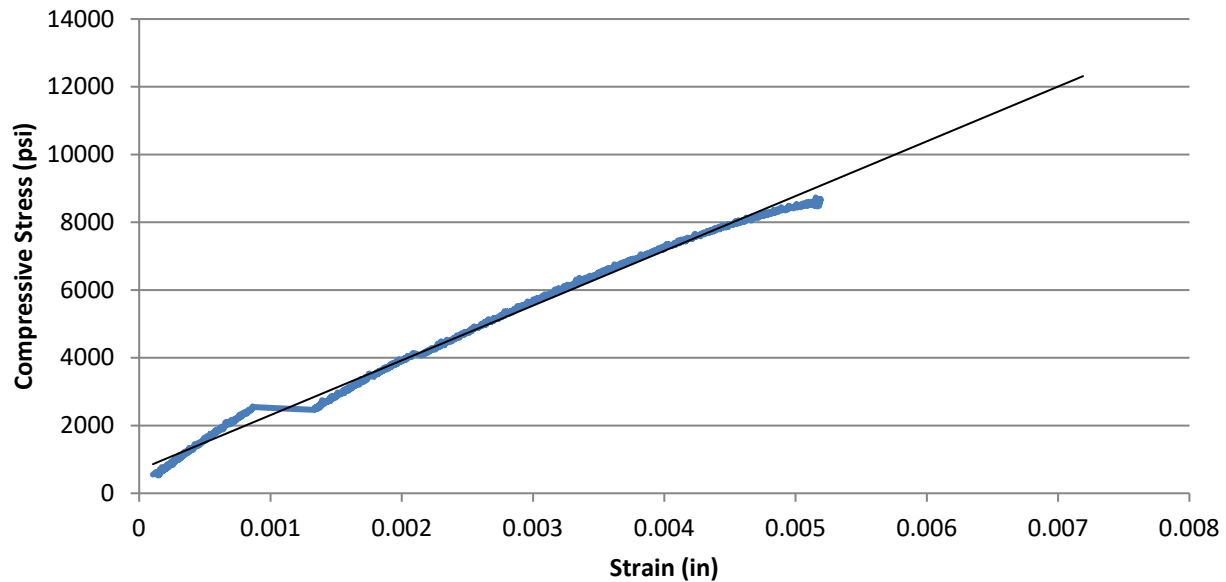
Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	-236	-7	2,349	879	7.46	-0.03
20%	-557	68	4,663	1,746	6.27	0.12
30%	-1371	793	6,962	2,607	3.80	0.58
40%	-1788	852	9,326	3,492	3.91	0.48
50%	-2308	1453	11,662	4,367	3.78	0.63
60%	-2760	1885	13,992	5,239	3.80	0.68
70%	-3265	2666	16,326	6,113	3.74	0.82
80%	-3828	3343	18,656	6,986	3.65	0.87
90%	-4442	4407	20,986	7,858	3.54	0.99
100%	-5155	7928	23,322	8,733		



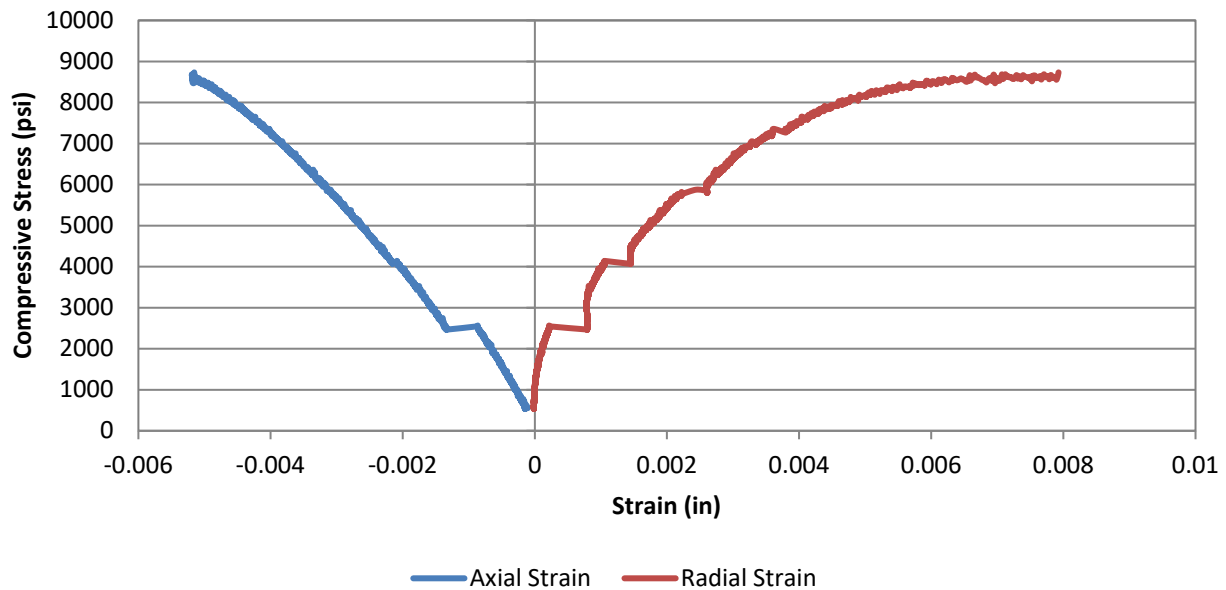
Test Results			
Unconfined Compressive Strength (psi)	8,730	Elastic Modulus (psi)	3.84E+06
		Poisson's Ratio in Elastic Range	0.59
Comments	Elastic range was taken as between 0.0015 and 0.003 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.		

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.844	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	4.491	Reviewed By	WJG
Boring	B-2	Unit Weight (pcf)	177.5	Core Size	NQ
Sample No.	NQ-1 / 24-3840	L/D Ratio	2.44	Recovery	89%
Depth	31.2' - 31.6'	Load Rate (psi/sec)	20	RQD	76%
Description	Black/Gray Metagabbro				

Axial Stress vs. Strain



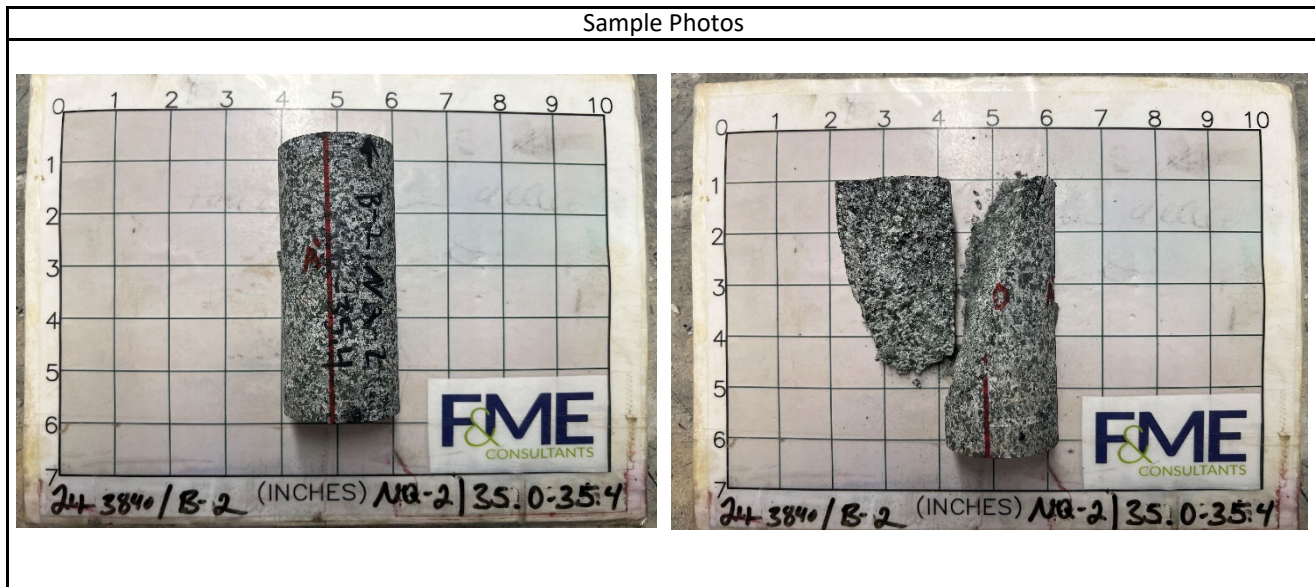
Stress vs. Strain



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

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.841	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	4.392	Reviewed By	WJG
Boring	B-2	Unit Weight (pcf)	181.0	Core Size	NQ
Sample No.	NQ-2 / 24-3840	L/D Ratio	2.39	Recovery	88%
Depth	35.0' - 35.4'	Load Rate (psi/sec)	20	RQD	88%
Description	Black/Gray Metagabbro				

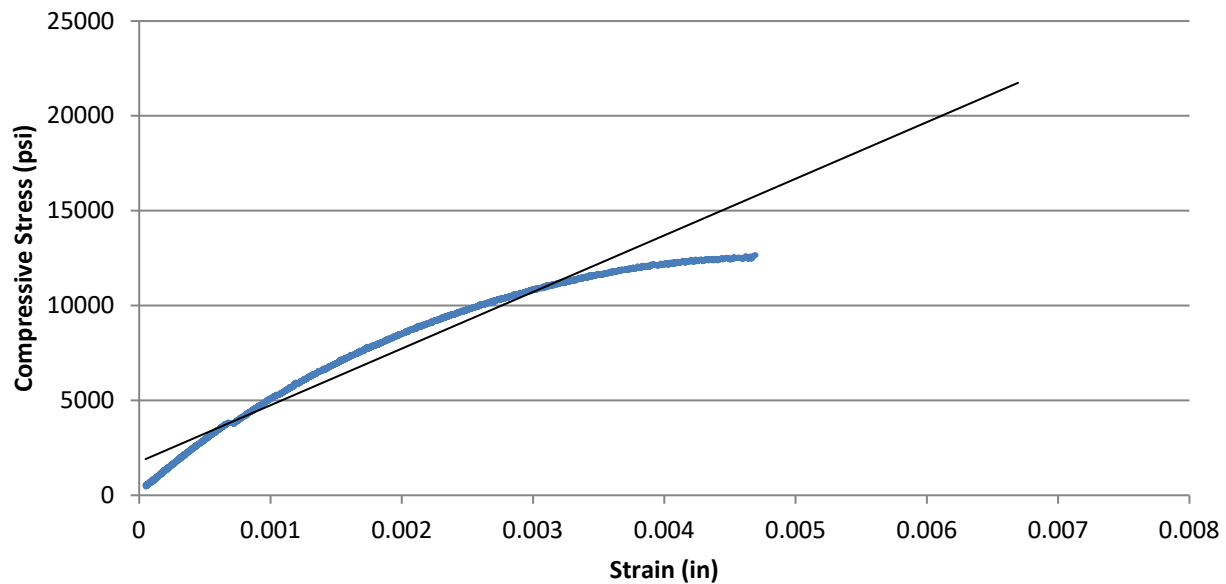
Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	-179	-3	3,370	1,266	14.13	-0.02
20%	-419	40	6,735	2,530	12.09	0.10
30%	-722	265	10,112	3,799	10.52	0.37
40%	-995	308	13,484	5,065	10.19	0.31
50%	-1312	408	16,856	6,332	9.65	0.31
60%	-1681	513	20,226	7,598	9.04	0.31
70%	-2115	637	23,602	8,867	8.39	0.30
80%	-2658	862	26,966	10,130	7.62	0.32
90%	-3351	1259	30,339	11,397	6.80	0.38
100%	-4694	3612	33,709	12,663		



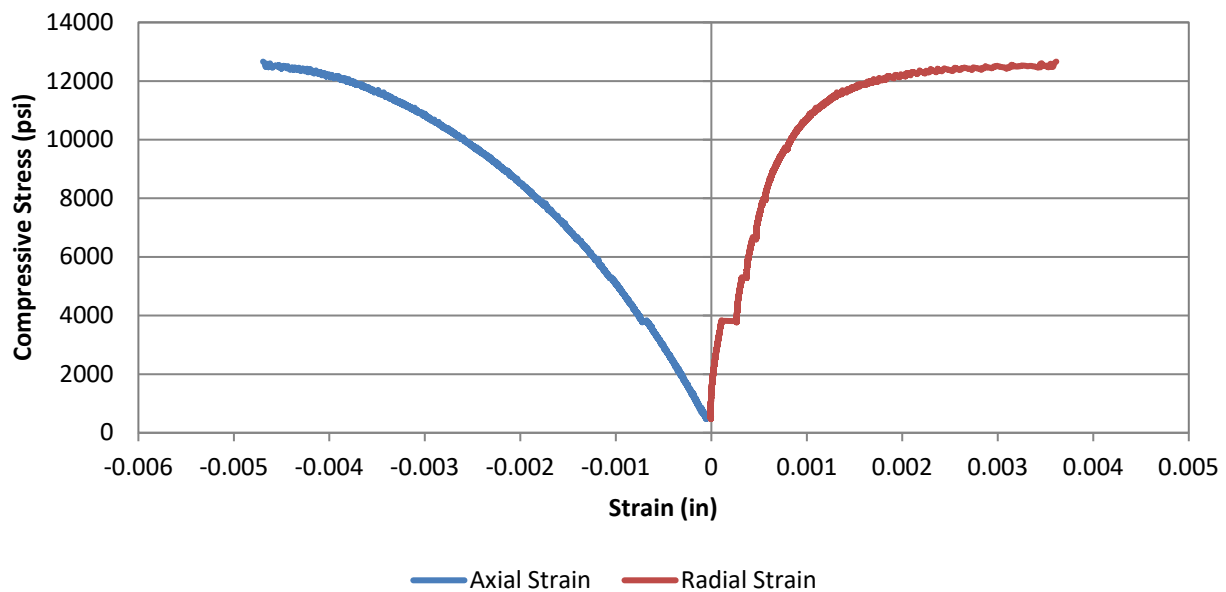
Test Results			
Unconfined Compressive Strength (psi)		12,660	Elastic Modulus (psi)
			9.92E+06
			Poisson's Ratio in Elastic Range
			0.29
Comments	Elastic range was taken as between 0.0005 and 0.002 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.		

