Geotechnical Data Report

S-38-50 (Four Holes Road)
over I-26 Emergency Bridge Replacement
Orangeburg County, South Carolina

May 22, 2018 (Revision 1)
SCDOT Project ID.: P037465
Terracon Project No. 73155050U

Prepared for:
South Carolina Department of Transportation
Columbia, South Carolina

Prepared by:
Terracon Consultants, Inc.
Columbia, South Carolina

May 22, 2018 (Revision 1)

South Carolina Department of Transportation
955 Park Street, Room 421
Columbia, South Carolina 29201

Attn: Mr. Trapp Harris, P.E.
Geotechnical Design Engineer – Design-Build Section

Re: Geotechnical Data Report
S-38-50 (Four Holes Road) Emergency Bridge Replacement over I-26
Orangeburg County, South Carolina
SCDOT Project ID.: P037465
Terracon Project Number: 73155050U

Dear Mr. Harris:

Terracon Consultants Inc. (Terracon) has completed the geotechnical exploration and testing services for the above referenced project. These services were conducted in general accordance with the SCDOT Request for Subsurface Exploration and Laboratory Testing (SCDOT Project ID: P037465, authorized on April 24, 2018). This geotechnical data report presents the findings of the subsurface exploration and laboratory testing along with an overview of testing activities.

1.0 INTRODUCTION

The South Carolina Department of Transportation (SCDOT) has contracted Terracon to perform subsurface exploration and laboratory testing for the replacement of the S-38-50 (Four Holes Road) Bridge over I-26 in Orangeburg County, SC. The purpose this work is to develop information relative to subsurface soil, rock, and groundwater conditions at the bridge location. This report presents the results of that work. No geotechnical recommendations are associated with the requested scope of study.

The following sections of this report contain a summary of the activities for our field exploration and laboratory testing. The logs of the borings, the Site Location Map and the Exploration Plan are included in Appendix A of this report. The results of the laboratory testing performed on rock samples obtained from the site during the field exploration are included in Appendix B of this report. Descriptions of the field exploration and laboratory testing are included in their respective appendices.

2.0 PROJECT DESCRIPTION

The project site is located at the overpass of S-38-50 (Four Holes Road) and Interstate 26 in Orangeburg County, South Carolina. The Site Location Map and Boring Location Plan are presented in Appendix A of this report. It is our understanding that the project will include the replacement of the previously demolished bridge with a new structure on the existing or similar horizontal alignment. The original structure appears to have been supported with deep foundations.

3.0 GEOTECHNICAL TESTING

The geotechnical exploration for this project was performed between April 26 and 27, 2018. The results of our field work and our associated laboratory testing is attached in appendixes A and B of this report.

3.1 Field Exploration

Our field exploration at the site consisted of the following:

- Two (2) Standard Penetration Test (SPT) Borings (B-1 and B-2)
- Two (2) CPT Soundings (C-1 and C-2)
- Geophysical testing including one (1) Multi-channel Analysis of Surface Waves test array (MASW-1)

The tests were performed at the approximate locations provided by the SCDOT. A description of our testing methods and graphical logs outlining the soil conditions at each test location are presented in Appendix A. Test locations were established in the field by Terracon and surveyed by Construction Support Services, LLC, after completion. Photographs of the drill rig set up at each boring location along with general photographs of the existing bridge are provided in Appendix A.

3.2 Laboratory Testing

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

- Ten (10) Natural Moisture Content Tests
- Ten (10) No. 200 Wash
- Three (3) Compressive Strength of Rock Tests

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

4.0 CLOSURE

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

Sincerely,
Terracon Consultants, Inc.

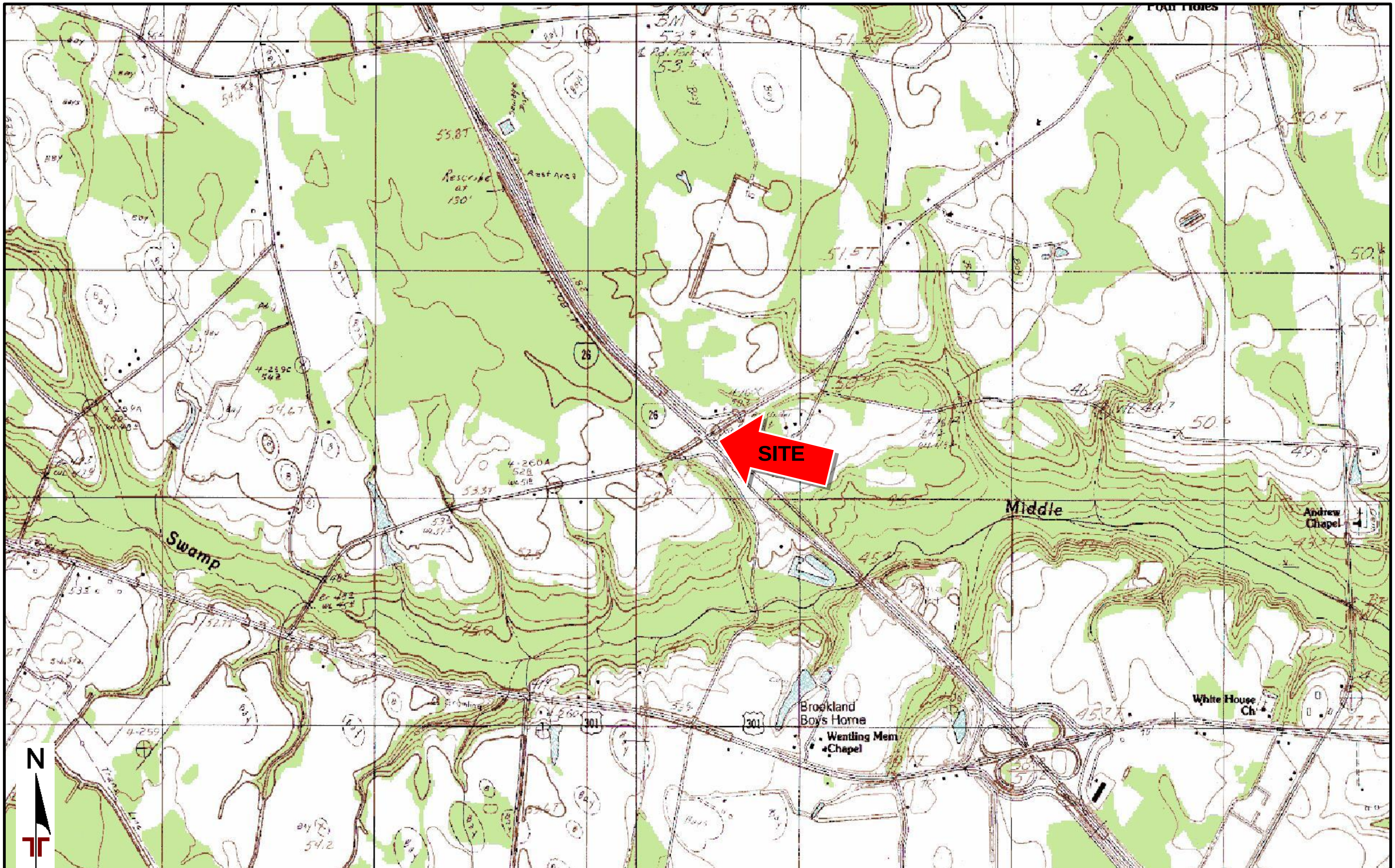
Joseph D.M. Fredendall, E.I.T.
Geotechnical Staff Engineer

Phillip A. Morrison, P.E.
Geotechnical Department Manager
SC Registration No. 17275

Attachments

Copies: Addressee (1 via email)
File (1)

APPENDIX A
FIELD EXPLORATION



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: ORANGEBURG SOUTH, SC (1/1/1982) and INDIAN CAMP BRANCH, SC (1/1/1982).

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

Project Manager: JDF	**Project No.** 73155050U
Drawn by: PTK	**Scale:** 1"=2,000'
Checked by: JDF	**File Name:** A-1 & A-2
Approved by: PAM	**Date:** May 2018

Terracon

521 Clemson Rd

Columbia, SC 29229-4307

SITE LOCATION MAP

S-38-50 (Four Holes Road) RBO I-26

SC-38-50

Columbia, South Carolina

Exhibit

A-1

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

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

Project Manager: JDF	Project No. 73155050U
Drawn by: PTK	Scale: AS SHOWN
Checked by: JDF	File Name: A-1 & A-2
Approved by: PAM	Date: May 2018

Terracon
521 Clemson Rd
Columbia, SC 29229-4307

EXPLORATION PLAN

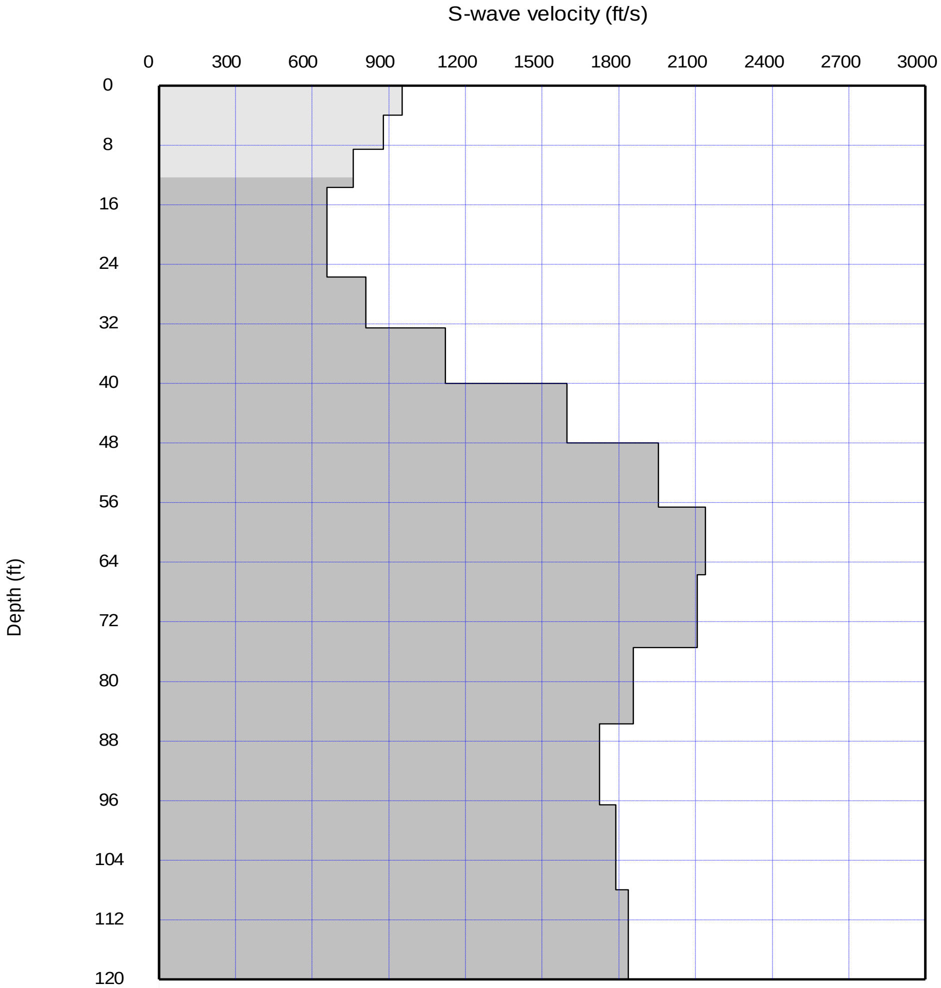
S-38-50 (Four Holes Road) RBO I-26
SC-38-50
Columbia, South Carolina

Exhibit
A-2

Summary of Field Data

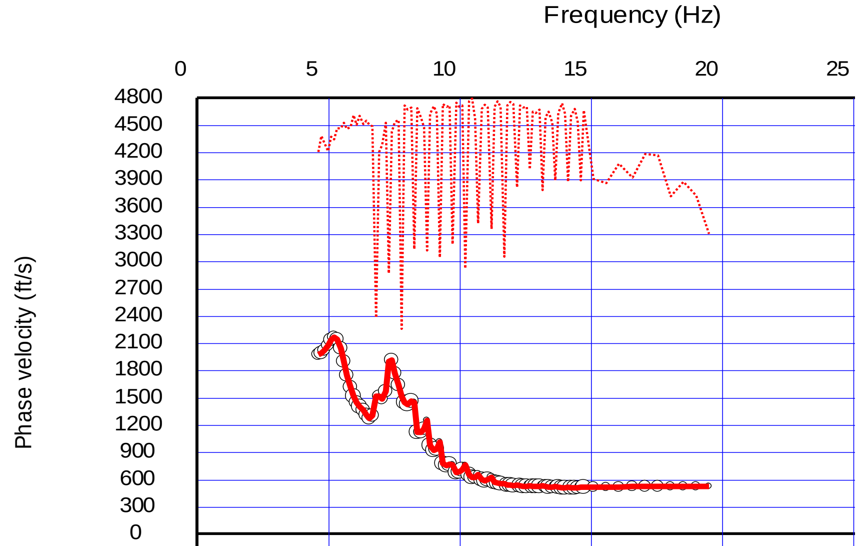
Test No.	Ground Elevation (ft)	Test Depth (ft.)	Northing	Easting	Latitude	Longitude
B-1	191.31	94	595711.75	2077182.07	33.4703928	-80.7468663
B-2	191.20	90	595846.24	2077438.70	33.4707608	-80.7460235
C-1	190.78	66.8	595687.49	2077171.71	33.4703262	-80.7469007
C-2	190.84	67.4	595869.56	2077446.91	33.4708248	-80.7459964
MASW-1[1]	152.31[1]	N.A.	595607.86[1]	2077075.09[1]	33.4701081[1]	-80.7472182[1]

1. Approximate center of array



S-wave velocity model : Active and Passive Combined.rst

Testing Results	
Depth(ft)	**S-wave velocity(ft/s)**
0.0	952
4.0	878
8.6	760
13.7	658
19.4	658
25.7	810
32.6	1122
40.0	1597
48.0	1954
56.6	2140
65.7	2106
75.4	1857
85.7	1900
96.6	1920
108.0	1836



Dispersion curve : Active and Passive Combined.rst

Average Weighted Shear Wave Velocity (ft/s)[1] = **1271**

Seismic Site Classification = **C**

1. Between 0 ft and 100 ft.

Project Mgr:	BTS	Project No.	73155050U
Prepared by:	WJB		
Checked by:	BTS	Scale:	NA
Approved by:	BTS	Date:	4/30/2018

Terracon

1450 FIFTH STREET WEST NORTH CHARLESTON, SC
PH: (843) 884-1234 Fax. (843) 884-9234

GEOPHYSICAL TESTING RESULTS
MASW SHEAR WAVE VELOCITY

S-38-50 (Four Holes Road) over I-26 Bridge Replacement
Orangeburg County, South Carolina

TEST N0
MASW-1

FIELD EXPLORATION DESCRIPTION

Overview

The testing locations were provided by the SCDOT and located in the field by Terracon by taking measurements from existing structures shown on the provided drawings. The borings were surveyed by Construction Support Services, LLC after testing and drilling was complete. The locations as shown in the Exploration Location Plan are shown to the scale indicated.