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.841	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	4.392	Reviewed By	WJG
Boring	B-2	Unit Weight (pcf)	181.0	Core Size	NQ
Sample No.	NQ-2 / 24-3840	L/D Ratio	2.39	Recovery	88%
Depth	35.0' - 35.4'	Load Rate (psi/sec)	20	RQD	88%
Description	Black/Gray Metagabbro				

Axial Stress vs. Strain



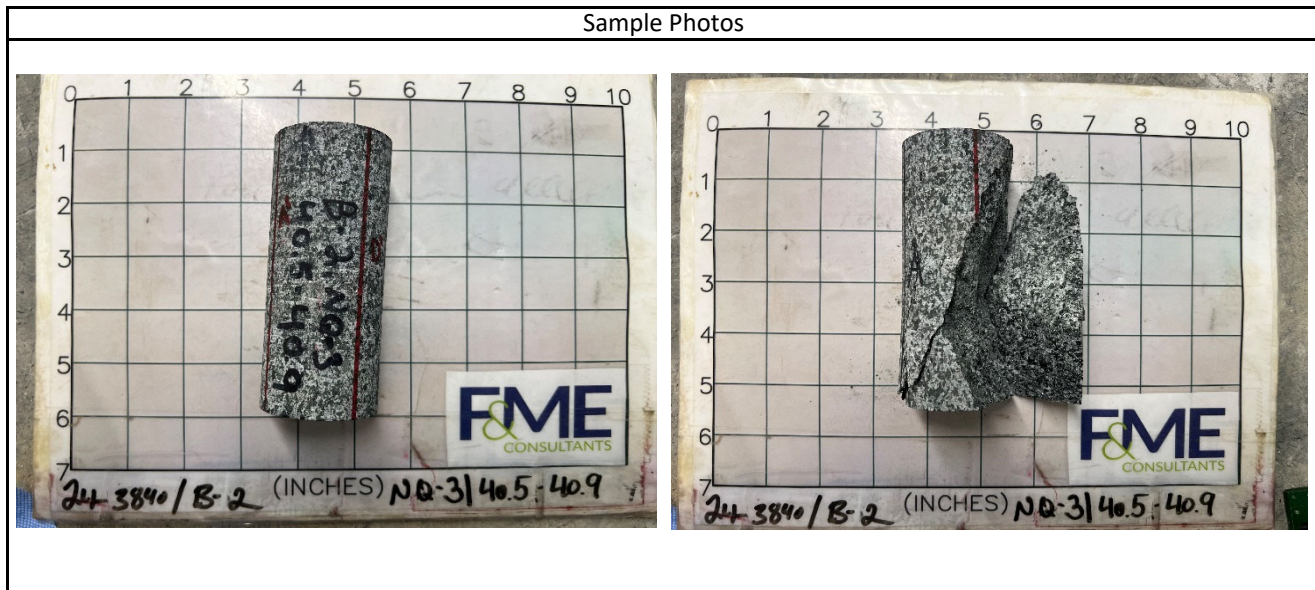
Stress vs. Strain



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

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.838	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	4.424	Reviewed By	WJG
Boring	B-2	Unit Weight (pcf)	181.4	Core Size	NQ
Sample No.	NQ-3 / 24-3840	L/D Ratio	2.41	Recovery	100%
Depth	40.5' - 40.9'	Load Rate (psi/sec)	20	RQD	96%
Description	Black/Gray Metagranodiorite				

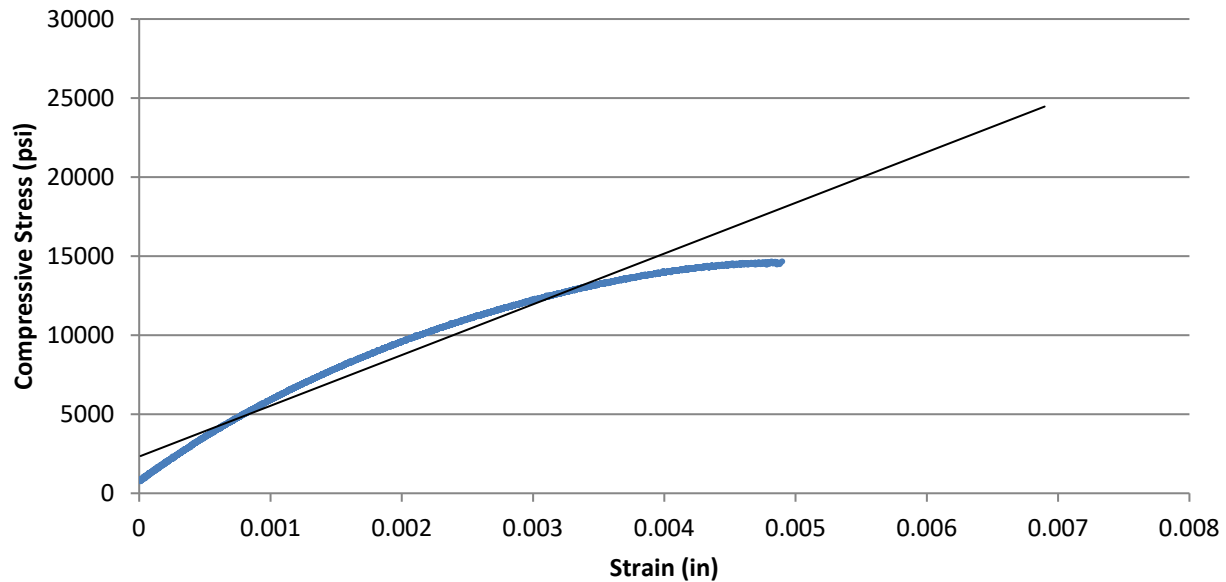
Test Data						
Percent of Failure Load	Strain (10^{-6})		Load (lbs)	Compressive Stress (psi)	Secant Modulus $\times 10^6$ (psi)	Poisson's Ratio
	Axial	Radial				
10%	-118	58	3,892	1,467	24.86	0.50
20%	-389	138	7,784	2,934	15.09	0.35
30%	-669	526	11,679	4,402	13.16	0.79
40%	-989	580	15,566	5,867	11.86	0.59
50%	-1347	622	19,451	7,331	10.88	0.46
60%	-1755	619	23,346	8,799	10.03	0.35
70%	-2231	661	27,240	10,267	9.20	0.30
80%	-2795	674	31,125	11,731	8.39	0.24
90%	-3482	763	35,019	13,199	7.58	0.22
100%	-4898	3414	38,910	14,665		



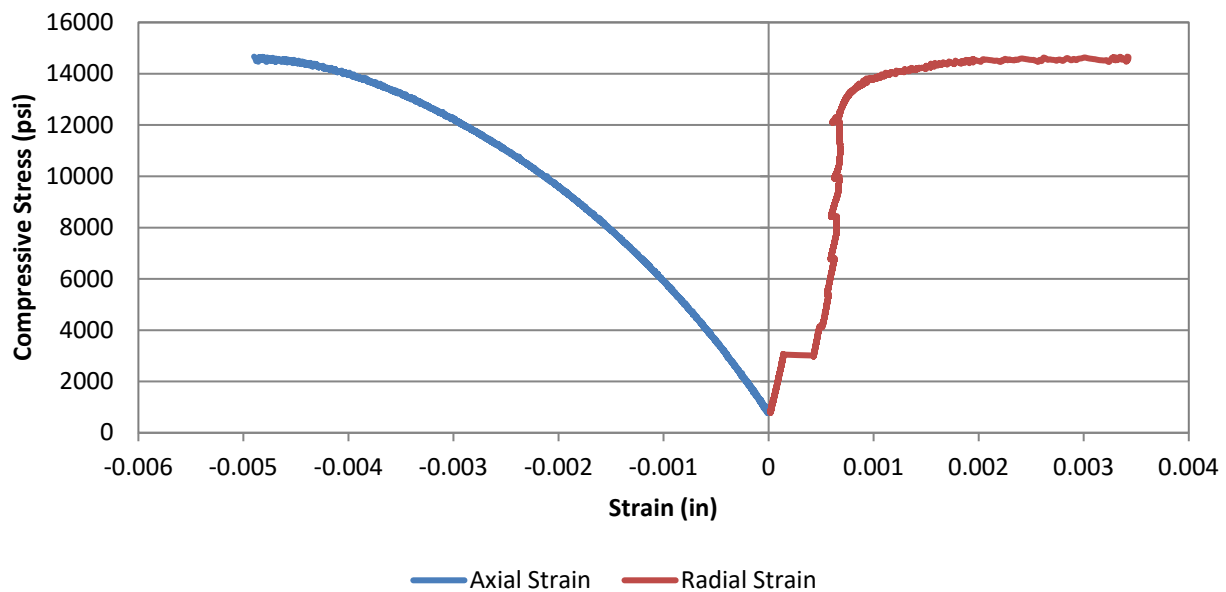
Test Results			
Unconfined Compressive Strength (psi)	14,670	Elastic Modulus (psi)	1.06E+07
		Poisson's Ratio in Elastic Range	0.43
Comments	Elastic range was taken as between 0.0005 and 0.002 inches of axial strain. This range was chosen to avoid any non-linear behavior from the initial loading and the inflection point at the end of the elastic range.		

Project	S-24-230 over Townsend Creek			Date	11/1/2024
Project No.	G7100.007 - Task 00003	Sample Diameter (in.)	1.838	Tested By	TP
SCDOT ID	P043995	Sample Length (in.)	4.424	Reviewed By	WJG
Boring	B-2	Unit Weight (pcf)	181.4	Core Size	NQ
Sample No.	NQ-3 / 24-3840	L/D Ratio	2.41	Recovery	100%
Depth	40.5' - 40.9'	Load Rate (psi/sec)	20	RQD	96%
Description	Black/Gray Metagranodiorite				

Axial Stress vs. Strain



Stress vs. Strain



S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

APPENDIX

SECTION 5 ON SITE DRILL RIG PHOTOS

Drill Rig Photos



B-1

Drill Rig Photos



B-2

Drill Rig Photos



P-1

Drill Rig Photos



P-2

Drill Rig Photos



P-3

Drill Rig Photos



P-4

Drill Rig Photos



P-5

Drill Rig Photos



P-6

S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

APPENDIX

SECTION 6 PAVEMENT CORE PHOTOS

Pavement Core Photos



B-1 (6.0-in.)



B-2 (10.0-in.)



P-1 (2.0-in.)



P-2 (7.0-in.)

Pavement Core Photos



P-3 (3.0-in.)



P-4 (2.5-in.)



P-5 (2.0-in.)



P-6 (2.5-in.)

S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

APPENDIX

SECTION 7 SPT HAMMER CALIBRATION

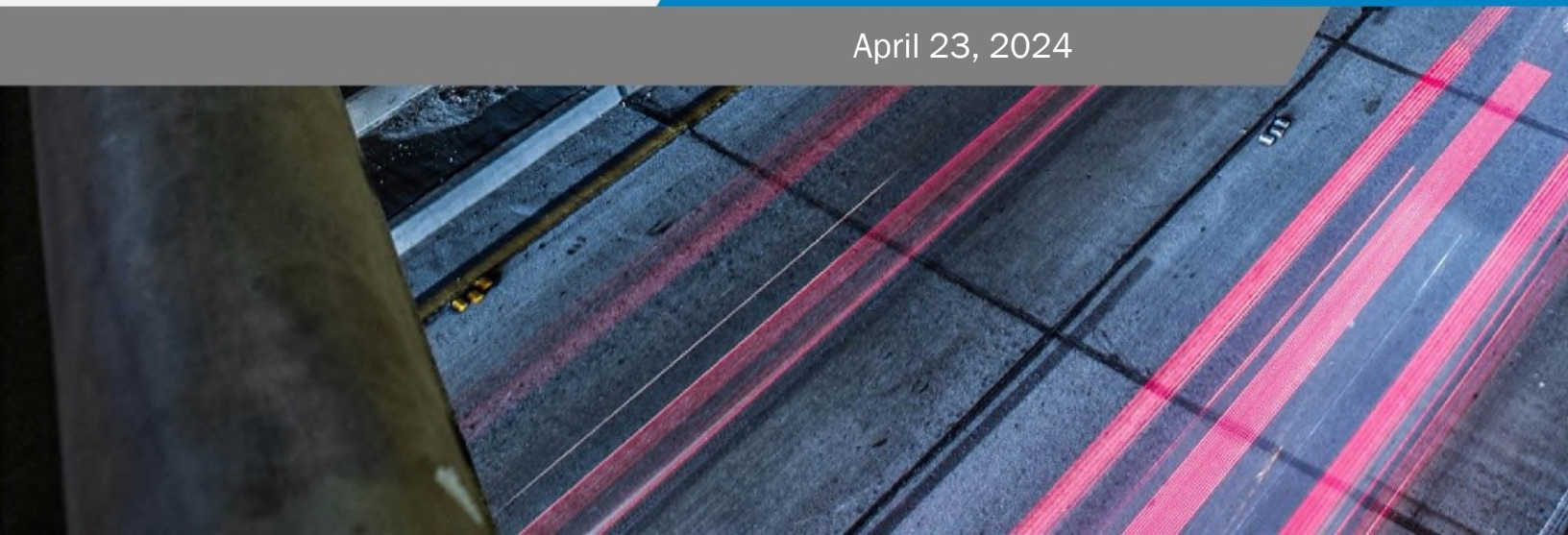


**CAROLINAS
GEOTECHNICAL
GROUP**

Report of SPT Hammer Energy

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

April 23, 2024





2400 Crownpoint Executive Drive
Suite 800
Charlotte, NC 28227



(980) 339-8684



contact@carolinasgeotech.com



www.carolinasgeotech.com

April 23, 2024

Mr. Adam J. Shannon
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. Shannon:

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 April 12, 2024. 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 at SPT_Hammer_Energy_Submittal@ncdot.gov for review and approval no later than May 10, 2024.

DYNAMIC TESTING METHODOLOGY

Testing was performed using a model SPT (Serial No. 4553 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. K10959 and K10960) bolted to a 2-foot long AWJ drill rod (SN 728AWJ) internally instrumented with two strain transducers. The instrumented AWJ drill rod has a cross-sectional area of 1.13 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 Appendix III.

Report of SPT Hammer Energy

Chester, South Carolina

CG2 Project No.: 240021095

TESTING AND OBSERVATIONS

CG2 personnel was on site April 12, 2024 to observe and perform high-strain dynamic testing during SPT sampling on the CME 550X ATV-mounted drill rig operated by C. Taylor 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 34.7704109, -81.2453633. No Soil Test Boring Log was maintained. SPT energy measurements were recorded during four intervals at depths of approximately 28½, 33½, 38½, and 43½ 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	C. Taylor
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)	1.13
Typical Lengths (feet)	5
Instrumented Rod Type	AWJ (SN 728)
OD (inches)	1.75
ID (inches)	1.25
Cross-Sectional Area (in ²)	1.13
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 hammer drop height was observed to not be within tolerance during hammer operation due to high engine throttle for sample interval 33½ to 35; therefore, data from this sample interval was not used in the analysis.

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 48.5 to 55.4 blows per minute (BPM) during dynamic testing. The measured transferred hammer energy (EFV) ranged from 252.1 to 286.2 foot-pounds, which corresponds to Energy Transfer Ratio (ETR) values of 72.0 to 81.8%, respectively. These data ranges are based on the overall minimum and maximum values for the last 12 inches of each sample interval.

The SPT Energy Measurement Data Summary tables in Appendix I 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, a summary of the test data, and average computed BPM, EFV, and ETR values are provided in Table 2. The BPM, EFV, and ETR values presented in Table 2 were computed by averaging data from the last 12 inches of each sample interval. Plots and tables of the following are also included in Appendix I 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	6-8-10 / 18	SA SILT	54.4	271.9	77.7
2	38½ - 40	40	43.6	5-10-12 / 22	SA SILT	50.5	265.4	75.8
3	43½ - 45	45	48.6	7-9-9 / 18	SA SILT	50.3	262.1	74.9
Overall Average						51.7	266.4	76.1

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

Report of SPT Hammer Energy

Chester, South Carolina

CG2 Project No.: 240021095

drill rig (for the depth intervals presented in Table 2) was 266.4 foot-pounds, with an average ETR of 76.1%.

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:


F926DBFBA80F4FE...
Pressley M. Perry, EIT
Staff Professional

DocuSigned by:


8AD703B2A8484F4...
Robert E. Kral, PE
Geotechnical Design Manager
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



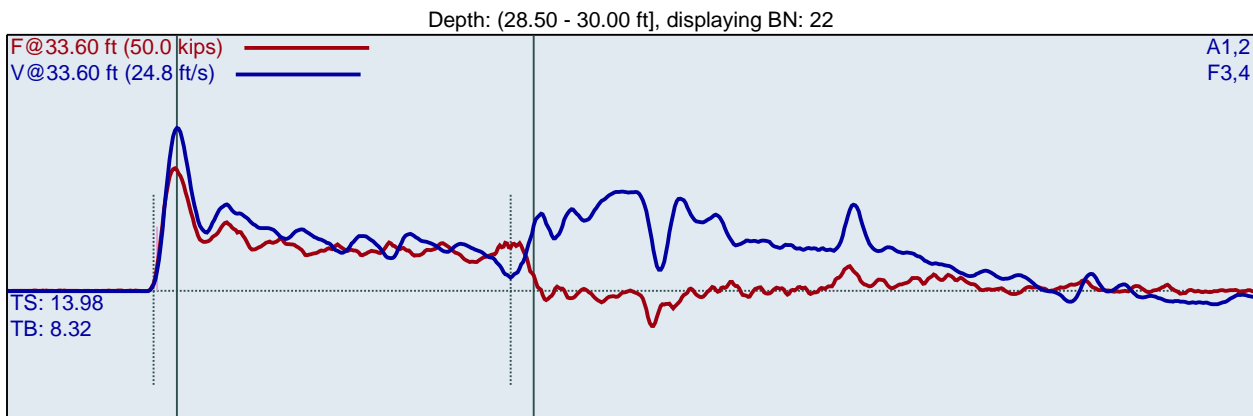
APPENDIX I

CME 550X (SN 269553)
REK
B-4

B-4
Interval start: 4/12/2024

AR: 1.13 in²
LE: 33.60 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft³
EM: 30000 ksi



F3 : [728AWJ1] 224.649 PDICAL (1) FF1
F4 : [728AWJ2] 224.139 PDICAL (1) FF1

A1 (PR): [K10959] 413.827 mv/6.4v/5000g (1) VF1
A2 (PR): [K10960] 419.894 mv/6.4v/5000g (1) VF1

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

LP	BL#	BC	BPM	FMX	VMX	DMX	CSX	DFN	EFV	ETR
ft		/6"	bpm	kips	ft/s	in	ksi	in	ft-lb	%
28.58	1	6	1.9	25.3	17.1	2.2	22.4	1.0	248.5	71.0
28.67	2	6	42.0	25.0	16.4	1.5	22.2	1.0	245.0	70.0
28.75	3	6	14.7	11.4	7.2	1.0	10.0	1.0	49.5	14.1
28.83	4	6	58.7	25.7	16.2	1.3	22.7	1.0	265.2	75.8
28.92	5	6	55.5	25.6	16.7	1.4	22.6	1.0	265.5	75.9
29.00	6	6	55.0	26.5	17.0	1.4	23.5	1.0	286.3	81.8
29.06	7	8	54.7	26.3	17.0	1.4	23.3	0.8	284.8	81.4
29.13	8	8	55.0	26.1	16.8	1.3	23.1	0.8	278.9	79.7
29.19	9	8	54.9	26.0	16.6	1.3	23.0	0.7	276.0	78.9
29.25	10	8	54.7	25.7	16.6	1.2	22.7	0.8	280.3	80.1
29.31	11	8	55.0	25.8	16.6	1.2	22.9	0.8	278.5	79.6
29.38	12	8	54.4	25.2	16.1	1.1	22.3	0.8	271.0	77.4
29.44	13	8	52.5	25.7	16.4	1.1	22.7	0.7	270.1	77.2
29.50	14	8	54.2	25.1	16.3	1.1	22.2	0.8	269.2	76.9
29.55	15	10	54.4	25.3	16.4	1.0	22.4	0.6	273.1	78.0
29.60	16	10	54.4	25.2	16.5	1.1	22.3	0.6	284.6	81.3
29.65	17	10	54.6	24.7	16.4	1.0	21.9	0.6	275.6	78.7
29.70	18	10	54.3	24.7	16.3	0.9	21.8	0.6	272.6	77.9
29.75	19	10	54.6	24.0	16.0	0.8	21.2	0.6	259.4	74.1
29.80	20	10	54.1	23.8	15.6	0.9	21.0	0.6	265.6	75.9
29.85	21	10	54.2	24.0	15.9	0.9	21.3	0.6	264.5	75.6
29.90	22	10	54.4	23.9	15.8	0.7	21.2	0.6	263.0	75.1
29.95	23	10	54.1	23.8	15.6	0.7	21.1	0.6	265.2	75.8
30.00	24	10	54.4	23.6	15.4	0.7	20.9	0.6	262.6	75.0

Average	54.4	24.9	16.2	1.0	22.1	0.7	271.9	77.7
Std Dev	0.5	0.9	0.4	0.2	0.8	0.1	7.4	2.1
Maximum	55.0	26.3	17.0	1.4	23.3	0.8	284.8	81.4
Minimum	52.5	23.6	15.4	0.7	20.9	0.6	259.4	74.1
N-value: 18								

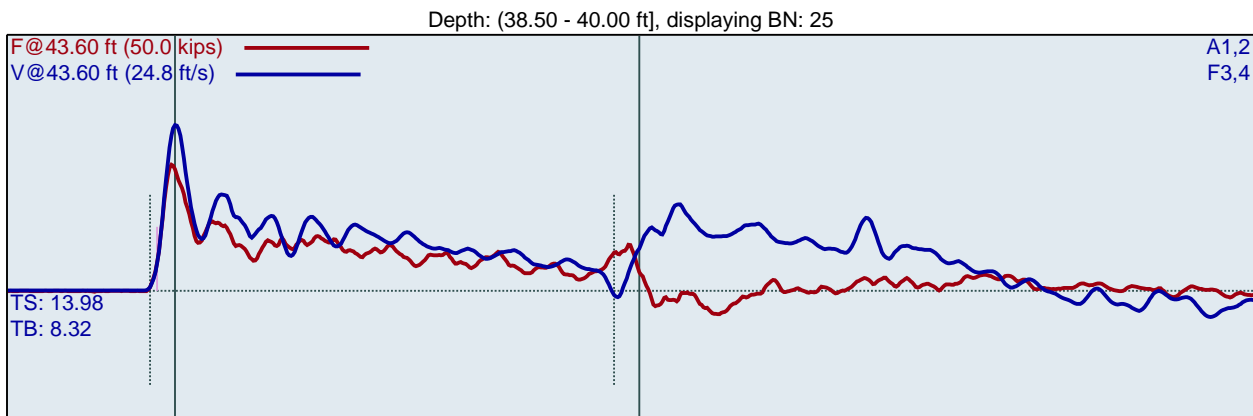
Sample Interval Time: 28.60 seconds.

CME 550X (SN 269553)
REK
B-4

B-4
Interval start: 4/12/2024

AR: 1.13 in²
LE: 43.60 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft³
EM: 30000 ksi



F3 : [728AWJ1] 224.649 PDICAL (1) FF1
F4 : [728AWJ2] 224.139 PDICAL (1) FF1

A1 (PR): [K10959] 413.827 mv/6.4v/5000g (1) VF1
A2 (PR): [K10960] 419.894 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 %
38.60	1	5	1.9	23.5	16.5	1.8	20.8	1.2	252.4	72.1
38.70	2	5	39.4	24.1	15.6	1.8	21.3	1.2	245.1	70.0
38.80	3	5	42.3	25.4	16.4	1.5	22.4	1.2	264.5	75.6
38.90	4	5	53.9	25.4	16.9	1.2	22.4	1.2	276.7	79.1
39.00	5	5	55.2	25.0	16.5	1.2	22.1	1.2	272.1	77.7
39.05	6	10	55.4	25.7	16.6	1.0	22.8	0.6	280.3	80.1
39.10	7	10	55.2	26.2	17.1	1.0	23.2	0.6	286.2	81.8
39.15	8	10	51.7	24.7	16.1	0.9	21.9	0.6	257.3	73.5
39.20	9	10	50.2	25.2	16.2	0.9	22.3	0.6	259.8	74.2
39.25	10	10	50.0	25.3	16.5	0.9	22.4	0.6	266.5	76.1
39.30	11	10	50.2	25.2	16.5	0.9	22.3	0.6	262.9	75.1
39.35	12	10	50.0	25.0	16.3	0.9	22.1	0.6	259.6	74.2
39.40	13	10	50.3	24.9	16.4	0.9	22.1	0.6	259.1	74.0
39.45	14	10	49.8	25.4	16.4	0.9	22.5	0.6	265.7	75.9
39.50	15	10	50.1	25.1	16.2	0.9	22.2	0.6	260.1	74.3
39.54	16	12	50.0	25.0	16.3	0.9	22.1	0.5	262.3	74.9
39.58	17	12	49.9	25.1	16.4	0.9	22.2	0.5	263.4	75.3
39.63	18	12	50.1	24.5	16.6	0.8	21.7	0.5	258.2	73.8
39.67	19	12	50.2	24.9	16.6	0.7	22.0	0.5	261.9	74.8
39.71	20	12	49.9	25.1	16.4	0.8	22.2	0.5	268.5	76.7
39.75	21	12	50.0	25.0	16.2	0.8	22.2	0.5	265.6	75.9
39.79	22	12	50.2	25.2	16.2	0.8	22.3	0.5	263.1	75.2
39.83	23	12	49.9	25.1	16.3	0.8	22.2	0.5	265.6	75.9
39.88	24	12	48.5	25.3	16.5	0.8	22.4	0.5	277.7	79.3
39.92	25	12	49.7	24.6	16.0	0.8	21.8	0.5	266.7	76.2
39.96	26	12	50.0	24.8	16.2	0.7	22.0	0.5	263.3	75.2
40.00	27	12	50.1	24.6	16.0	0.7	21.8	0.5	265.0	75.7