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

Soil Test Borings (STB)

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

- SCDOT Geotechnical Design Manual 2010
- ASTM D5783, “Standard Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geo-environmental Exploration”
- ASTM D6151, “Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling
- ASTM D1586 “Test Method for Penetration Test and Split-Barrel Sampling of Soils”
- ASTM D4220 “Standard Practices for Preserving and Transporting Soil”
- ASTM D2113 “Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration”
- ASTM D5079 “Standard Practices for Preserving and Transporting Rock Core Samples”

Each boring was advanced using rotary wash drilling techniques until refusal was encountered. Upon refusal the material was cored using wireline coring methods. The sampling program is summarized in the following table:

Test ID	Total Depth	Interval of Continuous Sampling
B-1	120 feet or refusal and 20 feet of coring	0 to 20 feet
B-2	120 feet or refusal and 20 feet of coring	0 to 20 feet
C-1	75 feet or refusal	N/A
C-2	75 feet or refusal	N/A

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

Soil Classification provides a general guide to the engineering properties of various soil types and enables the engineer to apply his experience to current situations. In our exploration, samples obtained during drilling operations are examined and visually classified by a geotechnical engineer using the procedures outlined in ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System). Laboratory testing was also performed on select split-spoon samples to evaluate index properties for further classification. The soils are described according to color, texture, and relative density or consistency (based on standard penetration resistance). The designations shown on the logs are described on Exhibit A-6.

The borings were advanced either to the planned drilling depth at which they were terminated, or to refusal of the drilling equipment and continued below this depth using diamond bit rock coring techniques. NQ2 sized cores were recovered from the borehole. The rock recovery ratios (REC, percentage of the total core run), Rock Quality Designation (RQD, percentage of the total core run of pieces greater than 4 inches) were recorded along with a description of the rock. An explanation of the rock descriptions shown on the logs is provided on Exhibit A-7 Photos of the recovered rock core specimens are provided on Exhibit A-11 of the Appendix.

The rock cores in Boring B-1 were obtained using a #6 diamond core bit. This is a general purpose coring bit suited for low to medium strength rock formations. The bit was changed to a #2 diamond core bit to core the rock in Boring B-2. This bit is generally more compatible with very low to low strength rock formations. Additionally, the water flow and pressure were reduced to aid in the recovery of the interbedded layers of silty and clayey sand. Based on the increased recovery and RQD values from Boring B-2 relative to Boring B-1, it is possible that similar results could be obtained in Boring B-1 using similar techniques.

Consistent with SCDOT GDM, the borings were drilled using mud rotary drilling techniques. As the drilling method introduces water into the borehole, time-of-drilling water levels could not be recorded. As noted on the boring log, the water level of Boring B-1 was recorded 1 day after the start of drilling activities, kept open using 3-inch diameter casing resting on a very dense clayey sand layer. The water level of Boring B-2 was recorded 4 days after the completion of drilling, kept open using 1-inch piezometer casing with well screen in the lower 10 feet. These water levels are indicated on the boring logs. At the conclusion of the work, the boreholes were backfilled with clean sand and the borings were capped with cold-patch asphalt.

Seismic Surface Wave Testing

Multi-Channel Analysis of Surface Waves (MASW testing) was performed to determine the shear wave velocity profile of the layered soil system. At the test location both MASW readings (active) and Microtremor Array Measurement (MAM) readings (passive) were recorded. The MASW test was conducted using the 24-channel Geometrics Geode seismographs and 4.5-Hz geophones with a linear geometry at an interval of 10-ft. Surface waves were generated by a 20-pound sledgehammer striking a polyethylene plate at four locations. MAM testing was performed along the same survey line.

MASW (Active) Testing - Multi-Channel Analysis of Surface Waves (MASW) is a seismic method that uses the dispersive characteristics of Rayleigh-type surface waves to determine the variation of the shear-wave velocity of layered soils with depth.

MAM (Passive) Testing - Microtremor Array Measurement (MAM) “for lower frequency surface waves (passive waves) arising from microtremors and/or urban (traffic) noise and recorded them using a linear or two-dimensional (triangle, circle, semicircle, and “shapes”) array of geophones (Zywicki and Rix, 1999; Lie et al., 2000). Multiple noise records are required for analysis. The data filters out the Rayleigh waves through a technique called spatial auto-correction (SPAC). This allows the development of a dispersion curve that is defined as the lower envelope of the measured energy peaks. MAM testing results in lower peak energy selections than the active testing described above.

SOIL DESCRIPTION TERMS

Relative Density/Consistency Terms

Relative Density[1]

Descriptive Term	Relative Density	SPT Blow Count
Very Loose	0 to 15%	4 and less
Loose	16 to 35%	5 to 10
Medium Dense	36 to 65%	11 to 30
Dense	66 to 85%	31 to 50
Very Dense	86 to 100%	51 and more

Consistency[2]

Descriptive Term	Unconfined Compression Strength (q_u) (tsf)	SPT Blow Count
Very Soft	0.25 and less	2 and less
Soft	0.26 to 0.50	3 to 4
Firm	0.51 to 1.00	5 to 8
Stiff	1.01 to 2.00	9 to 15
Very Stiff	2.01 to 4.00	16 to 30
Hard	4.01 and more	31 and more

Moisture Condition

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

Color

Describe the sample color while sample is still moist.

Angularity[1]

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

HCl Reaction[3]

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

Cementation[3]

Descriptive Term	Criteria
Weakly Cemented	Crumbles or breaks with handling or little finger pressure
Moderately Cemented	Crumbles or breaks with considerable finger pressure
Strongly Cemented	Will not crumble or break with finger pressure

Particle-Size Range[1]

Gravel	Diameter, mm	Sieve Size
Fine	4.76 to 19.1	#4 to ¾ inch
Coarse	19.1 to 76.2	¾ inch to 3 inch

Sand	Diameter, mm	Sieve Size
Fine	0.074 to 0.42	#200 to #40
Medium	0.42 to 2.00	#40 to #10
Coarse	4.00 to 4.76	#10 to #4

Primary Soil Type[1, 2]

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

USCS Soil Designation

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

AASHTO Soil Designation

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

[1] Applies to coarse-grained soils (major portion retained on No. 200 sieve)
[2] Applies to fine-grained soils (major portion passing No. 200 sieve)
[3] Use as required

DESCRIPTION OF ROCK PROPERTIES

WEATHERING

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

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

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

Joint, Bedding, and Foliation Spacing in Rock [a]

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

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

Rock Quality Designator (RQD)[a]

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

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

Joint Openness Descriptors

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

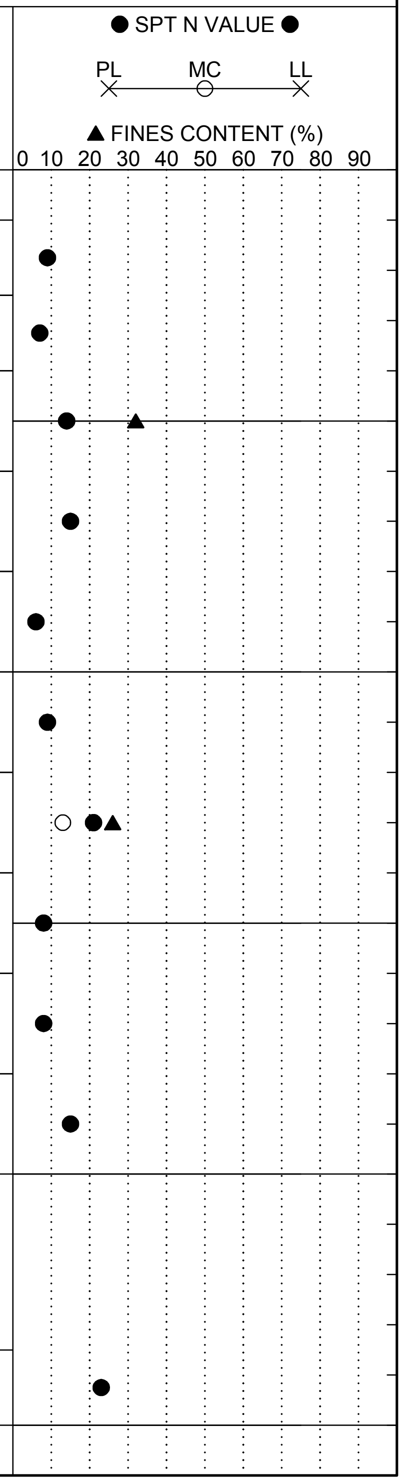
References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, Engineering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

SCDOT Soil Test Log

Project ID:	P037465	**County:**	Orangeburg	**Boring No.:**	B-1		
Site Description:	S-38-50 (Four Holes Road) over I-26 Emergency Bridge Replacement	**Route:**	S-38-50				
Eng./Geo.:	J. Fredendall	**Boring Location:**		**Offset:**		**Alignment:**	Existing
Elev.:	191.3 ft	**Latitude:**	33.4703928	**Longitude:**	-80.7468663	**Date Started:**	4/26/2018
Total Depth:	94 ft	**Soil Depth:**	74 ft	**Core Depth:**	20 ft	**Date Completed:**	4/27/2018
Bore Hole Diameter (in):	3.88	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55/300	**Drill Method:**	RW/RC	**Hammer Type:**	Automatic	**Energy Ratio:**	87.7%
Core Size:	NQ2	**Driller:**	A. McGuire	**Groundwater:**	**TOB** N.M.	**24HR**	18 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION
	0.0	Roadway
		ASPHALT (12 inches)
	1.0	**FILL** - Loose to medium dense, moist, brownish yellow to yellow, subangular, weakly cemented, fine to coarse Silty SAND (SM) (A-2-4) 10YR 6/6 to 10YR 7/6
186.3		@SS-3: NMC=14, &#200=31.8
	8.0	**FILL** - Loose to medium dense, moist, brownish yellow to yellowish brown, subangular, weakly cemented, fine to medium Clayey SAND (SC) (A-2-6) 10YR6/6 to 10YR 5/4
181.3		@SS-7: NMC=13, &#200=26.1
	14.0	**FILL** - Medium dense to loose, moist, yellowish brown, subangular, weakly cemented, fine to medium Clayey SAND (SC) (A-2-6) 10YR 5/4
176.3		
171.3		
	22.0	**COASTAL PLAIN** - Loose to medium dense, moist, gray to yellow, subrounded, weakly cemented, fine to medium Silty SAND (SM) (A-2-4) 10YR 6/1 to 10YR 8/6
166.3		

Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value
1.0	SS-1	6	5	4		9
2.5	SS-2	3	3	4		7
4.0	SS-3	3	8	6	9	14
6.0	SS-4	7	6	9	2	15
8.0	SS-5	3	3	3	3	6
10.0	SS-6	6	6	3	3	9
12.0	SS-7	9	11	10	7	21
14.0	SS-8	6	4	4	5	8
16.0	SS-9	4	4	4	4	8
18.0	SS-10	5	7	8	9	15
23.5	SS-11	6	17	6		23



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:	P037465	County:	Orangeburg	Boring No.:	B-1
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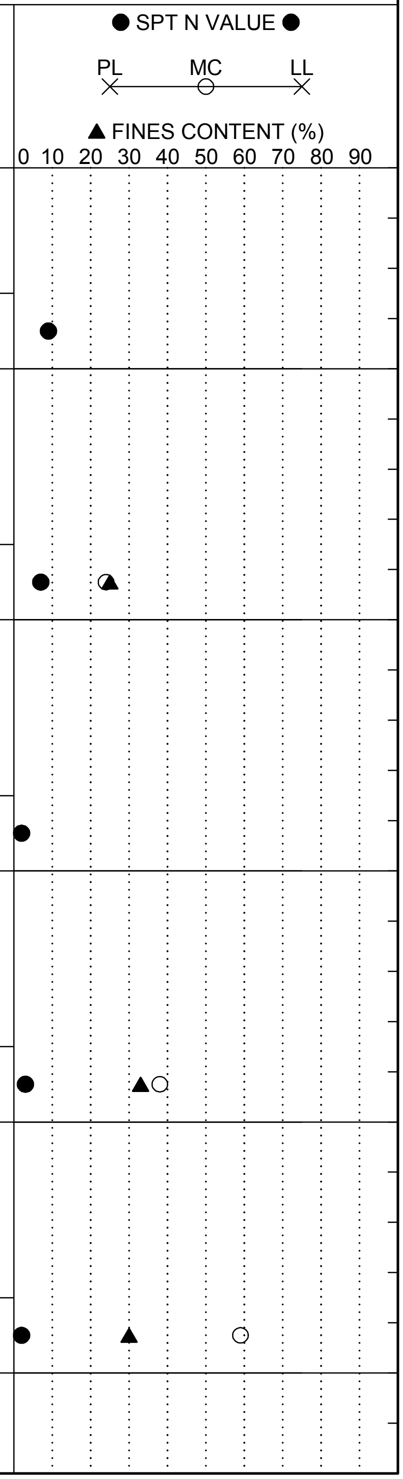
Total Depth:	94 ft	Soil Depth:	74 ft	Core Depth:	20 ft
Date Completed:	4/27/2018				
Bore Hole Diameter (in):	3.88	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME-55/300	Drill Method:	RW/RC	Hammer Type:	Automatic
Energy Ratio:	87.7%				
Core Size:	NQ2	Driller:	A. McGuire	Groundwater:	TOB N.M.
24HR	18 ft				

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value
			28.5	SS-12	3	5	4		9
161.3									
		@SS-13: NMC=24, %#200=25.0	33.5	SS-13	3	4	3		7
156.3									
	37.0	Very loose to loose, wet, red to reddish yellow, subangular, weakly reactive, weakly cemented, fine to medium Silty SAND with shell fragments (SM) (A-2-4) 5R 4/6 to 7.5YR 8/6	38.5	SS-14	2	1	1		2
151.3									
		@SS-15: NMC=38, %#200=33.2	43.5	SS-15	woh	1	2		3
146.3									
		@SS-16: NMC=59, %#200=30.0	48.5	SS-16	woh/12"		2		2
141.3									



LEGEND

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SAMPLER TYPE		DRILLING METHOD	
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Core Size:	NQ2	**Driller:**	A. McGuire	**Groundwater:**	**TOB** N.M.	**24HR**	18 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value
			53.5	SS-17	2	4	4		8
136.3									
	57.0	Stiff, wet, reddish yellow, weakly reactive, Sandy SILT with shell fragments (ML) (A-4) 7.5YR 8/6 @SS-18: NMC=54, %#200=50.9	58.5	SS-18	2	4	5		9
131.3									
			63.5	SS-19	3	4	5		9
126.3									
	67.0	Very dense, moist, gray, angular, weakly reactive, moderately cemented, fine to coarse, Clayey SAND with limestone fragments (SC) (A-2-6) 7.5YR 6/1	68.5	SS-20	28	39	32		71
121.3									
	72.0	Hard, moist, light gray, weakly reactive, Lean CLAY with sand (CL) (A-6) 7.5YR 7/1	73.5 74.0	SS-21	50	50/0"			50/0"
	74.0	**Refusal encountered at 74 feet, set casing and begin coring with #6 bit** Limestone, light greenish gray, 10G 8/1, smooth, fine to coarse grained, moderately to highly weathered, very weak to medium strong with bedding, narrow to moderately wide discontinuity width, infilled with clay	76.0	NQ2-1					
116.3									

● SPT N VALUE ●
PL MC LL
▲ FINES CONTENT (%)
0 10 20 30 40 50 60 70 80 90
>>

LEGEND

Continued Next Page

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

SCDOT Soil Test Log

Project ID:	P037465		**County:**	Orangeburg		**Boring No.:**	B-1	
Site Description:	S-38-50 (Four Holes Road) over I-26 Emergency Bridge Replacement					**Route:**	S-38-50	
Eng./Geo.:	J. Fredendall	**Boring Location:**		**Offset:**		**Alignment:**	Existing	
Elev.:	191.3 ft	**Latitude:**	33.4703928	**Longitude:**	-80.7468663	**Date Started:**	4/26/2018	
Total Depth:	94 ft	**Soil Depth:**	74 ft	**Core Depth:**	20 ft	**Date Completed:**	4/27/2018	
Bore Hole Diameter (in):	3.88	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)	
Drill Machine:	CME-55/300	**Drill Method:**	RW/RC	**Hammer Type:**	Automatic	**Energy Ratio:**	87.7%	
Core Size:	NQ2	**Driller:**	A. McGuire	**Groundwater:**	**TOB** N.M.	**24HR**	18 ft	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		and sand, very close to close discontinuity spacing, smooth to slightly rough surface			NQ2-2						
111.3		@NQ2-1: RQD=0, %REC=16, Run Time = 4 minutes, GSI=10									
		@NQ2-2: RQD=33, %REC=50, Run Time = 13 minutes, GSI=20, q_u=2,845psi, RMR=21 Class IIV: Poor Rock		81.0							
		@NQ2-3: RQD=0, %REC=10, Run Time = 4 minutes, GSI=10			NQ2-3						
106.3				86.0							
		@NQ2-4: RQD=10, %REC=10, Run Time = 5 minutes, GSI=5			NQ2-4						
101.3				91.0							
		@NQ2-5: RQD=18, %REC=50, Run Time = 10 minutes, GSI=10			NQ2-5						
	94.0	**Coring Terminated at 94 feet**									
96.3											
91.3											

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:	P037465	**County:**	Orangeburg	**Boring No.:**	B-2
Site Description:	S-38-50 (Four Holes Road) over I-26 Emergency Bridge Replacement			**Route:**	S-38-50
Eng./Geo.:	J. Fredendall	**Boring Location:**		**Offset:**	
Alignment:	Existing				
Elev.:	191.2 ft	**Latitude:**	33.4707608	**Longitude:**	-80.7460235
Date Started:	4/27/2018	**Date Completed:**	5/1/2018		
Total Depth:	90 ft	**Soil Depth:**	70 ft	**Core Depth:**	20 ft
Bore Hole Diameter (in):	3.88	**Sampler Configuration**			
Liner Required:	Y (N)	**Liner Used:**	Y (N)		
Drill Machine:	CME-55/300	**Drill Method:**	RW/RC	**Hammer Type:**	Automatic
Energy Ratio:	87.7%				
Core Size:	NQ2	**Driller:**	A. McGuire	**Groundwater:**	**TOB** N.M. **24HR** 22 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value
	0.0	Roadway							
	0.2	ASPHALT (2 inches)	0.5						
	0.5	SAND CLAY BASE (4 inches)		SS-1	7	8	6		14
		FILL - Medium dense to loose, dry, reddish yellow to light brown, subangular, weakly cemented, fine to medium, Silty SAND (SM) (A-2-4) 10YR 7/6 to 10YR 5/4	2.0	SS-2	3	4	5	7	9
186.2			4.0	SS-3	4	6	5	4	11
	6.0	**FILL** - Loose, moist, brown, subangular, weakly cemented, fine to medium Clayey SAND (SC) (A-2-6) 10YR 5/3	6.0	SS-4	3	4	5	6	9
	8.0	**FILL** - Medium dense, moist, reddish yellow, subangular, weakly cemented, fine to medium Silty SAND (SM) (A-2-4) 10YR 6/6	8.0	SS-5	5	6	6	6	12
181.2	10.0	@SS-5: NMC=13, &#200=25.0	10.0	SS-6	5	5	5	4	10
		FILL - Loose, moist, reddish yellow, subangular, weakly cemented, fine to medium Clayey SAND (SC) (A-2-6) 10YR 6/6	12.0	SS-7	3	5	4	7	9
176.2	14.0	**FILL** - Medium dense, moist, red, subangular, weakly cemented, fine to medium Silty SAND (SM) (A-2-4) 5R 5/6	14.0	SS-8	8	6	6	5	12
	16.0	**FILL** - Loose, moist, light reddish gray to dark gray, subangular, weakly cemented, fine to medium Clayey sand (SC) (A-2-6) 2.5YR 7/1 to 10YR 4/1	16.0	SS-9	5	4	5	5	9
			18.0	SS-10	4	4	6	8	10
171.2									
	22.0	**COASTAL PLAIN** Medium dense to loose, moist, dark gray to brownish yellow, subangular, nonreactive, weakly cemented, fine to medium, Silty SAND (SM) (A-2-4) 10YR 4/1 to 10YR 6/6	23.5	SS-11	6	5	6		11
166.2									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

SC_DOT 73155050U SCDOT 4 HOLES ROAD EBRO I-26.GPJ SCDOT DATA TEMPLATE_01_30_2015.GDT 5/22/18

LEGEND

Continued Next Page

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

SCDOT Soil Test Log

Project ID:	P037465	County:	Orangeburg	Boring No.:	B-2
Site Description:	S-38-50 (Four Holes Road) over I-26 Emergency Bridge Replacement	Route:	S-38-50		
Eng./Geo.:	J. Fredendall	Boring Location:		Offset:		Alignment:	Existing
Elev.:	191.2 ft	Latitude:	33.4707608	Longitude:	-80.7460235	Date Started:	4/27/2018
Total Depth:	90 ft	Soil Depth:	70 ft	Core Depth:	20 ft	Date Completed:	5/1/2018
Bore Hole Diameter (in):	3.88	Sampler Configuration		Liner Required:	Y (N)	Liner Used:	Y (N)
Drill Machine:	CME-55/300	Drill Method:	RW/RC	Hammer Type:	Automatic	Energy Ratio:	87.7%
Core Size:	NQ2	Driller:	A. McGuire	Groundwater:	TOB N.M.	24HR	22 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value
			28.5	SS-12	4	6	5		11
161.2									
		@SS-13: NMC=22, %#200=13.3	33.5	SS-13	4	5	5		10
156.2									
	37.0	Very loose to loose, wet, light red to brownish yellow, subangular, nonreactive, weakly cemented, fine to medium, Silty SAND (SM) (A-2-4) 5R 7/6 to 10YR 6/6							
		@SS-14: NMC=29, %#200=12.8	38.5	SS-14	1	2	1		3
151.2									
			43.5	SS-15	1	0	1		1
146.2									
		@SS-16: NMC=30, %#200=15.4	48.5	SS-16	3	4	2		6
141.2									
	52.0								

● SPT N VALUE ●
PL MC LL
▲ FINES CONTENT (%)
0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

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

SCDOT Soil Test Log

Project ID:	P037465		**County:**	Orangeburg		**Boring No.:**	B-2
Site Description:	S-38-50 (Four Holes Road) over I-26 Emergency Bridge Replacement					**Route:**	S-38-50
Eng./Geo.:	J. Fredendall	**Boring Location:**		**Offset:**		**Alignment:**	Existing
Elev.:	191.2 ft	**Latitude:**	33.4707608	**Longitude:**	-80.7460235	**Date Started:**	4/27/2018
Total Depth:	90 ft	**Soil Depth:**	70 ft	**Core Depth:**	20 ft	**Date Completed:**	5/1/2018
Bore Hole Diameter (in):	3.88	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55/300	**Drill Method:**	RW/RC	**Hammer Type:**	Automatic	**Energy Ratio:**	87.7%
Core Size:	NQ2	**Driller:**	A. McGuire	**Groundwater:**	**TOB** N.M.	**24HR**	22 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value	● SPT N VALUE ● / PL MC LL / ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		Very loose to loose, moist, gray, subrounded, weakly reactive, weakly cemented, fine Silty SAND with shell fragments (SM) (A-3) 10YR 5/1		53.5	SS-17	1	2	2		4	●
136.2											
				58.5	SS-18	3	4	3		7	●
131.2											
	62.0	Medium dense, moist, gray, subrounded, weakly reactive, weakly cemented, fine Silty SAND with shell fragments (SM) (A-2-4) 10YR 5/1		63.5	SS-19	5	6	10		16	●
126.2											
	67.0	Very dense, moist, gray, subrounded, weakly reactive, weakly cemented, fine Silty SAND with shell fragments (SM) (A-2-4) 10YR 5/1		68.5	SS-20	50	50/0"			50/0"	>>●
121.2	70.0	No Recovery **Refusal encountered at 70 feet, set casing and begin coring with #2 bit** Limestone, light greenish gray 10G 8/1, fine to coarse grained, moderately to extremely weathered, extremely weak to weak, bedded, narrow to wide discontinuity width, filled with clay and sand, very close to close discontinuity spacing, smooth to slightly rough @NQ2-1: RQD=13, %REC=26, Run Time = 5 minutes, GSI=10		70.0	NQ2-1						
116.2		@NQ2-2: RQD=25, %REC=75, Run Time = 8 minutes, GSI=20, q_u=3,786 psi, RMR=23		75.0	NQ2-2						