Average	50.5	25.1	16.4	0.8	22.2	0.5	265.4	75.8
Std Dev	1.6	0.4	0.2	0.1	0.3	0.0	7.1	2.0
Maximum	55.4	26.2	17.1	1.0	23.2	0.6	286.2	81.8
Minimum	48.5	24.5	16.0	0.7	21.7	0.5	257.3	73.5

N-value: 22

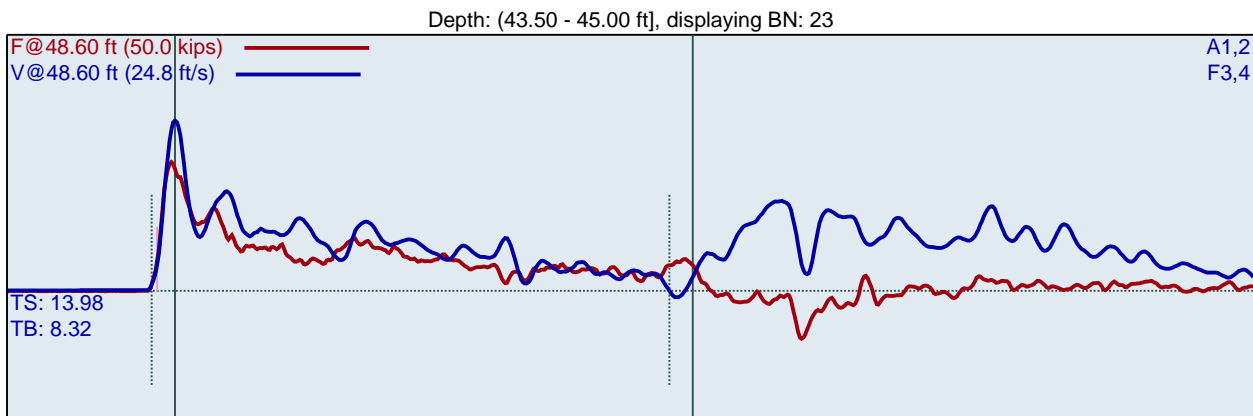
Sample Interval Time: 31.35 seconds.

CME 550X (SN 269553)
REK
B-4

B-4
Interval start: 4/12/2024

AR: 1.13 in²
LE: 48.60 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft³
EM: 30000 ksi



F3 : [728AWJ1] 224.649 PDICAL (1) FF1
F4 : [728AWJ2] 224.139 PDICAL (1) FF1

A1 (PR): [K10959] 413.827 mv/6.4v/5000g (1) VF1
A2 (PR): [K10960] 419.894 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 %
43.57	1	7	3.3	25.3	17.0	1.5	22.4	0.9	268.2	76.6
43.64	2	7	51.3	24.8	16.2	1.3	21.9	0.9	263.6	75.3
43.71	3	7	50.1	24.4	16.4	1.2	21.6	0.9	264.2	75.5
43.79	4	7	50.8	24.7	17.0	1.0	21.9	0.9	271.2	77.5
43.86	5	7	50.5	24.8	16.4	1.1	22.0	0.9	268.7	76.8
43.93	6	7	50.4	25.4	17.8	0.9	22.5	0.9	274.2	78.3
44.00	7	7	50.7	25.6	17.2	0.9	22.6	0.9	275.0	78.6
44.06	8	9	50.5	24.9	16.8	0.9	22.0	0.7	265.8	75.9
44.11	9	9	50.6	24.8	16.5	0.9	22.0	0.7	263.3	75.2
44.17	10	9	50.5	25.0	16.6	0.7	22.1	0.7	261.8	74.8
44.22	11	9	50.5	24.9	16.4	1.0	22.0	0.7	268.0	76.6
44.28	12	9	50.5	25.3	16.7	0.7	22.4	0.7	262.2	74.9
44.33	13	9	50.5	25.0	16.6	0.7	22.1	0.7	261.2	74.6
44.39	14	9	50.5	25.4	16.6	0.7	22.5	0.7	264.7	75.6
44.44	15	9	48.5	24.9	16.4	0.7	22.0	0.7	257.2	73.5
44.50	16	9	50.5	24.9	16.3	0.7	22.0	0.7	252.1	72.0
44.56	17	9	50.5	25.1	16.4	0.7	22.2	0.7	255.4	73.0
44.61	18	9	50.3	25.2	16.9	1.0	22.3	0.7	271.8	77.7
44.67	19	9	50.3	25.4	16.7	0.7	22.4	0.7	261.3	74.7
44.72	20	9	50.7	25.4	16.7	0.7	22.5	0.7	261.9	74.8
44.78	21	9	50.1	24.9	16.2	0.9	22.1	0.7	261.6	74.7
44.83	22	9	50.5	25.6	16.5	0.7	22.6	0.7	264.1	75.5
44.89	23	9	50.1	25.1	16.5	0.7	22.2	0.7	259.5	74.2
44.94	24	9	50.2	25.4	16.6	0.9	22.5	0.7	267.8	76.5
45.00	25	9	50.4	25.0	16.3	0.8	22.2	0.7	258.8	73.9
Average			50.3	25.1	16.5	0.8	22.2	0.7	262.1	74.9
Std Dev			0.5	0.2	0.2	0.1	0.2	0.0	4.6	1.3
Maximum			50.7	25.6	16.9	1.0	22.6	0.7	271.8	77.7
Minimum			48.5	24.8	16.2	0.7	22.0	0.7	252.1	72.0

N-value: 18

Sample Interval Time: 28.63 seconds.

Summary of SPT Test Results

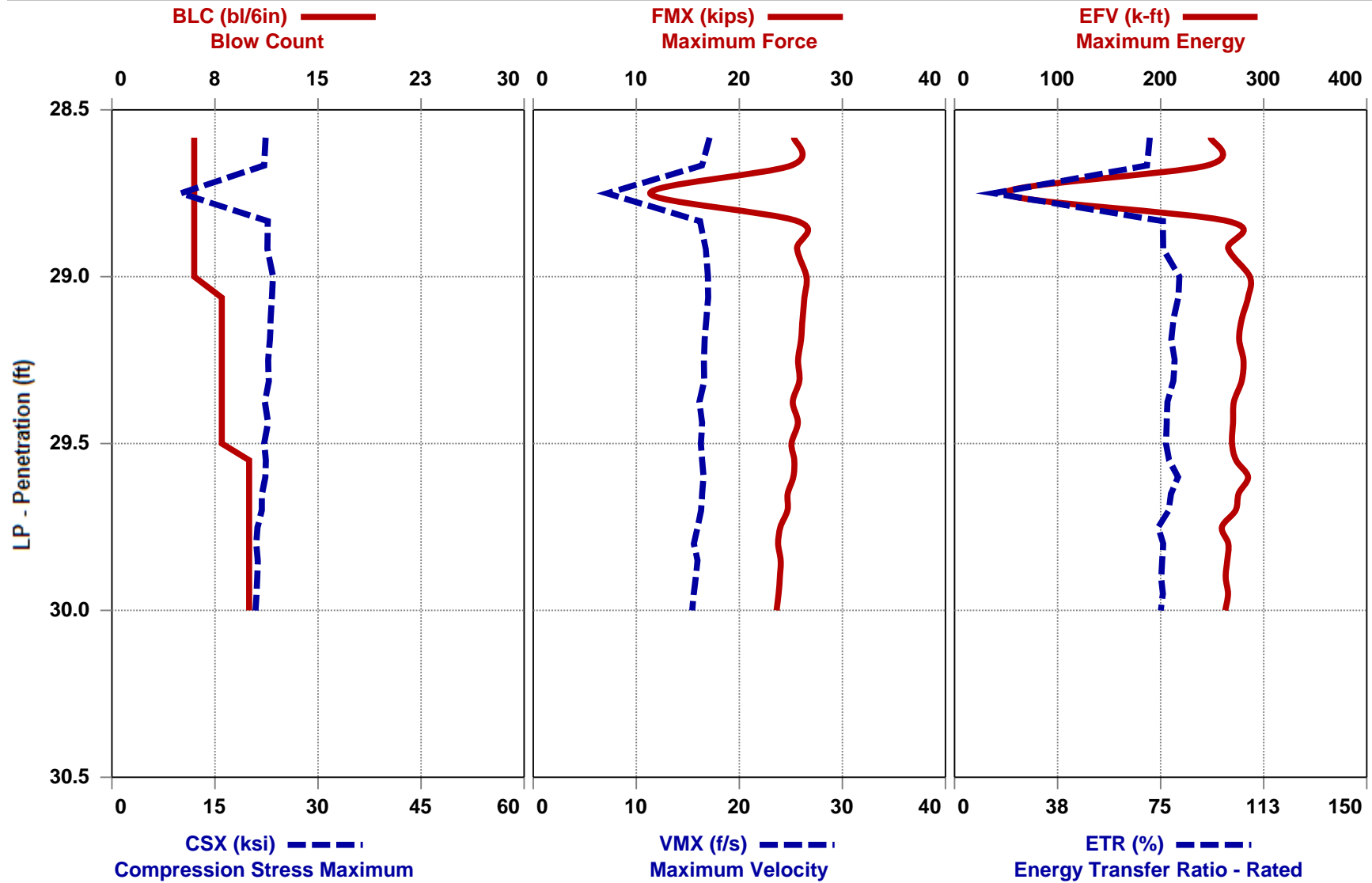
Project: CME 550X (SN 269553), Test Date: 4/12/2024

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							
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	6-8-10	18	22	54.4	24.9	16.2	1.0	22.1	0.7	271.9	77.7
43.60	38.50	40.00	5-10-12	22	27	50.5	25.1	16.4	0.8	22.2	0.5	265.4	75.8
48.60	43.50	45.00	7-9-9	18	22	50.3	25.1	16.5	0.8	22.2	0.7	262.1	74.9
Overall Average Values:						51.7	25.1	16.4	0.9	22.2	0.6	266.4	76.1
Standard Deviation:						2.1	0.6	0.3	0.2	0.5	0.1	7.6	2.2
Overall Maximum Value:						55.4	26.3	17.1	1.4	23.3	0.8	286.2	81.8
Overall Minimum Value:						48.5	23.6	15.4	0.7	20.9	0.5	252.1	72.0