LEGEND

Continued Next Page

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

SCDOT Soil Test Log

Project ID:	P037465			**County:**	Orangeburg	**Boring No.:**	B-2
Site Description:	S-38-50 (Four Holes Road) over I-26 Emergency Bridge Replacement					**Route:**	S-38-50
Eng./Geo.:	J. Fredendall	**Boring Location:**		**Offset:**		**Alignment:**	Existing
Elev.:	191.2 ft	**Latitude:**	33.4707608	**Longitude:**	-80.7460235	**Date Started:**	4/27/2018
Total Depth:	90 ft	**Soil Depth:**	70 ft	**Core Depth:**	20 ft	**Date Completed:**	5/1/2018
Bore Hole Diameter (in):	3.88	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55/300	**Drill Method:**	RW/RC	**Hammer Type:**	Automatic	**Energy Ratio:**	87.7%
Core Size:	NQ2	**Driller:**	A. McGuire	**Groundwater:**	**TOB** N.M.	**24HR**	22 ft

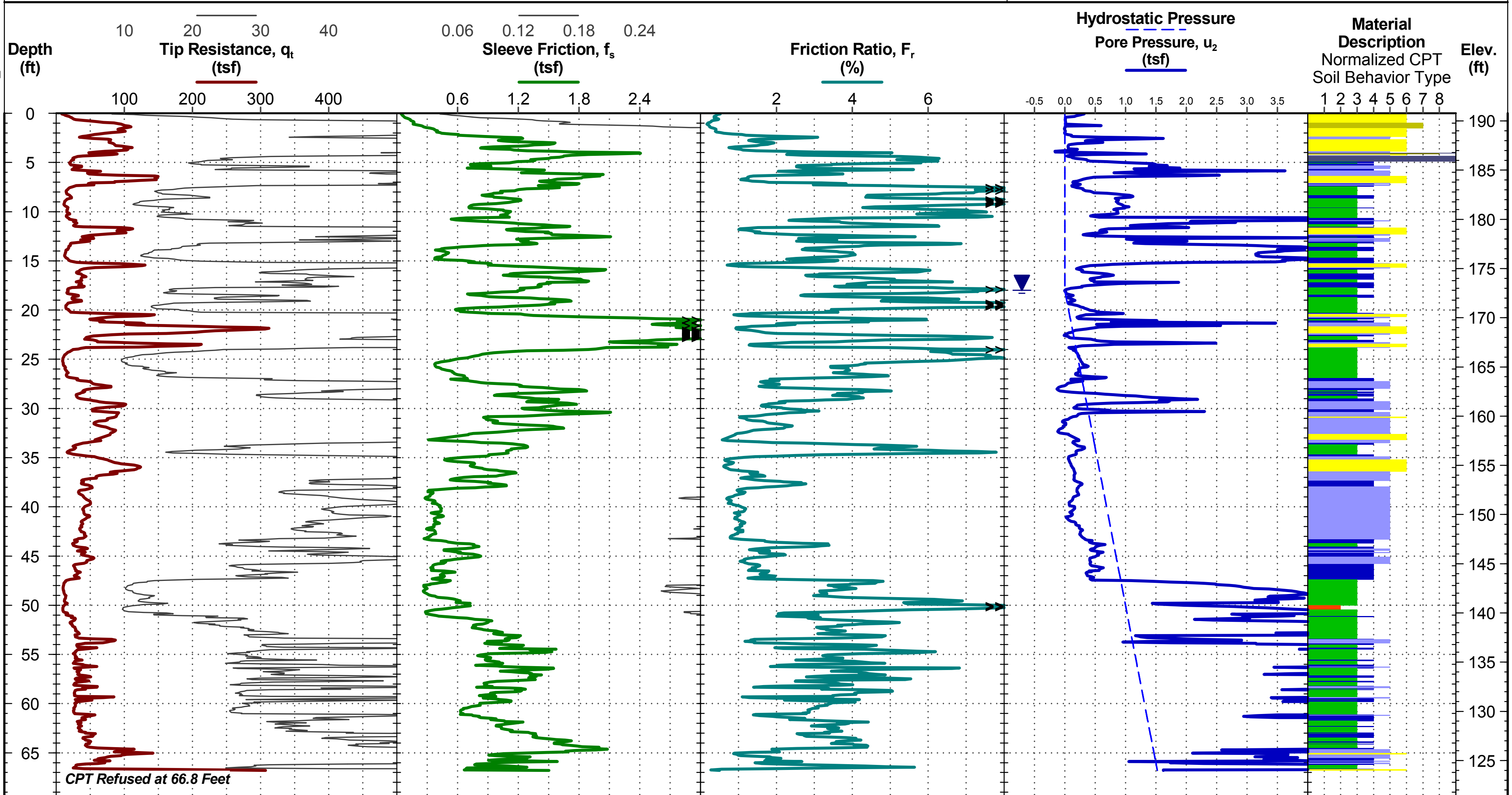
Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		Class IV: Poor Rock									
111.2		@NQ2-3: RQD=52, %REC=96, Run Time = 7 minutes, GSI=50, q_u=3,358 psi, RMR=21 Class IV: Poor Rock		80.0	NQ2-3						
106.2		@NQ2-4: RQD=30, %REC=100, Run Time = 8 minutes, GSI=30		85.0	NQ2-4						
101.2	90.0	**Coring Terminated at 90 feet**									
96.2											
91.2											

LEGEND

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

CPT LOG NO. C-1

PROJECT: S-38-50 (Four Holes Road) Emergency Bridge Replacement over I-26	**CLIENT:** SCDOT Columbia, South Carolina	**TEST LOCATION:** See Exhibit A-2
SITE: 4 Holes Road Orangeburg County, South Carolina		Surface Elev.: 190.78 ft Latitude: 33.4703262° Longitude: -80.7469007°



See Terracon's CPT General Notes for explanation of symbols and abbreviations.
Elevations provided by Construction Support Services

Auger anchors used as reaction force.
CPT sensor calibration reports available upon request.

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

WATER LEVEL OBSERVATION

18 ft measured water depth
(used in normalizations and correlations)

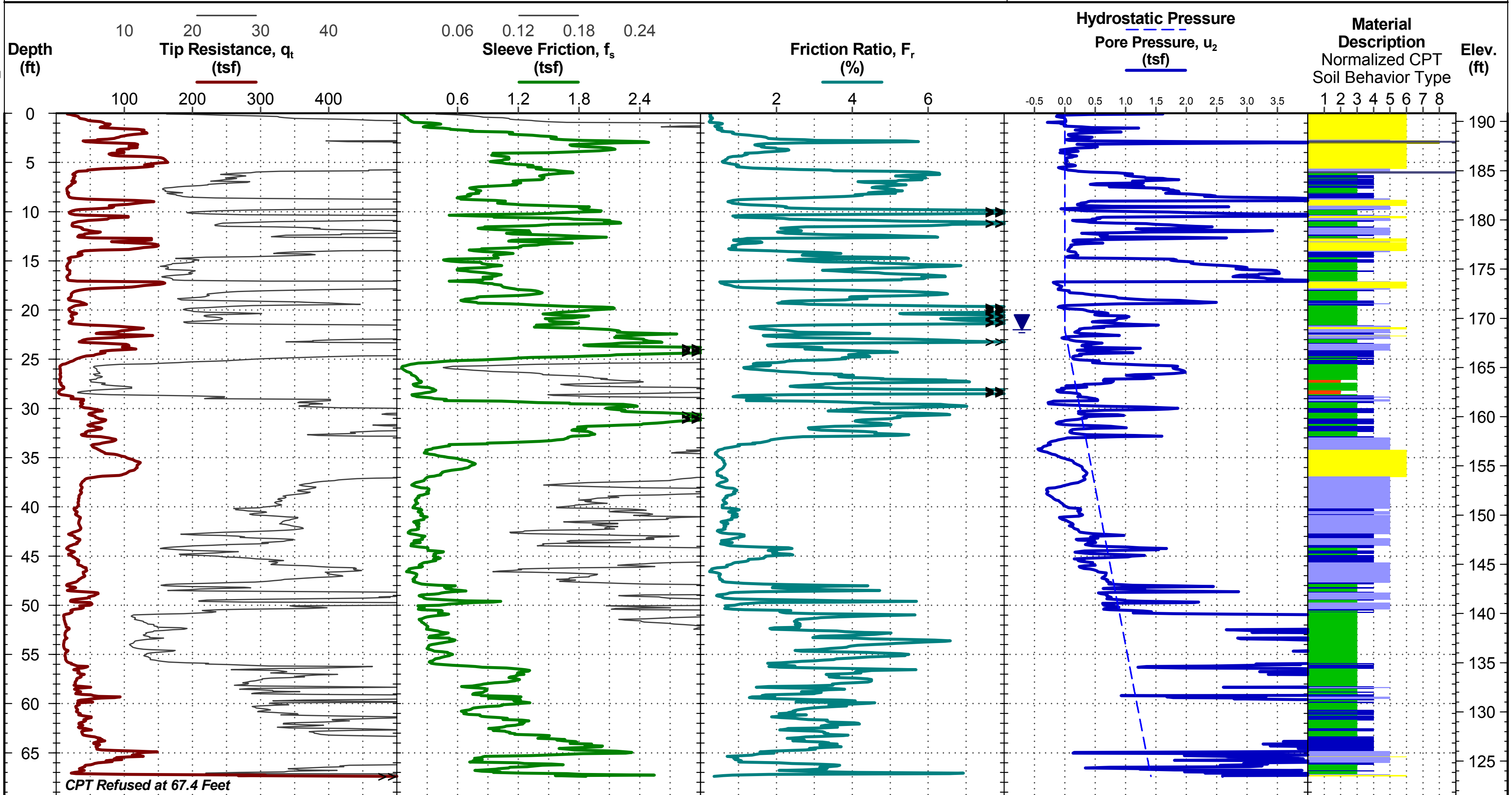
Probe no. 4986 with net area ratio of 0.865
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 10/3/2017
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
521 Clemson Rd
Columbia, SC

CPT Started: 4/25/2018	CPT Completed: 4/25/2018
Rig: Pagani TG73-200	Operator: B. Rozier
Project No.: 73155050U	

CPT LOG NO. C-2

PROJECT: S-38-50 (Four Holes Road) Emergency Bridge Replacement over I-26	**CLIENT:** SCDOT Columbia, South Carolina	**TEST LOCATION:** See Exhibit A-2 Surface Elev.: 190.84 ft Latitude: 33.4708248° Longitude: -80.7459964°
SITE: 4 Holes Road Orangeburg County, South Carolina		



See Terracon's CPT General Notes for explanation of symbols and abbreviations.
Elevations provided by Construction Support Services

Auger anchors used as reaction force.
CPT sensor calibration reports available upon request.

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

WATER LEVEL OBSERVATION 22 ft measured water depth (used in normalizations and correlations)	Probe no. 4986 with net area ratio of 0.865 U2 pore pressure transducer location Manufactured by Geotech A.B.; calibrated 10/3/2017 Tip and sleeve areas of 10 cm^2 and 150 cm^2 Ring friction reducer with O.D. of 1.875 in	Terracon 521 Clemson Rd Columbia, SC	CPT Started: 4/25/2018 Rig: Pagani TG73-200 Project No.: 73155050U	CPT Completed: 4/25/2018 Operator: B. Rozier

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT CORRELATIVE PARAMETERS REPORT 73155050U TERRACON LAB 4 HOLES ROAD.GPJ TERRACON_DATATEMPLATE

CPT CORRELATIVE PARAMETER LOG NO. C-1

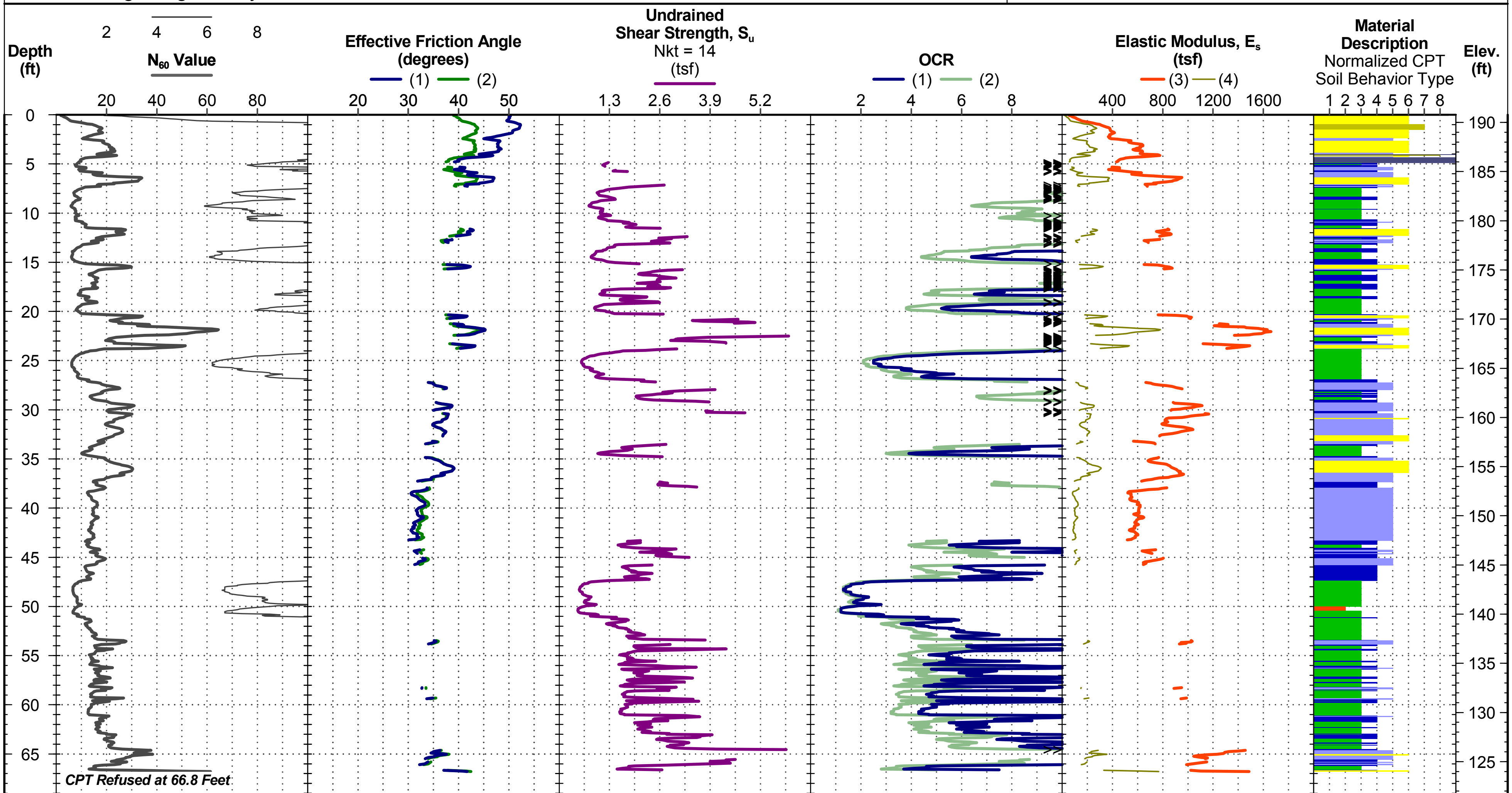
SEE CPT LOG NO. C-1 FOR DETAILED TEST RESULTS

PROJECT: S-38-50 (Four Holes Road) Emergency Bridge Replacement over I-26

CLIENT: SCDOT
Columbia, South Carolina

SITE: 4 Holes Road
Orangeburg County, South Carolina

TEST LOCATION: See Exhibit A-2
Surface Elev.: 190.78 ft
Latitude: 33.4703262°
Longitude: -80.7469007°



Tip resistance, sleeve resistance, porewater pressure, and tilt angle are measured. Other parameters presented are derived from interpretations of the measured data, based upon published correlations, but do not necessarily represent actual values that would be derived from direct testing.

WATER LEVEL OBSERVATION	Notes:	Terracon	CPT Started: 4/25/2018	CPT Completed: 4/25/2018
18 ft measured water depth (used in normalizations and correlations)	Probe no. 4986 with net area ratio of 0.865 Manufactured by Geotech A.B.; calibrated 10/3/2017 Tip and sleeve areas of 10 cm^2 and 150 cm^2 Ring friction reducer with O.D. of 1.875 in	Columbia, SC	Rig: Pagani TG73-200 Project No.: 73155050U	Operator: B. Rozier

CPT CORRELATIVE PARAMETER LOG NO. C-2

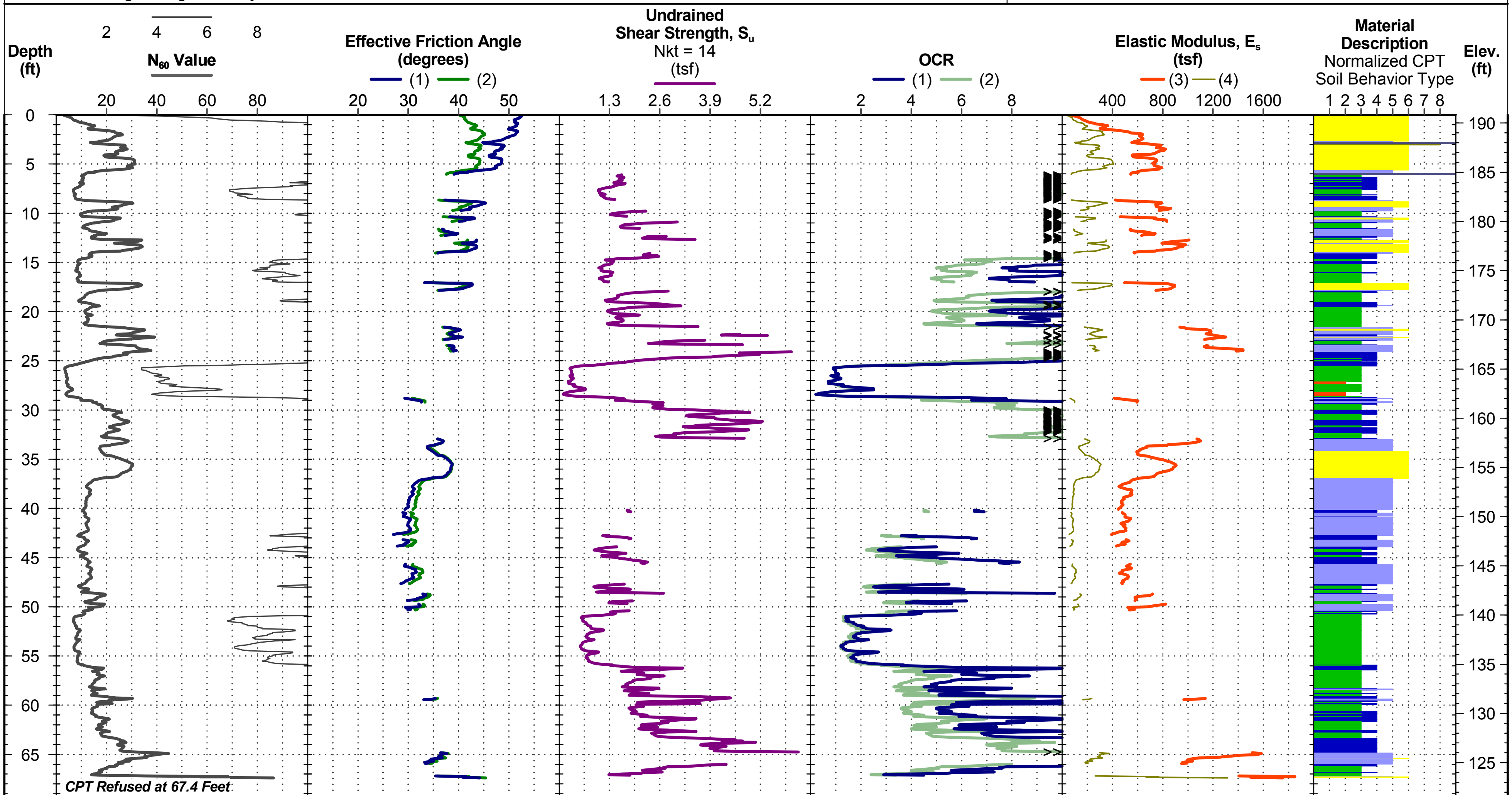
SEE CPT LOG NO. C-2 FOR DETAILED TEST RESULTS

PROJECT: S-38-50 (Four Holes Road) Emergency Bridge Replacement over I-26

CLIENT: SCDOT
Columbia, South Carolina

TEST LOCATION: See Exhibit A-2
Surface Elev.: 190.84 ft
Latitude: 33.4708248°
Longitude: -80.7459964°

SITE: 4 Holes Road
Orangeburg County, South Carolina



Tip resistance, sleeve resistance, porewater pressure, and tilt angle are measured. Other parameters presented are derived from interpretations of the measured data, based upon published correlations, but do not necessarily represent actual values that would be derived from direct testing.

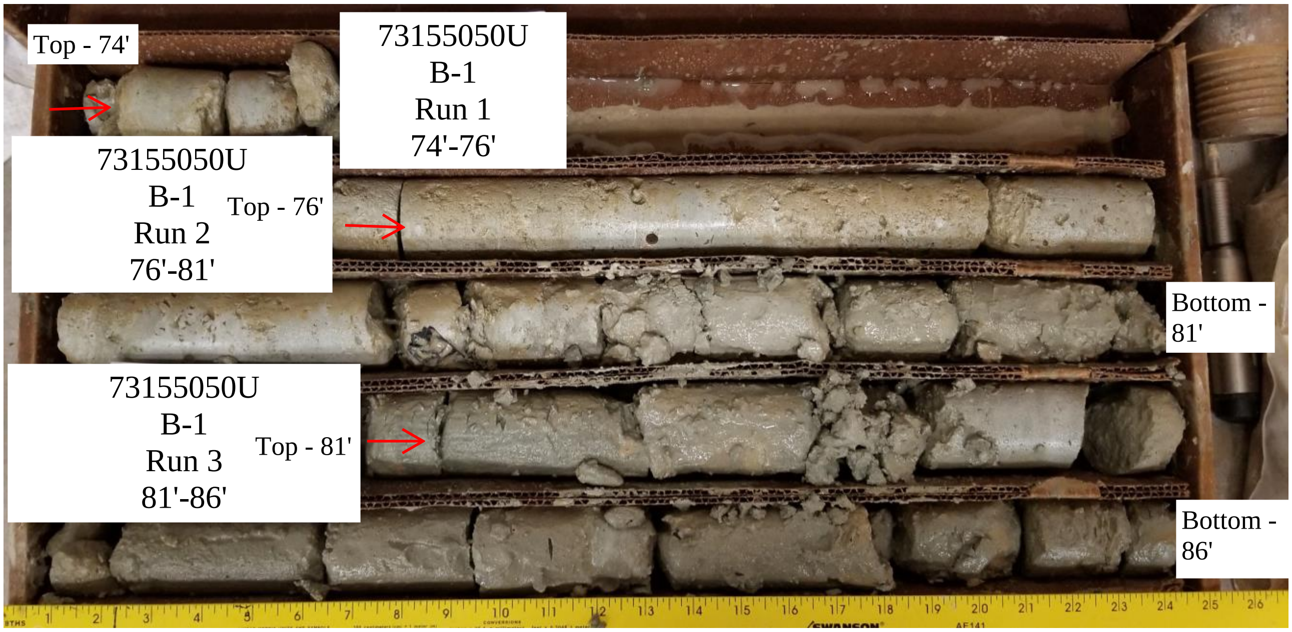
WATER LEVEL OBSERVATION
22 ft measured water depth
(used in normalizations and correlations)

Notes:
Probe no. 4986 with net area ratio of 0.865
Manufactured by Geotech A.B.; calibrated 10/3/2017
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
Columbia, SC

CPT Started: 4/25/2018
Rig: Pagani TG73-200
Project No.: 73155050U

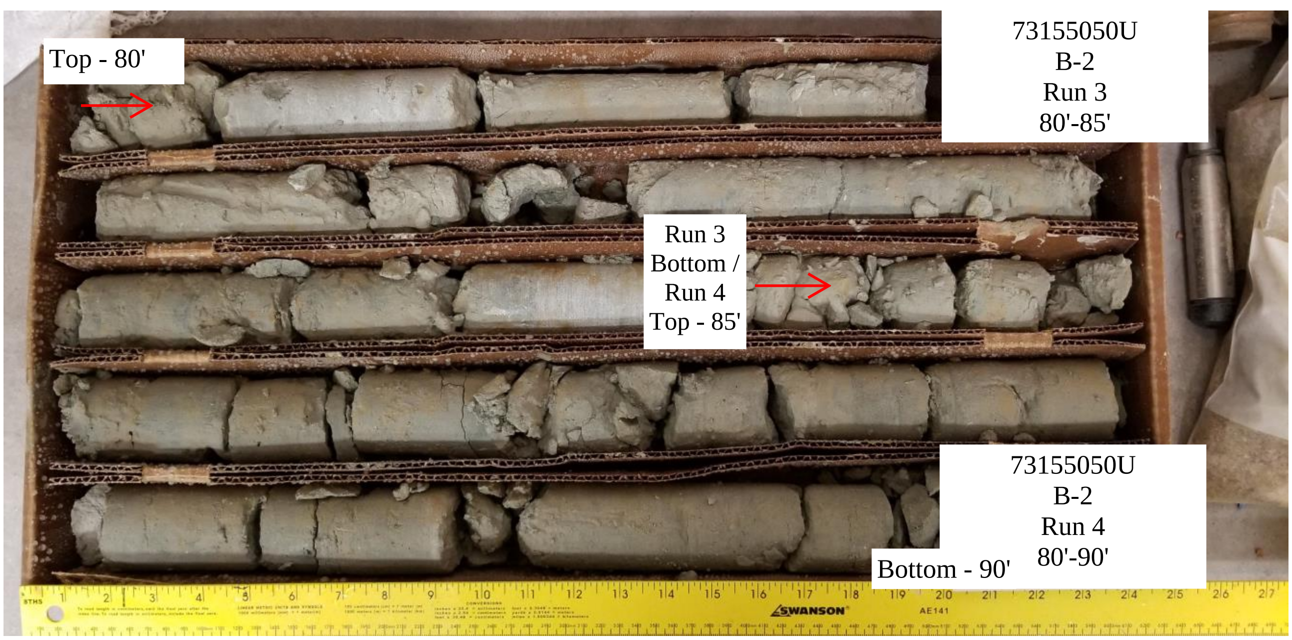
CPT Completed: 4/25/2018
Operator: B. Rozier



B-1 NQ2-1 74-76, NQ2-2 76-81, and NQ2-3 81-86

B-1 NQ2-4 86-71 and NQ2-5 91-94

B-2 NQ2-1 70-75 and NQ2-2 75-80



B-2 NQ2-3 80-85 and NQ2-4 85-90

Drill rig on B-1

Drill rig on B-2

CPT rig on C-1

CPT rig on C-2

APPENDIX B
LABORATORY TESTING

Exhibit B-1 – Laboratory Testing Description
Exhibit B-2 – Summary of Laboratory Data
Laboratory Data Sheets