CME 550X (SN 269553) - 28.5 TO 30.0

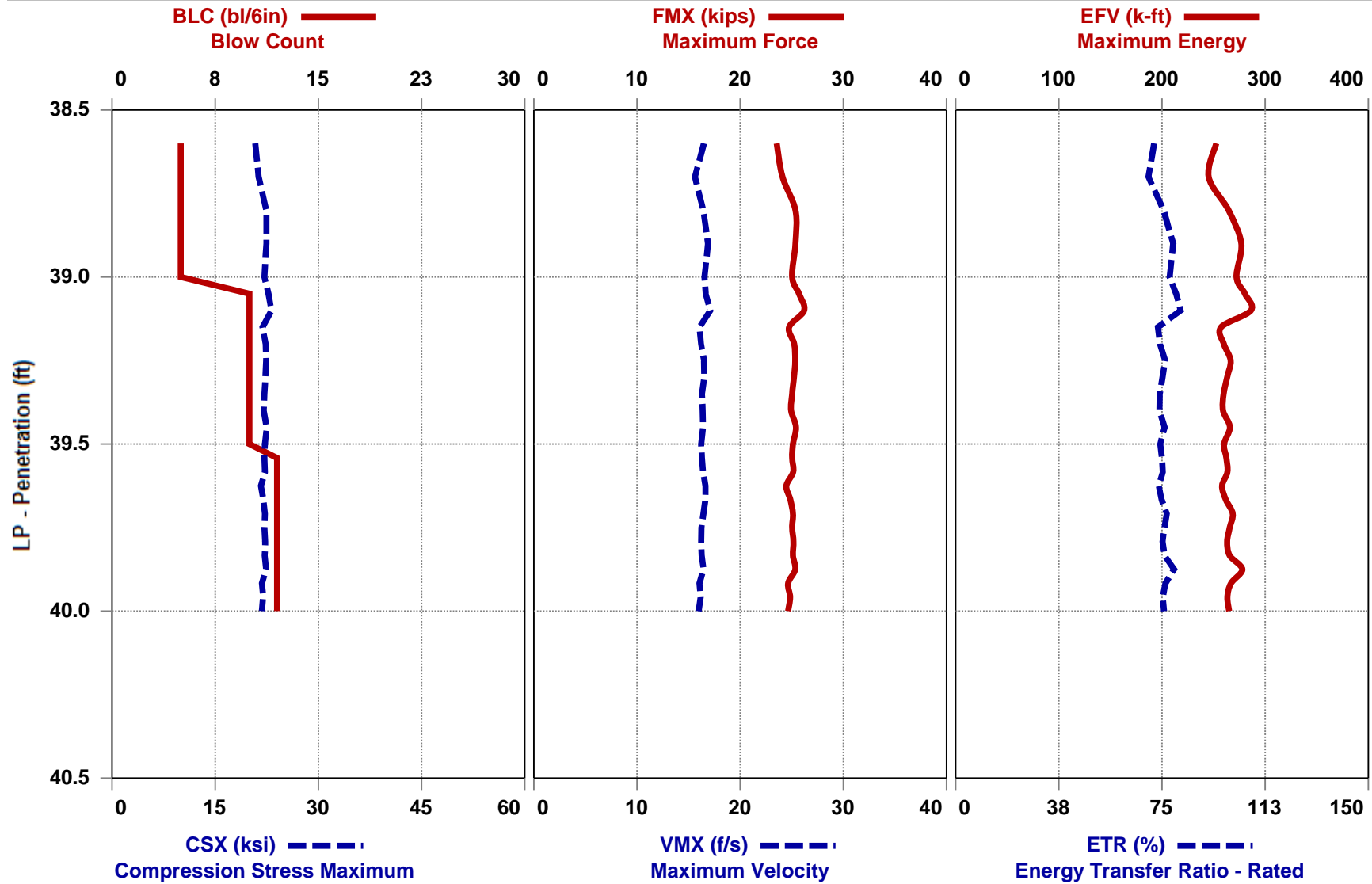
B-4





CME 550X (SN 269553) - 38.5 TO 40.0

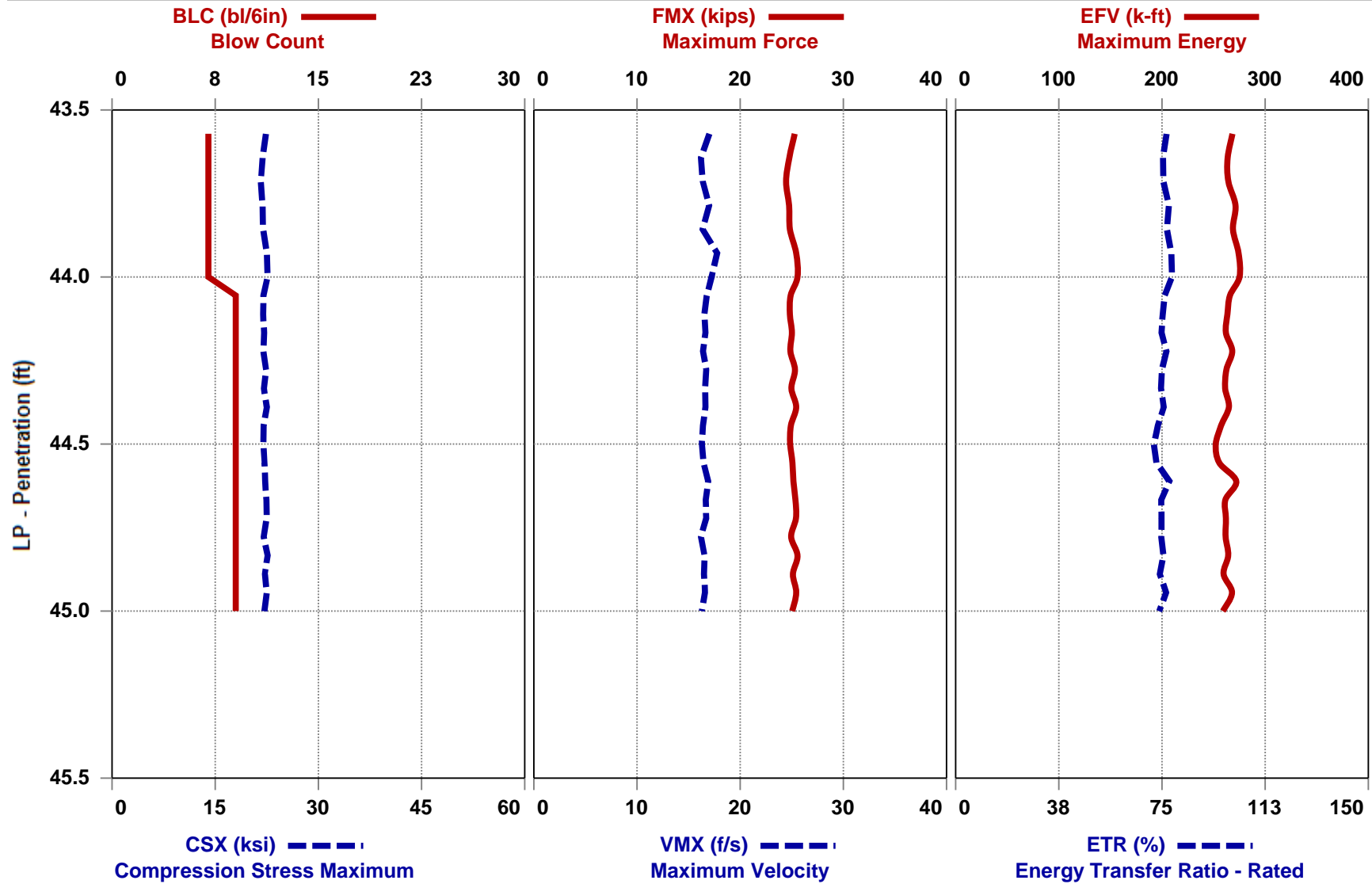
B-4

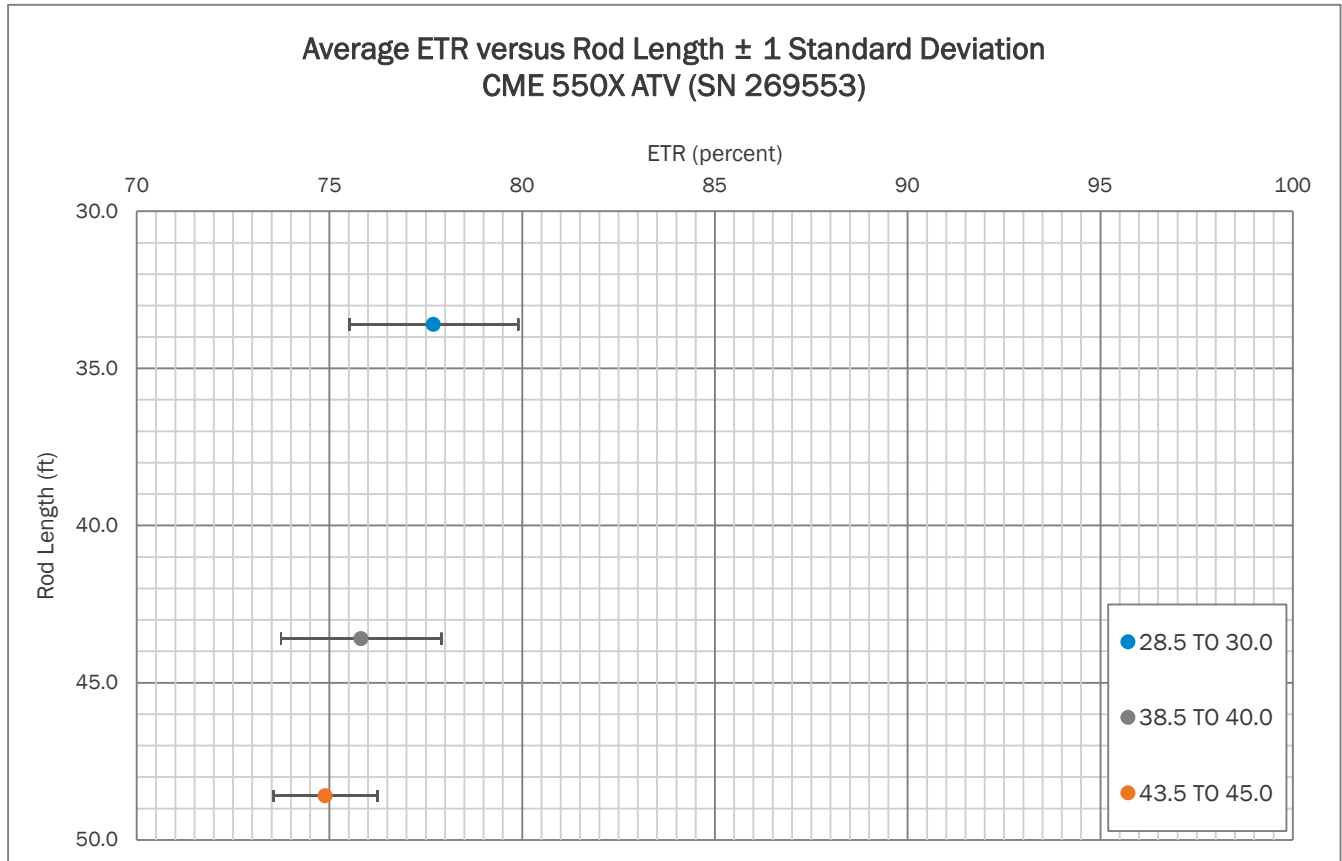
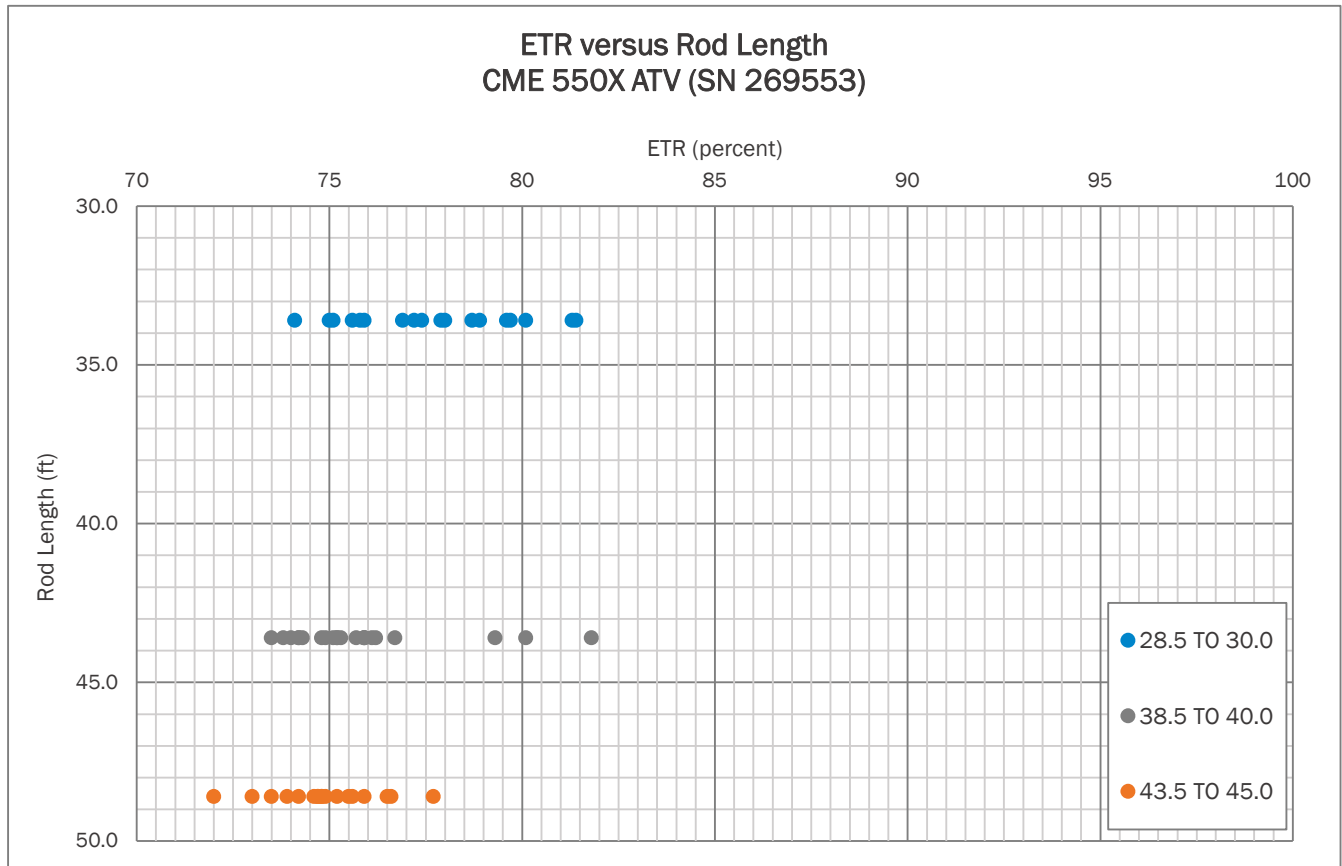




CME 550X (SN 269553) - 43.5 TO 45.0

B-4







APPENDIX II

SPT Hammer Energy Field Form

Project: SPT HAMMER ENERGY
Project No.: 240021095
Boring No.: B-4

Date: 4/12/2024
Weather: 50's CLEAR
Drill Rod Type: AWJ

On-site Personnel

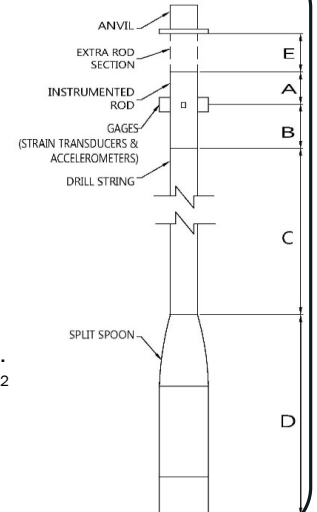
Drilling Company: BRECCIA CONSTRUCTION, LLC
 Rig Operator: C. TAYLOR
 Engr/Geologist: N/A
 Client Rep.: N/A
 Analyzer Oper.: R. KRAL

Rig/Hammer Info

Drill Rig Make/Model: CME 550X
 Carrier Type: ATV
 Rig Serial No.: 269553
 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: 728AWJ
 Instr. Rod Outside Dia.: 1.75 in.
 Instr. Rod Area: 1.13 in²
 PDA Make/Model: SPT
 PDA Serial No.: 4553 TB
 Calib. Pulse Test (y/n): Y



Gage Info

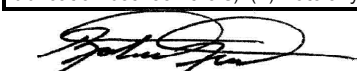
Gage		Serial No.	Calibration No.
Accel.	A3	K10959	413.83
	A4	K10960	419.89
Strain	F3	728AWJ-1	224.65
	F4	728AWJ-2	224.14

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		
12-Apr	28.5 TO 30.0	0844/0844	30	33.6	55	6	8	10	18	Y	SA SI
12-Apr	33.5 TO 35.0	0855/0856	35	38.6	53	8	8	10	18	N	SA SI
12-Apr	38.5 TO 40.0	0910/0910	40	43.6	50	5	10	12	22	Y	SA SI
12-Apr	43.5 TO 45.0	0918/0918	45	48.6	50	7	9	9	18	Y	SA SI

Notes:

TESTING PERFORMED AT 1817 LOWRYS HIGHWAY IN CHESTER, SOUTH CAROLINA (CHESTER COUNTY). THE APPROXIMATE COORDINATES ARE 34.7704109, -81.2453633. HAMMER OPERATION DURING SAMPLE INTERVAL 33.5 TO 35.0 IS NOT SATISFACTORY.

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.



Prepared By (print/signature)

4/12/2024
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

Certificate of Calibration

Pile Dynamics, Inc. certifies that the

Pile Driving Analyzer®, Model SPT

Serial Number: 4553 TB

was calibrated on 18 December 2023
using a PDA Calibration Box whose output was calibrated with test equipment
traceable to NIST.

This certificate is valid for 2 years from above date.



Tested by [Signature]

Pile Dynamics, Inc.
30725 Aurora Road
Cleveland, Ohio 44139 USA



Certificate of Calibration

Pile Dynamics, Inc. certifies that the

Pile Driving Analyzer®, Model SPT

Serial Number: 4549 TB

was calibrated on 14 July 2022

using a PDA Calibration Box whose output was calibrated with test equipment
traceable to NIST.

This certificate is valid for 2 years from above date.



Tested by

MCQ

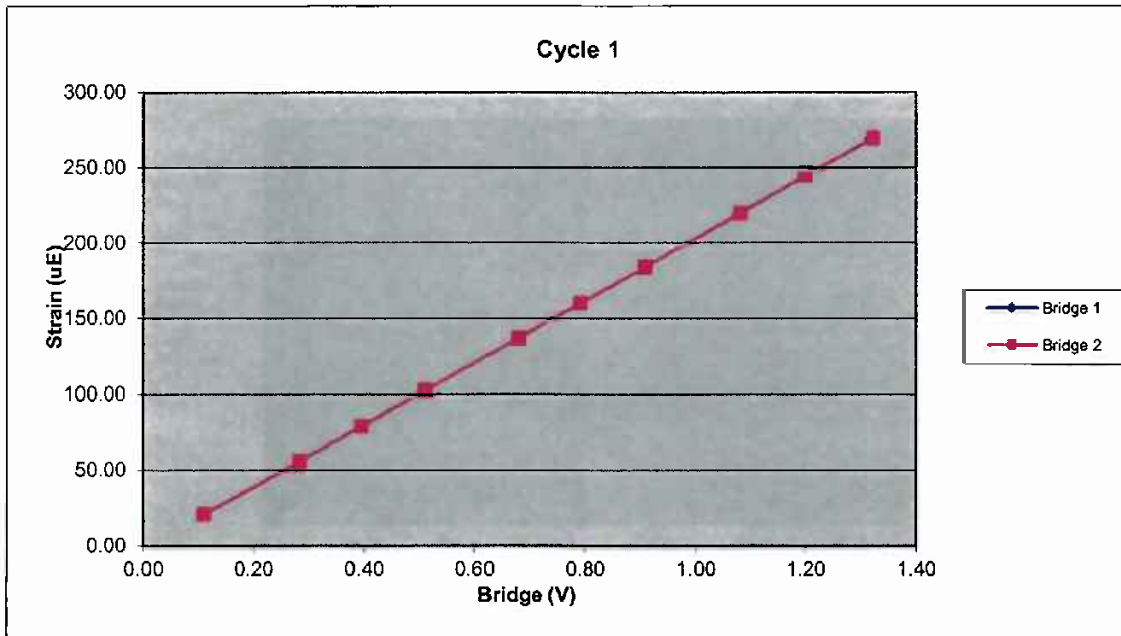


Pile Dynamics, Inc.
30725 Aurora Road
Cleveland, Ohio 44139 USA

528AWJ		Cycle 1		
Sample	Force (lb)	Strain (μE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	803.20	21.15	0.11	0.11
3	2080.73	56.33	0.28	0.28
4	2904.01	79.79	0.39	0.39
5	3765.89	103.49	0.51	0.51
6	5005.11	138.03	0.68	0.68
7	5828.59	161.56	0.79	0.79
8	6692.71	185.68	0.91	0.91
9	7962.93	221.03	1.08	1.08
10	8831.54	245.89	1.20	1.20
11	9736.80	270.68	1.32	1.32

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7358.13	Force Calibration (lb/V)	7351.82
Offset	3.52	Offset	6.26
Correlation	0.999999	Correlation	0.999999
Strain Calibration ($\mu\text{E/V}$)	205.90	Strain Calibration ($\mu\text{E/V}$)	205.73
Offset	-1.56	Offset	-1.48
Correlation	0.999995	Correlation	0.999996

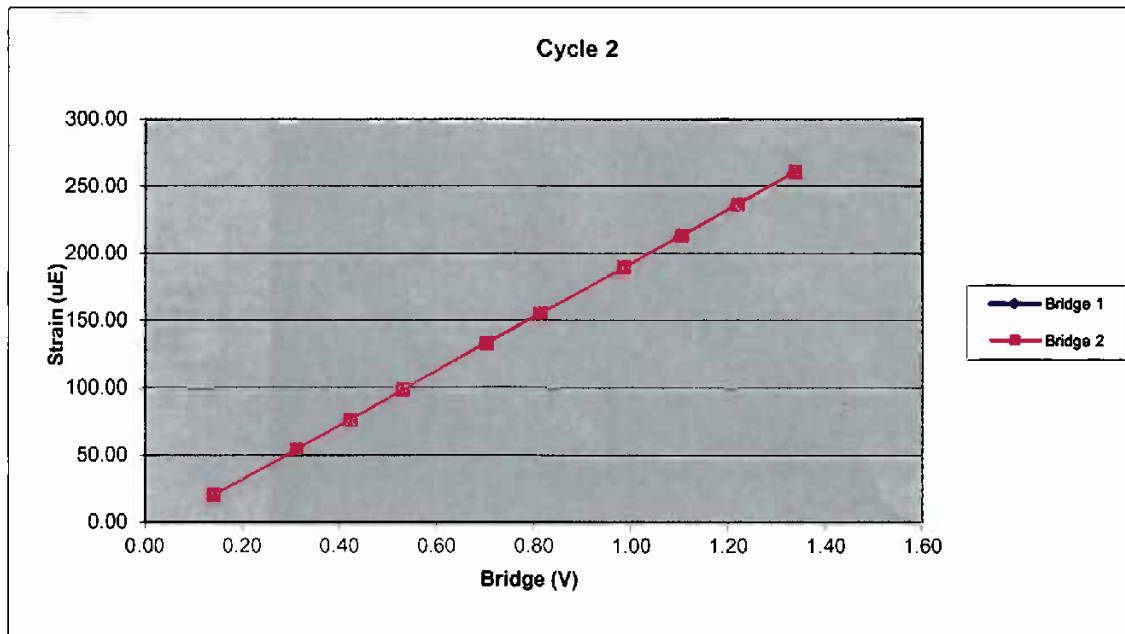
Force Strain Calibration	
EA (Kips)	35735.87
Offset	59.29
Correlation	0.999995



528AWJ		Cycle 2		
Sample	Force (lb)	Strain (μE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1038.71	19.60	0.14	0.14
3	2288.25	53.30	0.31	0.31
4	3093.11	75.49	0.42	0.42
5	3893.00	97.84	0.53	0.53
6	5167.50	132.26	0.70	0.70
7	5988.25	154.39	0.81	0.81
8	7248.72	188.87	0.98	0.98
9	8125.71	212.29	1.10	1.10
10	8976.19	235.45	1.22	1.22
11	9854.85	259.50	1.33	1.34

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7381.92	Force Calibration (lb/V)	7365.94
Offset	-0.76	Offset	4.69
Correlation	0.999998	Correlation	0.999999
Strain Calibration ($\mu\text{E}/\text{V}$)	200.83	Strain Calibration ($\mu\text{E}/\text{V}$)	200.40
Offset	-8.59	Offset	-8.44
Correlation	0.999997	Correlation	0.999996

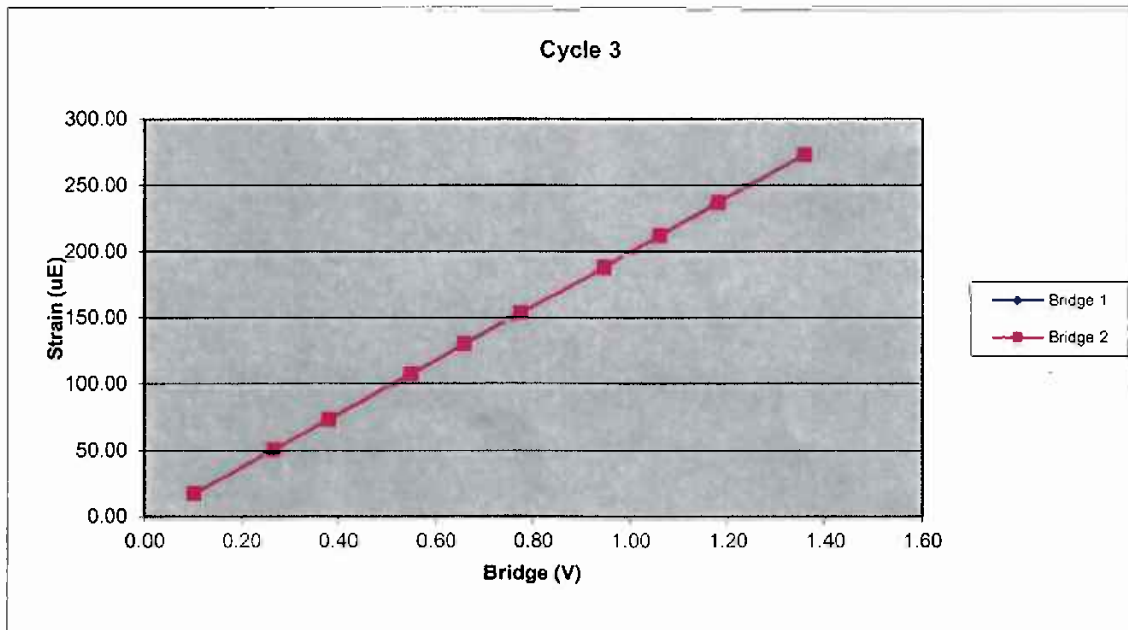
Force Strain Calibration	
EA (Kips)	36756.34
Offset	315.07
Correlation	0.999995



528AWJ		Cycle 3		
Sample	Force (lb)	Strain (μE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	734.68	18.74	0.10	0.10
3	1943.58	51.94	0.26	0.26
4	2781.29	75.07	0.38	0.38
5	4027.81	108.88	0.55	0.55
6	4829.55	131.78	0.66	0.66
7	5689.29	155.36	0.77	0.77
8	6956.49	190.12	0.95	0.95
9	7799.46	214.09	1.06	1.06
10	8693.90	238.78	1.18	1.18
11	10007.88	275.06	1.36	1.36

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7366.71	Force Calibration (lb/V)	7364.49
Offset	-6.17	Offset	-9.40
Correlation	0.999998	Correlation	0.999999
Strain Calibration ($\mu\text{E/V}$)	203.78	Strain Calibration ($\mu\text{E/V}$)	203.72
Offset	-2.08	Offset	-2.17
Correlation	0.999989	Correlation	0.999993

Force Strain Calibration	
EA (Kips)	36149.33
Offset	69.26
Correlation	0.999994



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

Calibration Factors	528AWJ		
Bridge 1 ($\mu\text{E/V}$)	203.51	Bridge 2 ($\mu\text{E/V}$)	203.28
EA Factor (Kips)	36213.85	Area (in^2)	1.21

Calibrated by:



Calibrated Date:

7/18/2022

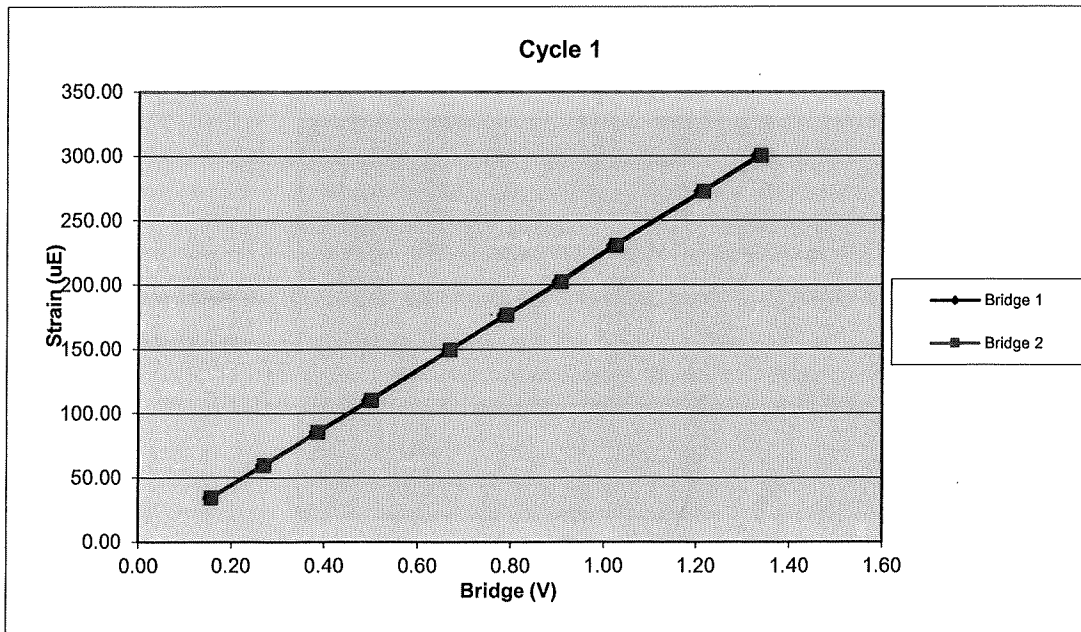
Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

Traceable to N.I.S.T.