LABORATORY TESTING DESCRIPTION

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

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

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

- Particle-Size Distribution (Gradation) of Soils — AASHTO T88/(ASTM D6913)
- Moisture Content Determination — AASHTO T265/(ASTM D2216)
- Compressive Strength and Elastic Moduli of Rock — AASHTO T226/(ASTM D7012)

Summary of Laboratory Results

BORING ID	Depth (Ft.)	% Fines	Water Content (%)
B-1	4 - 6	31.8	14
B-1	12 - 14	26.1	13
B-1	33.5 - 35	25.0	24
B-1	43.5 - 45	33.2	38
B-1	48.5 - 50	30.0	59
B-1	58.5 - 60	50.9	54
B-2	8 - 10	25.0	13
B-2	33.5 - 35	13.3	22
B-2	38.5 - 40	12.8	29
B-2	48.5 - 50	15.4	30

PROJECT: S-38-50 (Four Holes Road) Emergency Bridge Replacement over I-26

SITE: Four Holes Road
Orangeburg County, South Carolina

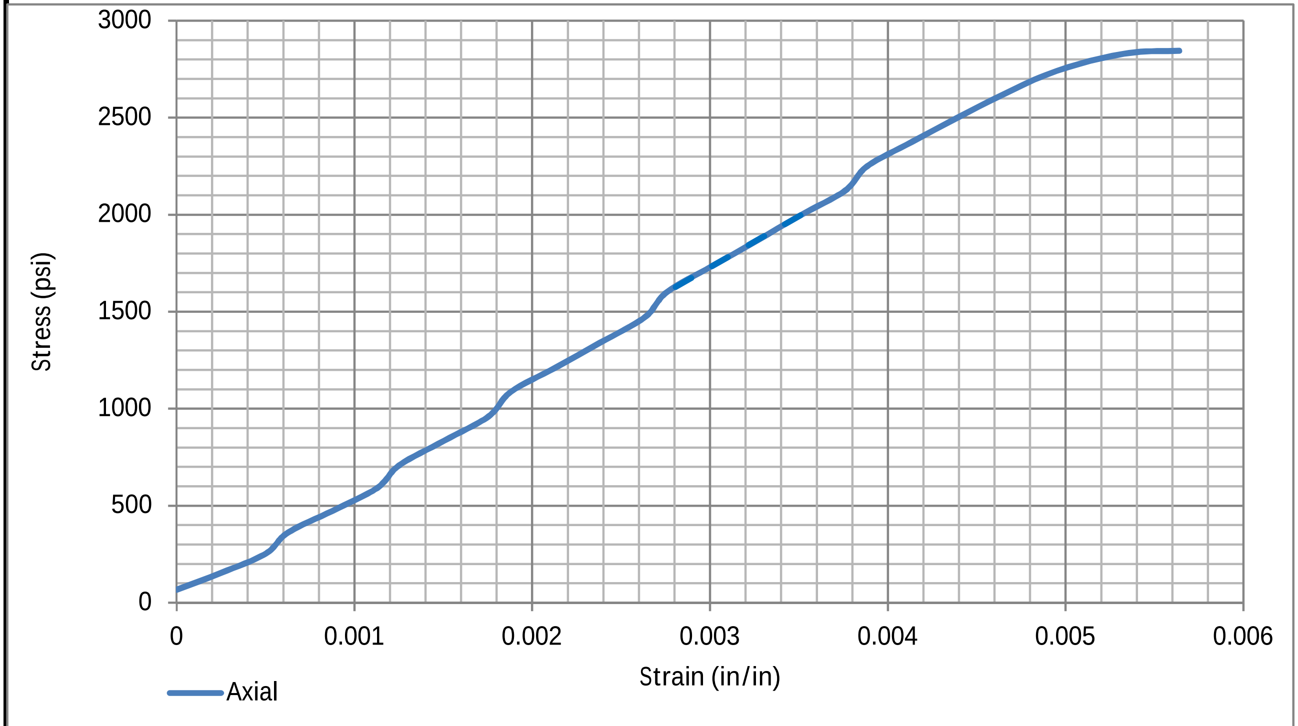
Terracon
521 Clemson Rd
Columbia, SC

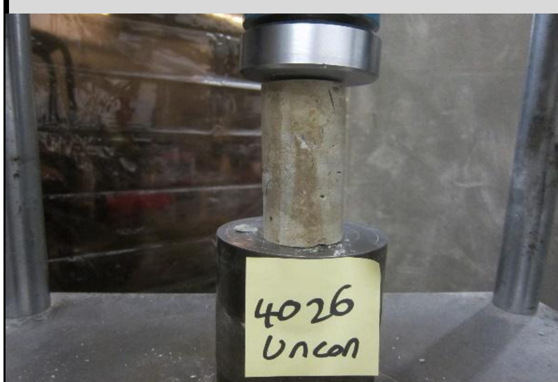
PROJECT NUMBER: 73155050U

CLIENT: SCDOT
Columbia, South Carolina

EXHIBIT: B-2

COMPRESSIVE STRENGTH AND ELASTIC MODULUS OF INTACT ROCK ASTM D7012





SAMPLE LOCATION			
Boring:	B-1	Depth (feet):	76.0 - 81.0
SPECIMEN INFORMATION			
Sample No.:	NQ2-2	Mass (g):	489.90
Length (in.):	4.01	Diameter (in.):	1.96
L/D Ratio:	2.05	Density (pcf):	154.25

TEST RESULTS	
Failure Load (lbs):	8,591
Failure Strain (%):	0.56
Unconfined Compressive Strength (psi):	2,845
Elastic Modulus, E, (ksi):	528

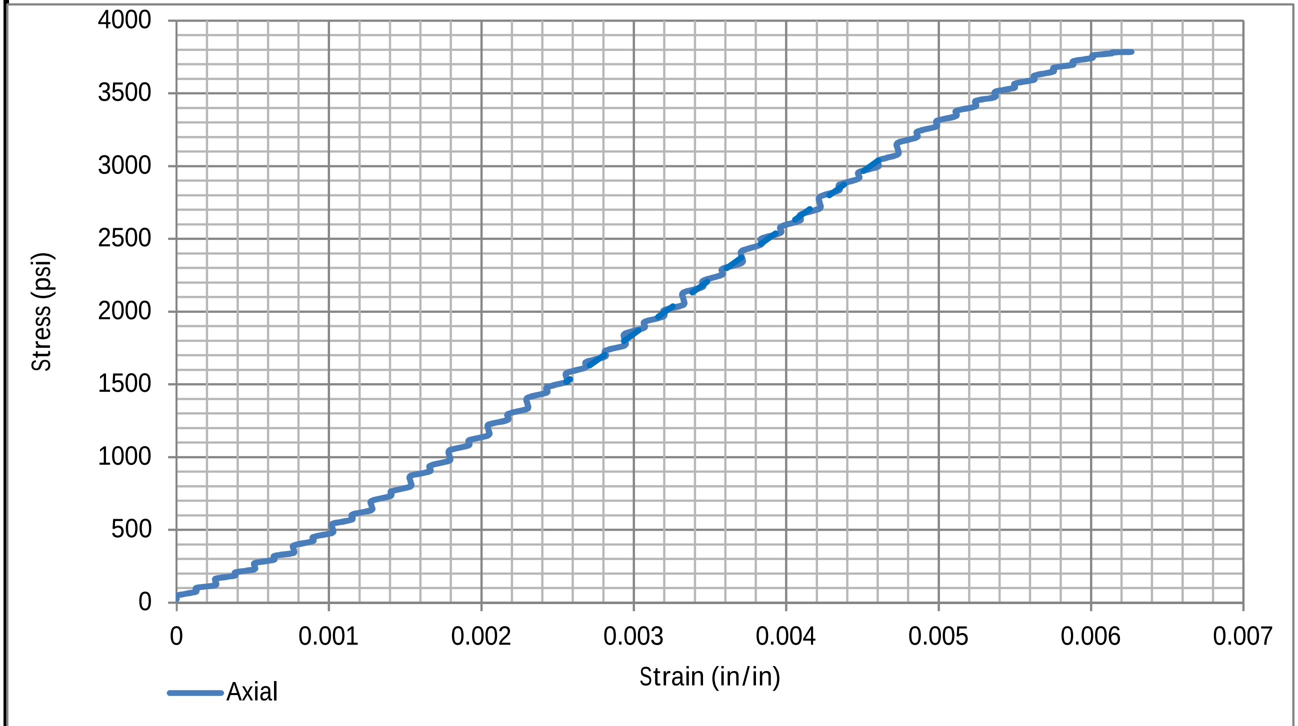
Description: Limestone

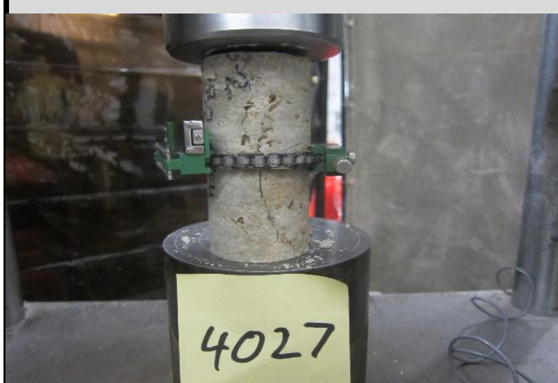
NOTES:

Poisson's Ratio not provided due to non-linear deformation.

CLIENT: SCDOT	Terracon Consulting Engineers & Scientists	LAB NO.: 4026 - Unconfined
PROJECT: S-38-50 (Four Holes Road) over I-26 Emergency Replacement		DATE TESTED: 5/15/2018
		DATE REDUCED: 5/18/2018
PROJECT NO.: 73155050U		

COMPRESSIVE STRENGTH AND ELASTIC MODULUS OF INTACT ROCK ASTM D7012





SAMPLE LOCATION			
Boring:	B-2	Depth (feet):	75.0 - 80.0
SPECIMEN INFORMATION			
Sample No.:	NQ2-2	Mass (g):	475.20
Length (in.):	3.93	Diameter (in.):	1.95
L/D Ratio:	2.02	Density (pcf):	154.24
TEST RESULTS			
Failure Load (lbs):			11,178
Failure Strain (%):			0.63
Unconfined Compressive Strength (psi):			3,786
Elastic Modulus, E, (ksi):			744

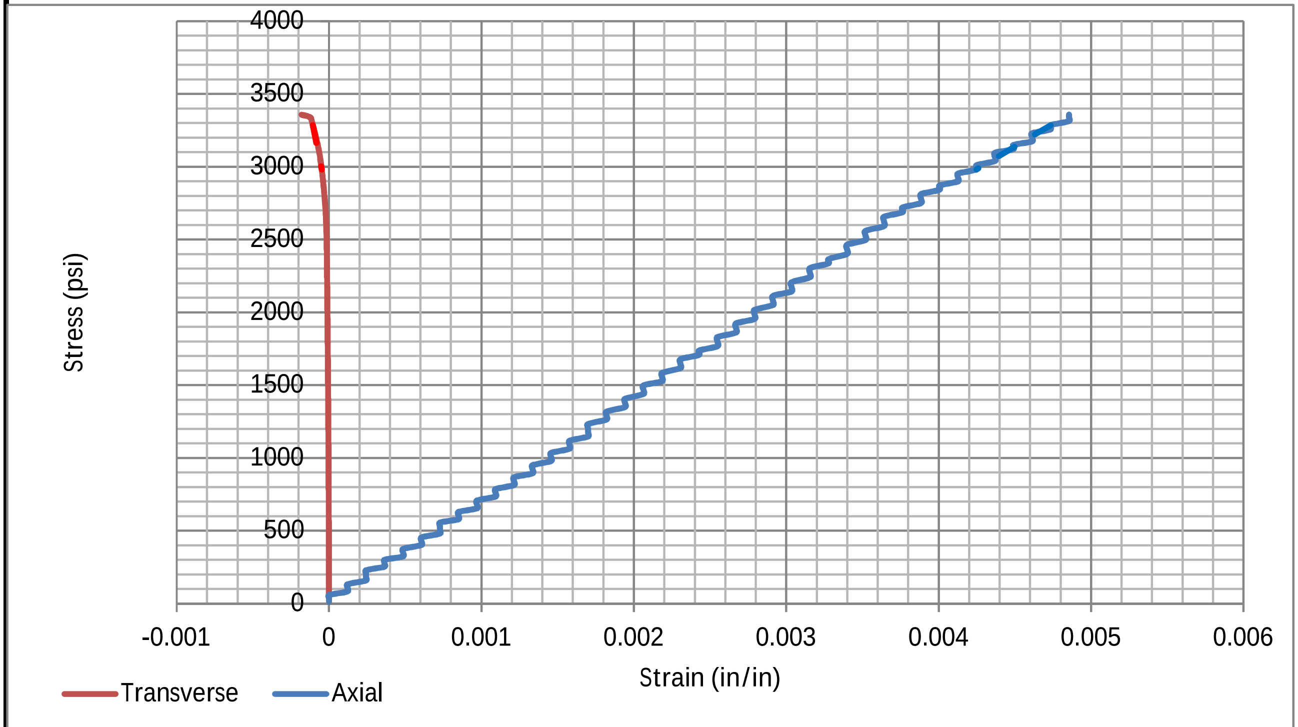
Description: Limestone

NOTES:

Poisson's Ratio not provided due to non-linear deformation.