728AWJ		Cycle 1		
Sample	Force (lb)	Strain (μ E)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1199.06	34.33	0.16	0.16
3	2052.76	59.72	0.27	0.27
4	2924.20	85.27	0.38	0.39
5	3782.68	110.02	0.50	0.50
6	5074.34	149.22	0.67	0.67
7	5985.06	176.19	0.79	0.79
8	6869.47	202.19	0.90	0.91
9	7768.10	230.48	1.02	1.03
10	9202.28	272.31	1.21	1.22
11	10126.06	300.27	1.33	1.34

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7583.03	Force Calibration (lb/V)	7557.58
Offset	20.67	Offset	0.95
Correlation	1.000000	Correlation	0.999999
Strain Calibration (μ E/V)	226.02	Strain Calibration (μ E/V)	225.27
Offset	-1.27	Offset	-1.86
Correlation	0.999984	Correlation	0.999979

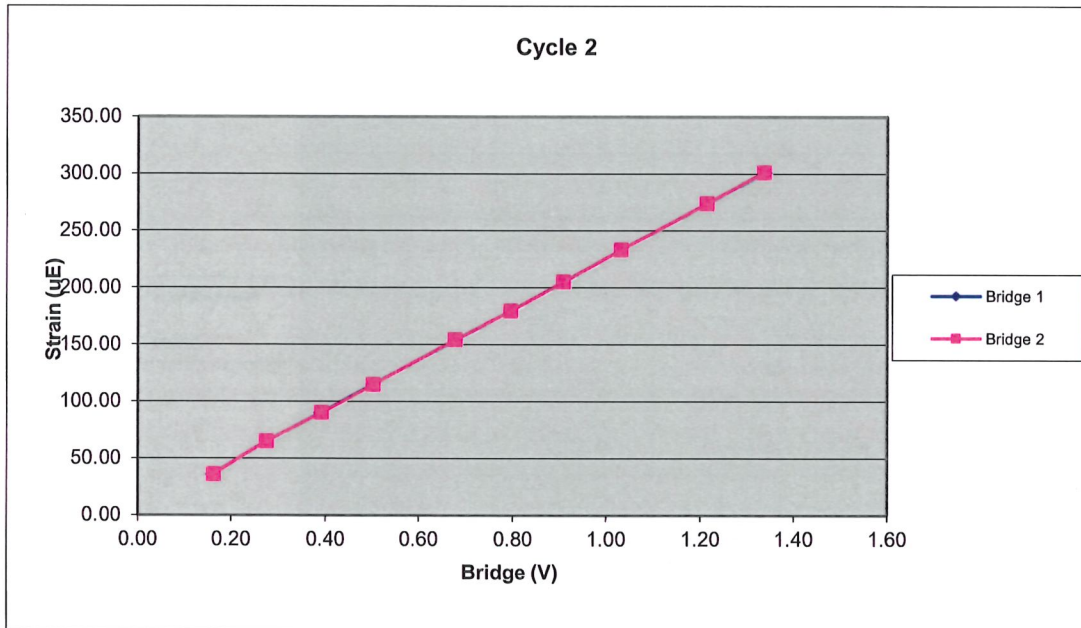
Force Strain Calibration	
EA (Kips)	33548.47
Offset	63.54
Correlation	0.999983



728AWJ		Cycle 2		
Sample	Force (lb)	Strain (μ E)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1236.98	35.69	0.16	0.16
3	2108.61	64.71	0.28	0.28
4	2976.64	89.52	0.39	0.39
5	3811.14	114.45	0.50	0.50
6	5141.89	153.54	0.68	0.68
7	6032.24	178.92	0.80	0.80
8	6903.48	204.54	0.91	0.91
9	7825.42	232.64	1.03	1.03
10	9217.58	273.43	1.22	1.22
11	10151.02	300.79	1.34	1.34

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7561.16	Force Calibration (lb/V)	7576.28
Offset	14.33	Offset	4.68
Correlation	0.999997	Correlation	0.999995
Strain Calibration (μ E/V)	223.39	Strain Calibration (μ E/V)	223.84
Offset	1.55	Offset	1.27
Correlation	0.999945	Correlation	0.999943

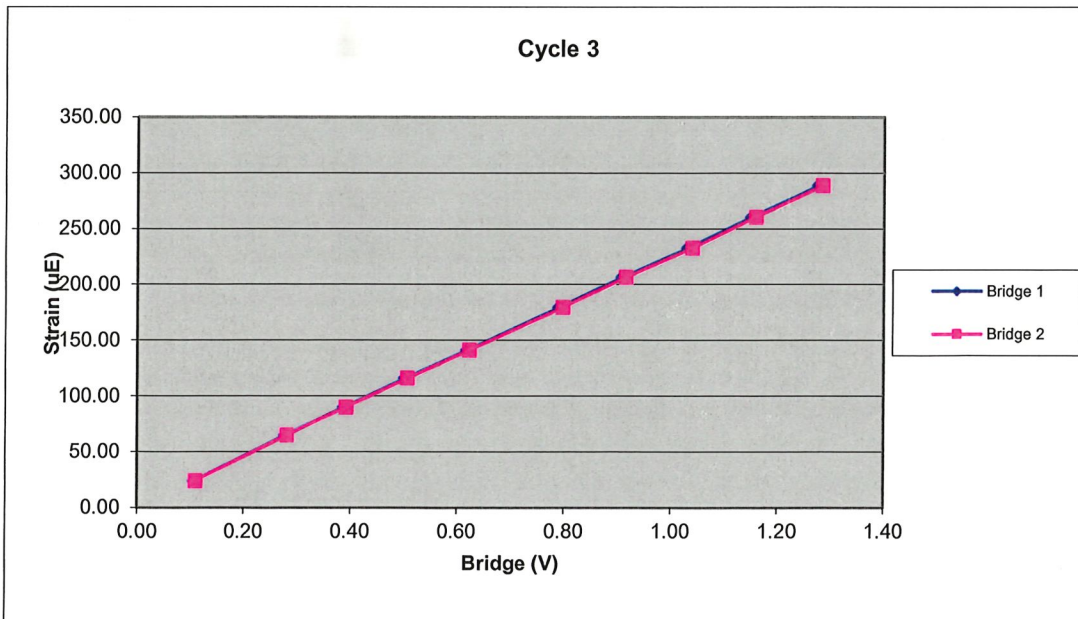
Force Strain Calibration	
EA (Kips)	33843.24
Offset	-37.68
Correlation	0.999950



728AWJ		Cycle 3		
Sample	Force (lb)	Strain (μE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	822.90	24.10	0.11	0.11
3	2132.69	64.89	0.28	0.28
4	2972.74	89.98	0.39	0.39
5	3841.65	115.75	0.50	0.51
6	4741.16	141.06	0.62	0.62
7	6043.35	179.33	0.79	0.80
8	6961.58	206.39	0.91	0.92
9	7901.94	232.60	1.03	1.04
10	8816.85	260.36	1.15	1.16
11	9759.65	288.75	1.28	1.29

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7644.24	Force Calibration (lb/V)	7602.69
Offset	-5.25	Offset	-12.15
Correlation	0.999999	Correlation	0.999997
Strain Calibration ($\mu\text{E}/\text{V}$)	224.53	Strain Calibration ($\mu\text{E}/\text{V}$)	223.31
Offset	1.57	Offset	1.37
Correlation	0.999950	Correlation	0.999942

Force Strain Calibration	
EA (Kips)	34041.33
Offset	-58.11
Correlation	0.999945



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

Calibration Factors	728AWJ		
Bridge 1 (µE/V)	224.65	Bridge 2 (µE/V)	224.14
EA Factor (Kips)	33811.01	Area (in^2)	1.13

Calibrated by: Sean Bannon
Calibrated Date: 2/6/2024

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 14Jun2022

Serial No: K10959 Temperature: 79.0 °F

Model: PR Humidity: 50%

Calibrated on: Channel 3 on 8G 5161 LE

PDA CALIBRATION FACTOR

413.8 mv/5000g

(82.8 μ v/g)

R²: 0.999956 [Chip programmed]

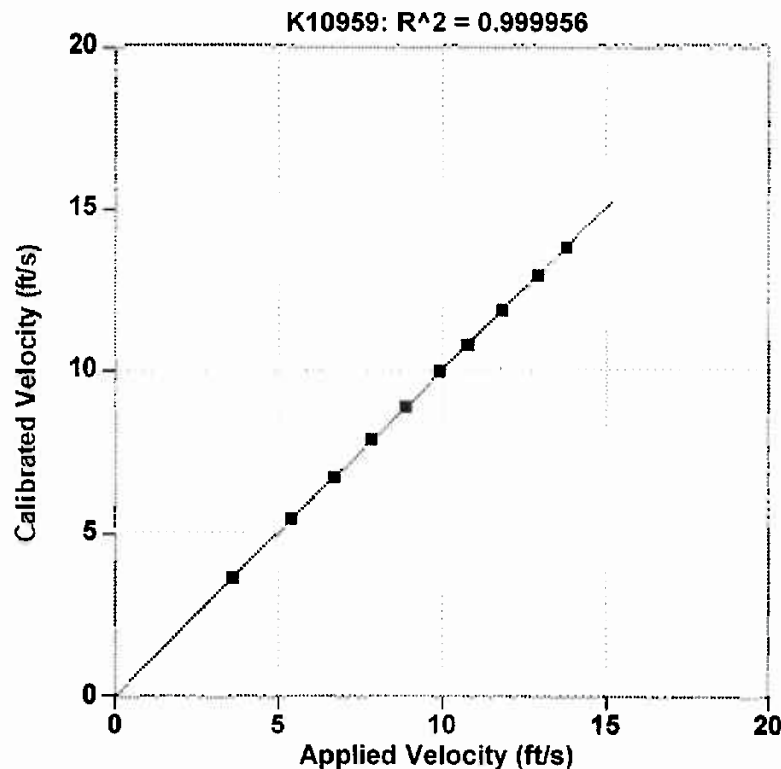
Ref Acc 1: 72517! Cal on: 24Mar2022
1049 g's/volt

Ref Acc 2: 72505! Cal on: 24Mar2022
1035 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 K10959 Velocity
ft/s	ft/s
3.605	3.589
5.397	5.412
6.705	6.699
7.841	7.862
8.877	8.913
9.904	9.929
10.746	10.721
11.807	11.815
12.910	12.889
13.783	13.762

Maximum Acceleration: 935 g's

Accelerometer Calibration Certificate

Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.
Calibration performed on 14Jun2022

Serial No: K10960 Temperature: 79.0 °F

Model: PR Humidity: 50%

Calibrated on: Channel 3 on 8G 5161 LE

PDA CALIBRATION FACTOR

419.9 mv/5000g

(84.0 $\mu\text{v/g}$)

R²: 0.999944 [Chip programmed]

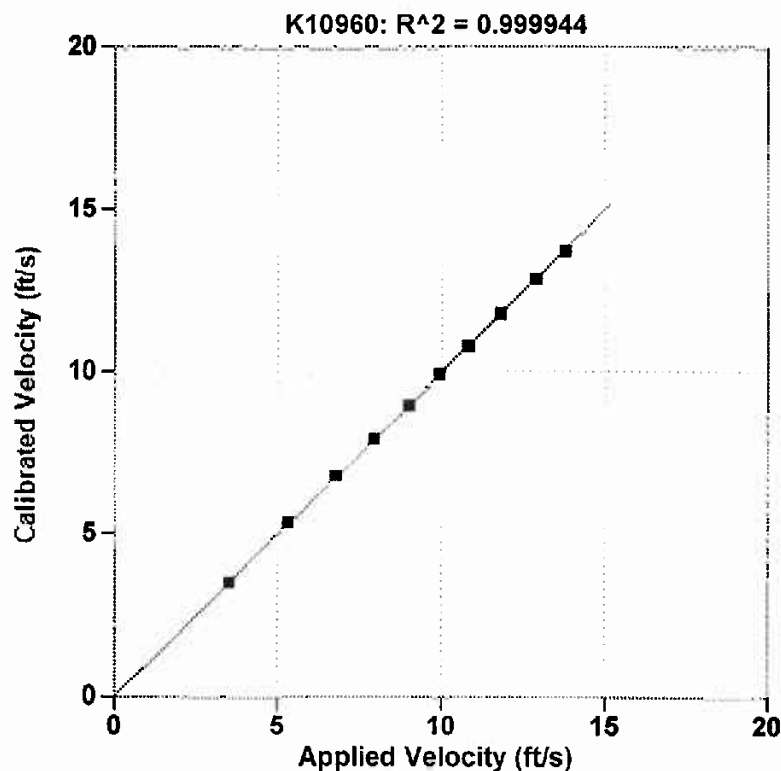
Operator: William Johnson

Ref Acc 1: 72517! Cal on: 24Mar2022
1049 g's/volt

Ref Acc 2: 72505! Cal on: 24Mar2022
1035 g's/volt

Signed

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



Reference Velocity	S/N K10960 Velocity
ft/s	ft/s
3.513	3.540
5.322	5.345
6.769	6.796
7.933	7.937
8.998	9.037
9.912	9.923
10.788	10.775
11.781	11.779
12.877	12.863
13.771	13.732