CLIENT: SCDOT	Terracon Consulting Engineers & Scientists	LAB NO.: 4027
PROJECT: S-38-50 (Four Holes Road) over I-26 Emergency Replacement		DATE TESTED: 5/15/2018
		DATE REDUCED: 5/18/2018
PROJECT NO.: 73155050U		

COMPRESSIVE STRENGTH AND ELASTIC MODULUS OF INTACT ROCK ASTM D7012



SAMPLE LOCATION			
Boring:	B-2	Depth (feet):	80.0 - 85.0
SPECIMEN INFORMATION			
Sample No.:	NQ2-3	Mass (g):	515.50
Length (in.):	4.14	Diameter (in.):	1.97
L/D Ratio:	2.10	Density (pcf):	155.63

TEST RESULTS	
Failure Load (lbs):	10,182
Failure Strain (%):	0.49
Unconfined Compressive Strength (psi):	3,358
Elastic Modulus, E, (ksi):	625
Poisson's Ratio, ν:	0.12

Description:	Limestone

NOTES:

CLIENT: SCDOT	Terracon Consulting Engineers & Scientists	LAB NO.: 4028
PROJECT: S-38-50 (Four Holes Road) over I-26 Emergency Replacement		DATE TESTED: 5/15/2018
PROJECT NO.: 73155050U		DATE REDUCED: 5/18/2018

APPENDIX C

SUPPORTING DOCUMENTS

Exhibit C-1 – General Notes
Exhibit C-2 – Unified Soil Classification System
Exhibit C-3 – Rock Description Terms
Rig Calibration Documentation

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING		
	Auger	Split Spoon
	Shelby Tube	Macro Core
	Ring Sampler	Rock Core
	Grab Sample	No Recovery

WATER LEVEL

- **Water Initially Encountered**
- **Water Level After a Specified Period of Time**
- **Water Level After a Specified Period of Time**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	**Hand Penetrometer**
(T)	**Torvane**
(b/f)	**Standard Penetration Test (blows per foot)**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, psf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Terracon

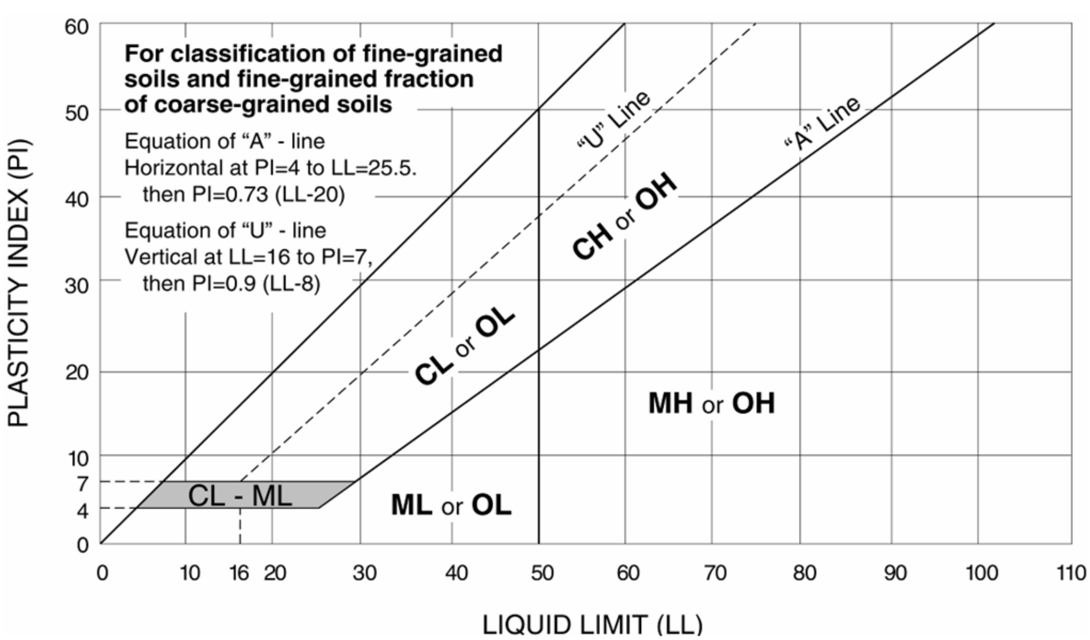
UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification: Group Symbol	Soil Classification: Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			$PI < 4$ or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10} \quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains $\geq$ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] $PI \geq 4$ and plots on or above "A" line.
[O] $PI < 4$ or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



DESCRIPTION OF ROCK PROPERTIES

WEATHERING	
Term	**Description**
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, PSI (MPa)**
Extremely weak	Indented by thumbnail	40-150 (0.3-1)
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
Strong rock	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
Very strong	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
Extremely strong	Specimen can only be chipped with geological hammer	>36,000 (>250)

DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Extremely close	< ¾ in (<19 mm)	**Laminated**	< ½ in (<12 mm)
Very close	¾ in – 2-1/2 in (19 - 60 mm)	**Very thin**	½ in – 2 in (12 – 50 mm)
Close	2-1/2 in – 8 in (60 – 200 mm)	**Thin**	2 in – 1 ft (50 – 300 mm)
Moderate	8 in – 2 ft (200 – 600 mm)	**Medium**	1 ft – 3 ft (300 – 900 mm)
Wide	2 ft – 6 ft (600 mm – 2.0 m)	**Thick**	3 ft – 10 ft (900 mm – 3 m)
Very Wide	6 ft – 20 ft (2.0 – 6 m)	**Massive**	> 10 ft (3 m)

Discontinuity Orientation (Angle): Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0 degree angle.

ROCK QUALITY DESIGNATION (RQD*)	
Description	**RQD Value (%)**
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

*The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

Reference: U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009 Technical Manual for Design and Construction of Road Tunnels – Civil Elements

DRILL RIG SPT HAMMER ENERGY CALIBRATION REPORT

Drill Rig Model CME-55 SN 359485
Terracon Drill Rig No. 727
Columbia, SC
July 7, 2016

Project No. 73XX0500

Prepared for:
Terracon Consultants, Inc.
Columbia, SC

Prepared by:
Terracon Consultants, Inc.
North Charleston, SC

Terracon

July 7, 2016

Terracon Consultants Inc.
521 Clemson Road
Columbia, SC 29229

Attn: Mr. Phillip Morris
P: (803) 212-0062
M: (803) 518-3788
E: Phillip.Morrison@Terracon.com

Re: SPT Rig Calibration Report
Columbia, SC
Terracon Project Number: 73XX0500

Mr. Morrison:

The Charleston office of Terracon Consultants, Inc. (Terracon) has completed the SPT rig calibration for the above referenced rig. This report provides Energy Transfer Ratio (ETR) for the SPT hammer found on CME-55 (Serial Number 359485).

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

Sincerely,
Terracon Consultants, Inc.

Yulian A. Kebede,
Project Manager
Geotechnical Services

SOUTH CAROLINA
TERRACON CONSULTANTS, INC.
No. 2220
CERTIFICATE OF AUTHORIZATION

Bryan T. Shiver, P.E.
Geotechnical Department Manager
SC Registration No. 27816

Susheel Kolwalkar

Susheel Kolwalkar, Ph.D., P.E
Senior Engineer
Geotechnical Services

Terracon Consultants, Inc. 1450 Fifth Street West North Charleston, South Carolina 29405
P [843] 884 1234 F [843] 884 9234 terracon.com

1.0 PROJECT INFORMATION

ITEM	DESCRIPTION
Drill Rig Identification	CME-55, SN: 359485 (see photograph on cover page)
Drill Rig Owner	Terracon
Drill Rig Operator	Craig Fredrychowsky
Testing Date	June 14, 2016
Testing Location	Columbia, SC
Terracon Project Number	73XX0500
Boring Identification	Test Hole (B-1)
Energy Measurement Depths	40.5 ft.; 43.5 ft.; 45.5 ft.; 48.5ft.
Hammer Type	Automatic
Boring Method	Mud Rotary
Drill Rods	■ AWJ ■ 1¾" outside diameter ■ 3/16" wall thickness
SPT Calibration Testing Equipment	■ 2 foot AWJ rod instrumented w/ 2 strain gauges and 2 accelerometers ■ Model PAX Pile Driving Analyzer™ (PDA)
SPT Calibration Personnel	Kenneth Zur

2.0 TEST RESULTS

Table 1:
SPT Hammer Energy Calibration Testing Summary.

Boring	Start Depth[1] (ft)	Rod Length[2] (ft)	Rod Sections[3]			Measured Blow Counts (blows/6 inches)				SPT N_m (bpf)	Soil Type[4]
			2 ft	5 ft	10 ft	1st Inc.	2nd Inc.	3rd Inc.	4th Inc.		
Test Hole (B-1)	40.5	45.83	1	8	0	9	10	12	-	22	Sand
	43.5	48.83	0	9	0	9	9	12	-	21	Sand
	45.5	50.85	1	9	0	12	19	19	-	38	Sand
	48.5	53.83	0	10	0	10	13	13	-	26	Sand

1. Depth from existing ground surface to bottom of drill rods at the beginning of SPT
2. Total rod length measured from instrumentation to bottom of sampler
3. Two foot section is instrumented and is located at top of drill rods
4. Soil type provided by Terracon personnel.

Table 2:
Energy Measurement and Analysis Summary.

Boring	Start Depth[1] (ft)	SPT N_m (bpf)	No. of Blows[2]	EFV (kip-ft)[3]				ETR (%)[3]	
				Max.	Min.	Ave.	Std. Dev.	Ave.	Std. Dev.
Test Hole (B-1)	40.5	22	25	0.29	0.27	0.28	0.004	80.2	1.14
	43.5	21	27	0.29	0.28	0.28	0.005	81.4	1.45
	45.5	38	48	0.29	0.27	0.28	0.007	80.2	1.94
	48.5	26	32	0.28	0.26	0.27	0.006	78.2	1.58
		Average:	33	0.29	0.27	0.28	0.01	80.0	1.53

1. Boring ID and depth from existing ground surface to bottom of drill rods at the beginning of SPT
2. Number of blows used in energy calibration analysis; limited to measurements recorded during the second and third 6-inch sampling intervals at each depth or during the first increment if refusal were encountered
3. EFV = Measured Transferred Energy, ETR = Energy Transfer Ratio.

Table 3:
Hammer Blow Rate Summary.

Boring	Start Depth[1] (ft)	SPT N_m (bpf)	No. of Blows[2]	BPM[3]			
				Max.	Min.	Ave.	Std. Dev.
Test Hole (B-1)	40.5	22	25	54.60	53.00	53.74	0.476
	43.5	21	27	54.60	53.10	53.71	0.344
	45.5	38	48	54.90	52.50	53.56	0.454
	48.5	26	32	54.40	52.90	53.68	0.426
		Average:	33	54.63	52.88	53.67	0.425

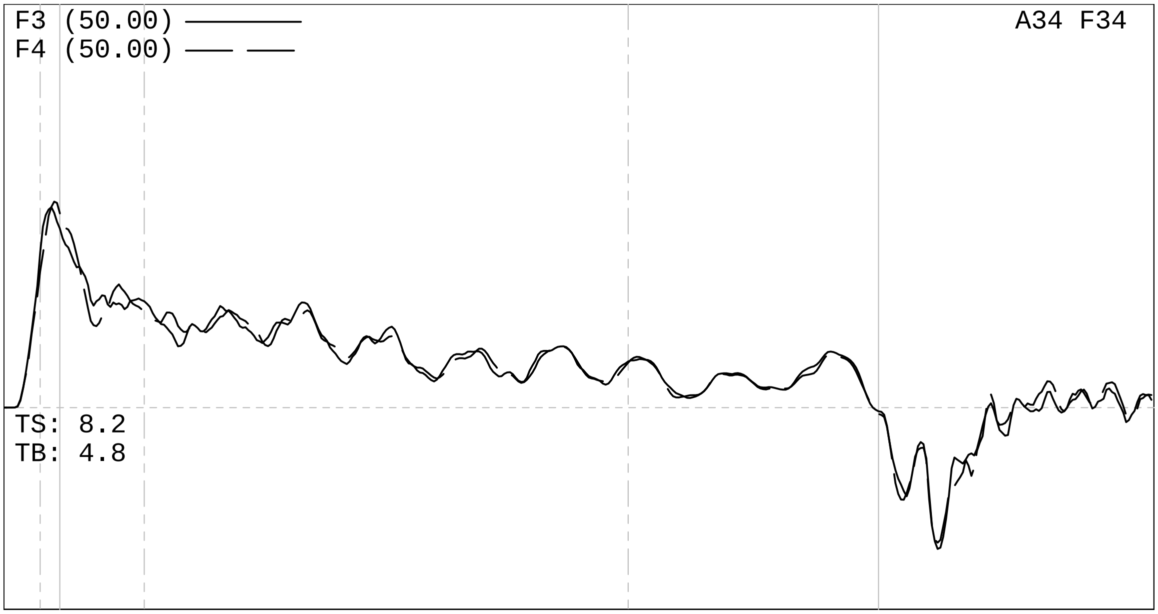
1. Boring ID and depth from existing ground surface to bottom of drill rods at the beginning of SPT.
2. Number of blows used in energy calibration analysis. Limited to measurements recorded during the second and third 6-inch sampling intervals at each depth or during the 1st increment if refusal conditions were encountered.
3. BPM = Blows per minute