Maximum Acceleration: 934 g's

Accelerometer Calibration Certificate

Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.
Calibration performed on 14Jun2022

Serial No: K11957 Temperature: 79.0 °F

Model: PR Humidity: 50%

Calibrated on: Channel 3 on 8G 5161 LE

PDA CALIBRATION FACTOR

409.6 mv/5000g

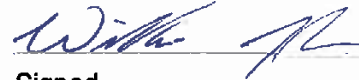
(81.9 μ v/g)

R²: 0.999919 [Chip programmed]

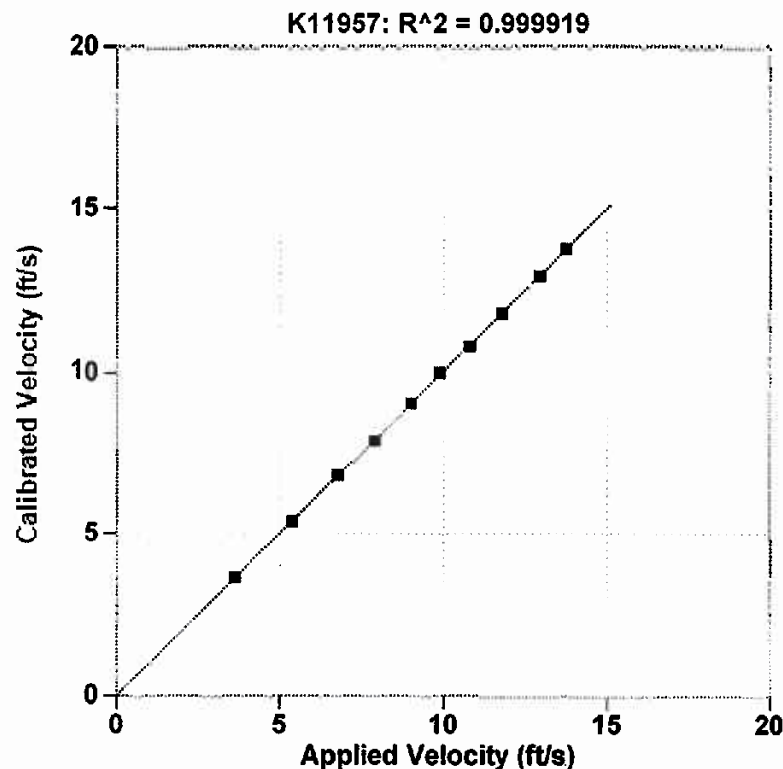
Operator: William Johnson

Ref Acc 1: 72517! Cal on: 24Mar2022
1049 g's/volt

Ref Acc 2: 72505! Cal on: 24Mar2022
1035 g's/volt


Signed

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



Reference Velocity ft/s	S/N K11957 Velocity ft/s
3.643	3.661
5.377	5.363
6.761	6.783
7.895	7.905
8.973	8.989
9.864	9.918
10.780	10.730
11.763	11.749
12.920	12.894
13.735	13.746

Maximum Acceleration: 931 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

S-24-230 over Townsend Creek

Geotechnical Subsurface Data Report

APPENDIX

SECTION 8 GEOSCOPING FORM

GeoScoping Form

PROJECT INFORMATION	
Project ID: 67100-007	Date of Trip: 10-23-2024
County: Greenwood County	Location: B/W Greenwood & Hodges, SC
Rd/Route: S-24-230	Local Name: Townsend Road E
Attendees: Benjamin Vogel	

EXISTING BRIDGE INFORMATION	
Bridge Length: 75'	Bridge Width: 25'
Superstructure Type: Precast concrete slabs	Substructure Type: Timber pile
Begin Bridge Sta.:	End Bridge Sta.:
Begin Bridge Embankment Sta. ¹ :	End Bridge Embankment Sta. ¹ :
Structure Number: 03322	Posted Weight Limit: N/A per a local & visually
Crossing: Townsend Creek	Skew: 5-10°??
Latitude: 34.26923	Longitude: -82.22054
Existing Fill Height:	Approximate Existing Slope Angle:

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

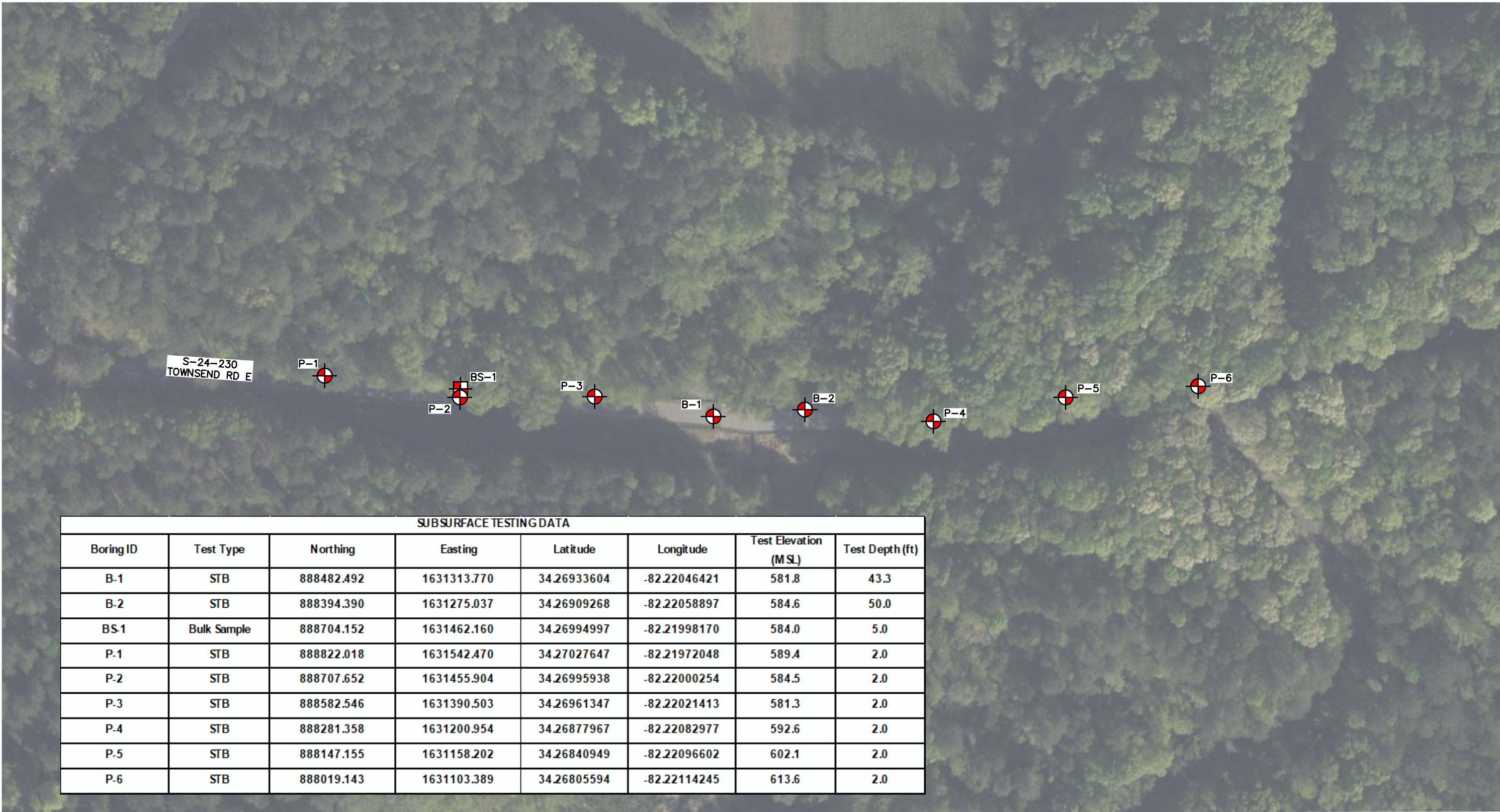
EXISTING ROADWAY EMBANKMENT INFORMATION	
Begin Project Sta.:	Begin Bridge Embankment Sta. ¹ :
Accessibility Issues: On W-pointing side: could probably get ATV close to creek but manual descent preferred & edge free in way; On E-pointing side: manual descent required, huge tree in way to steps	
Ground Cover: Wooded into tall & short grassy w/ asphalt waste mounds on slopes	
Existing Fill Height:	Approximate Existing Slope Angle: 30°, then 40-80°, then 50°
Local Development (undeveloped, developed residential, developed commercial, developed industrial, etc.): Undeveloped/residential	
Topography (level, flat, rolling, steep, hillside, valley, swamp, gully, etc.): Mostly flat, a little rolling	
Traffic Control Necessary (Y/N): Yes	
Surface Soil: F-M sandy SILT	
Muck (Y/N): No	
Exposed Rock (Y/N): No	In Stream Bed (Y/N): No - not in the creek
In Banks (Y/N): Yes - on sides of creek	
Wetlands On-Site (Y/N): Yes w/c in creek?	Wetlands Adjacent (Y/N): Yes w/c a creek?
Depth EG to Water: 18' both sides	Water Depth: 0-9" depending where
Depth to Existing Ground: W-pointing side: basically similar to Depth to Water (steep); E-pointing: 12' to ground, 17' to water's shore	
Scour Condition at EB: Mild	Scour Condition at IB: Mild
End Bridge Embankment Sta. ¹ :	End Project Sta.:
Accessibility Issues: W-pointing side: manual descent required - too much fallen trees & tall grass; E-pointing: manual descent required - trees fallen & steep	
Ground Cover: Wooded into short & tall grass w/ asphalt waste mound; abundant fallen trees	
Existing Fill Height:	Approximate Existing Slope Angle: 27-35° then 50-80°
Local Development (undeveloped, developed residential, developed commercial, developed industrial, etc.): Undeveloped/residential	
Topography (level, flat, rolling, steep, hillside, valley, swamp, gully, etc.): Hill/side	
Traffic Control Necessary (Y/N): Yes	
Surface Soil: silty F-C SAND & F sandy SILT	
Muck (Y/N): No	
Exposed Rock (Y/N): No	In Stream Bed (Y/N): No - not in the creek
In Banks (Y/N): Yes - on sides of creek	
Wetlands On-Site (Y/N): Yes w/c in creek?	Wetlands Adjacent (Y/N): Yes w/c a creek?
Depth EG to Water: 18' E-pointing side, mostly dry	Water Depth: 0-2' depending; W-pointing not dry
Depth to Existing Ground: E-pointing: 17' to water's shore, 11' to ground; W-pointing side: 15' to ground, stream bed then dry	
Scour Condition at EB: Mild	Scour Condition at IB: Mild

GeoScoping Form

UTILITIES INFORMATION	
Attached:	None seen
Above Ground/ Overhead:	Running parallel to bridge on W-pointing side, no contact
Underground:	None seen on W-pointing side
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.



SUBSURFACE TESTING DATA							
Boring ID	Test Type	Northing	Easting	Latitude	Longitude	Test Elevation (M.S.L.)	Test Depth (ft)
B-1	STB	888482.492	1631313.770	34.26933604	-82.22046421	581.8	43.3
B-2	STB	888394.390	1631275.037	34.26909268	-82.22058897	584.6	50.0
BS-1	Bulk Sample	888704.152	1631462.160	34.26994997	-82.21998170	584.0	5.0
P-1	STB	888822.018	1631542.470	34.27027647	-82.21972048	589.4	2.0
P-2	STB	888707.652	1631455.904	34.26995938	-82.22000254	584.5	2.0
P-3	STB	888582.546	1631390.503	34.26961347	-82.22021413	581.3	2.0
P-4	STB	888281.358	1631200.954	34.26877967	-82.22082977	592.6	2.0
P-5	STB	888147.155	1631158.202	34.26840949	-82.22096602	602.1	2.0
P-6	STB	888019.143	1631103.389	34.26805594	-82.22114245	613.6	2.0



LEGEND:

-  SOIL TEST BORING LOCATION
-  BULK SAMPLE LOCATION

4			
3			
2			
1			
REV.	BY	DATE	DESCRIPTION OF REVISION
TOPO.		DATE	
DWG.	CTC	DATE 10.25.24	GROUP -
R/W		DATE	



F&ME CONSULTANTS, INC.
COLUMBIA, SC

S-24-230 OVER TOWNSEND CREEK
GREENWOOD COUNTY, SOUTH CAROLINA

BORING LOCATION PLAN

SCDOT PROJECT ID: P043995	FME JOB NO. G7100.007 task 003
SCALE: 1" = 100'	FIGURE 2

Geo-Scoping Form



B1 Side Looking at B2 Side



B2 Side Looking at B1 Side



**Side Profile From B1 Side, Pointing
NW**



**Side Profile From B1 Side, Pointing
SE**



**Side Profile From B2 Side, Pointing
SE**



**Under B1 Side Looking at Under B2
Side**

Geo-Scoping Form



Under B1 Side



Under B2 Side