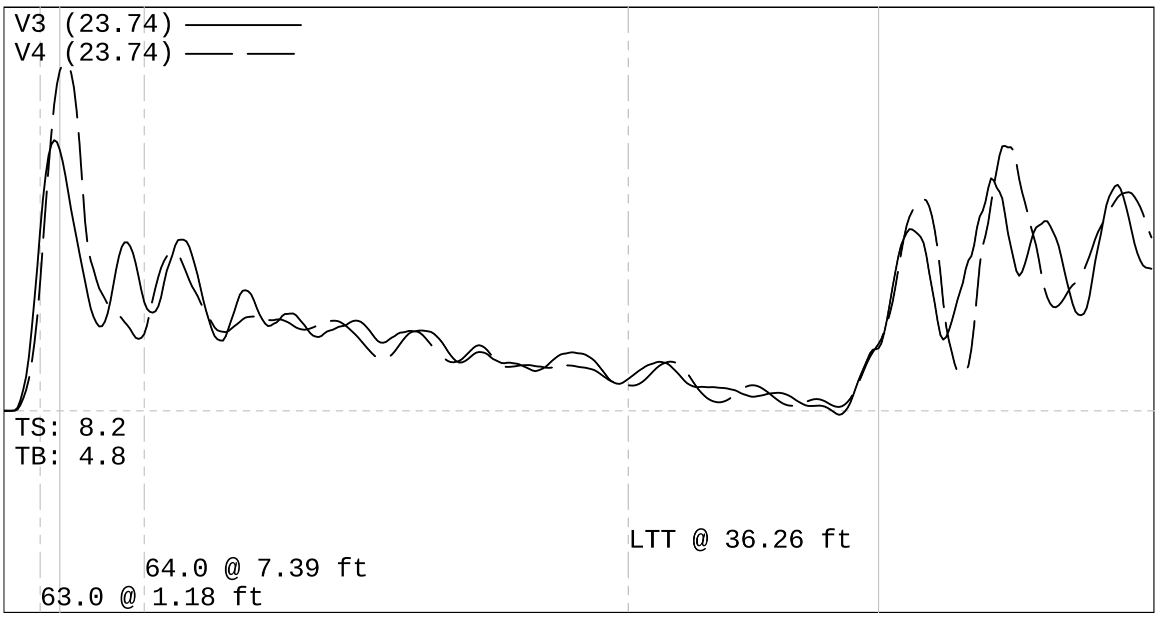
3.0 CONCLUSIONS

3.1 Energy Transfer Ratio (ETR) and Hammer Efficiency Correction (CE)

Based on our testing and subsequent analysis, CME-55 (Serial Number 359485) has an **ETR** of **80.0% ± 1.53%.** Based on this ETR, the hammer efficiency correction (**C_E**) is **1.33**.

Exhibit A-1 Representative Blow





Project Information

PROJECT: CME-55 CAL JUNE 2016
PILE NAME: B-1, 43.5 ft to 45 ft
DESCR: CME-55, SERIAL# 359485
OPERATOR: CF
FILE: B-1, 43.5-45.W01
6/14/2016 4:50:51 PM
Blow Number 9

Pile Properties

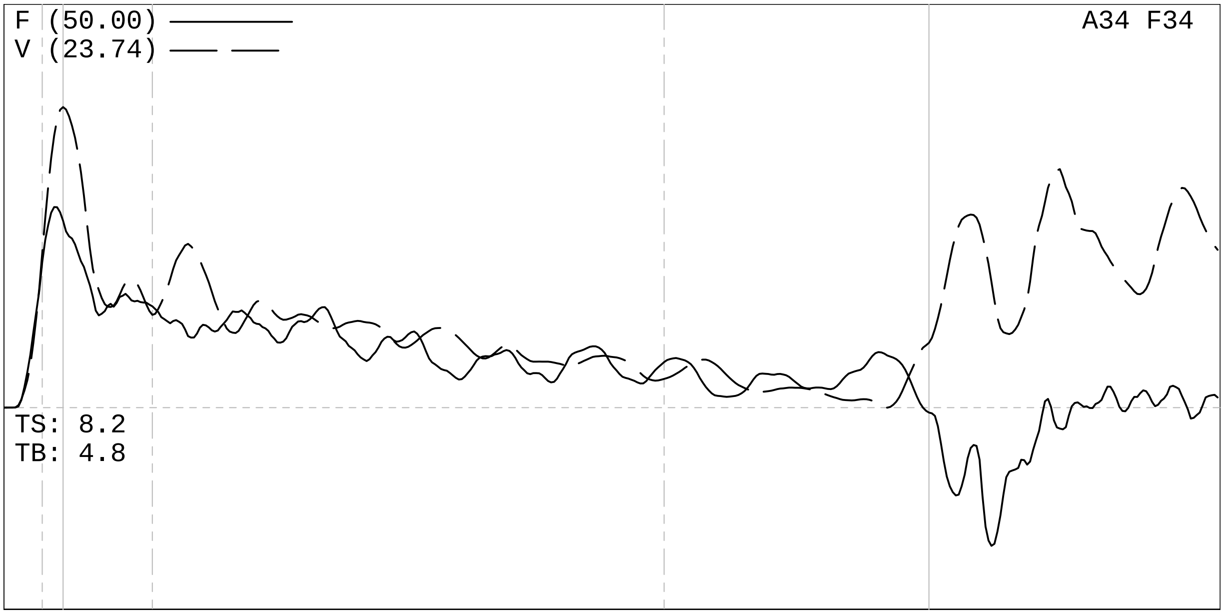
LE	48.83	ft
AR	1.18	in^2
EM	30000	ksi
SP	0.492	k/ft3
WS	16807.9	f/s
EA/C	2.1	ksec/ft
2L/C	5.82	ms
JC	[]	
LP	44.00	ft

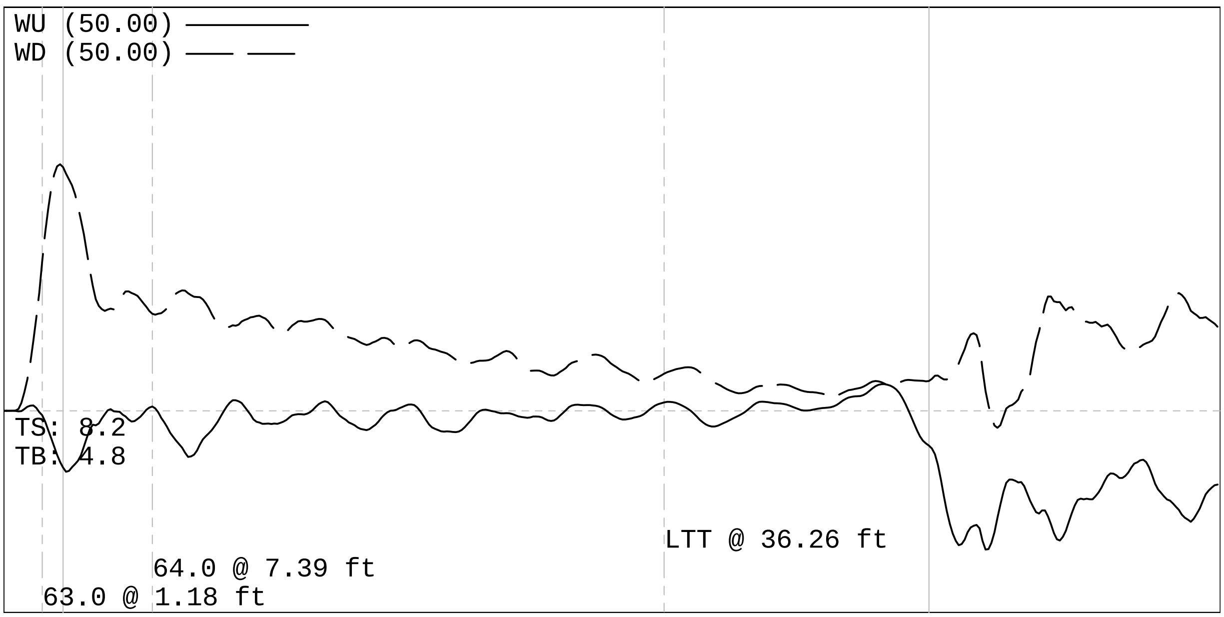
Quantity Results

FMX	24.83	kips
VMX	17.67	f/s
EFV	0.28	k-ft
ETR	79.0	(%)
BPM	53.30	bpm
DMX	0.79	in
CSX	21.05	ksi
DFN	0.67	in
TSX	15.40	ksi

Sensors

F3: [AWJ 1] 211.53 (1)
F4: [AWJ 2] 211.77 (1)
A3: [K1737] 342 mv/5000g's (1)
A4: [K1732] 360 mv/5000g's (1)
CLIP: OK





Project Information
PROJECT: CME-55 CAL JUNE 2016
PILE NAME: B-1, 43.5 ft to 45 ft
DESCR: CME-55, SERIAL# 359485
OPERATOR: CF
FILE: B-1, 43.5-45.W01
6/14/2016 4:50:51 PM
Blow Number 9

Pile Properties

LE	48.83	ft
AR	1.18	in^2
EM	30000	ksi
SP	0.492	k/ft3
WS	16807.9	f/s
EA/C	2.1	ksec/ft
2L/C	5.82	ms
JC	[]	
LP	44.00	ft

Quantity Results

FMX	24.83	kips
VMX	17.67	f/s
EFV	0.28	k-ft
ETR	79.0	(%)
BPM	53.30	bpm
DMX	0.79	in
CSX	21.05	ksi
DFN	0.67	in
TSX	15.40	ksi

Sensors
F3: [AWJ 1] 211.53 (1)
F4: [AWJ 2] 211.77 (1)
A3: [K1737] 342 mv/5000g's (1)
A4: [K1732] 360 mv/5000g's (1)
CLIP: OK

Exhibit A-2 PDA Equipment Calibrations

Certificate of Calibration

Pile Dynamics, Inc. certifies that the

Pile Driving Analyzer®, Model PAX

Serial Number: 3766L

was calibrated on 28 March 2014
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:

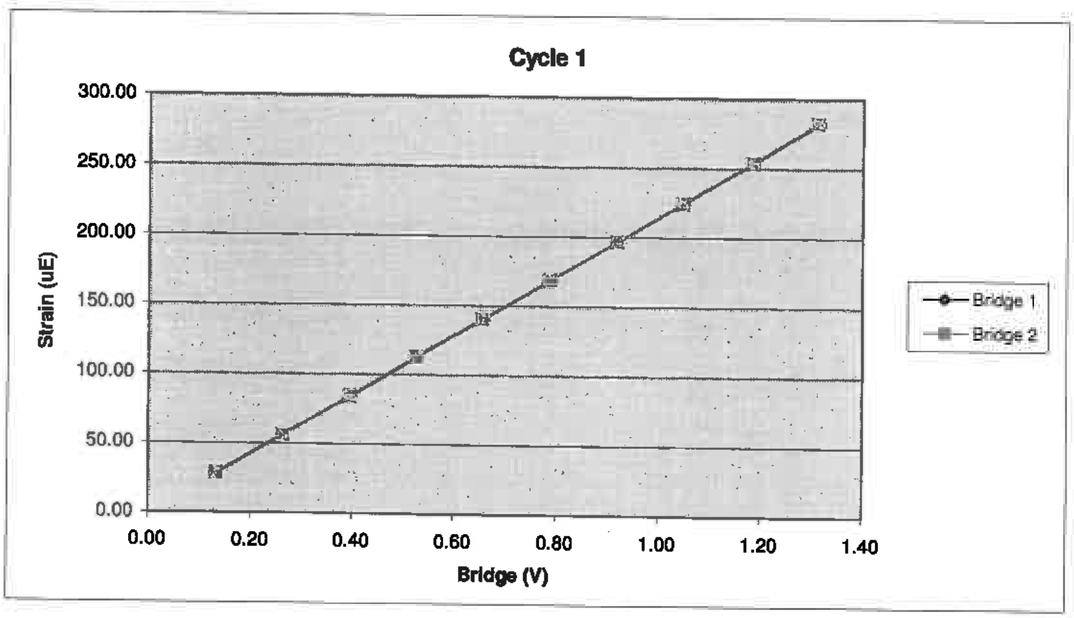
Pile Dynamics, Inc.
30725 Aurora Road
Cleveland, Ohio 44139 USA

March 2015

267AWJ		Cycle 1		
Sample	Force (lb)	Strain (µE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	989.85	28.25	0.13	0.13
3	1984.04	55.90	0.26	0.26
4	2984.15	84.22	0.40	0.39
5	3983.07	112.75	0.53	0.53
6	4967.80	140.04	0.66	0.65
7	5960.01	168.66	0.79	0.79
8	6950.26	196.46	0.92	0.92
9	7933.41	224.50	1.05	1.05
10	8967.62	253.80	1.18	1.18
11	9960.63	282.25	1.31	1.31

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7580.05**	**Force Calibration (lb/V)**	**7594.00**
Offset	-6.55	Offset	-12.19
Correlation	0.999997	Correlation	0.999996
Strain Calibration (µE/V)	**214.70**	**Strain Calibration (µE/V)**	**215.09**
Offset	-0.38	Offset	-0.54
Correlation	0.999994	Correlation	0.999993

Force Strain Calibration	
EA (Kips)	**35305.52**
Offset	6.95
Correlation	0.999996

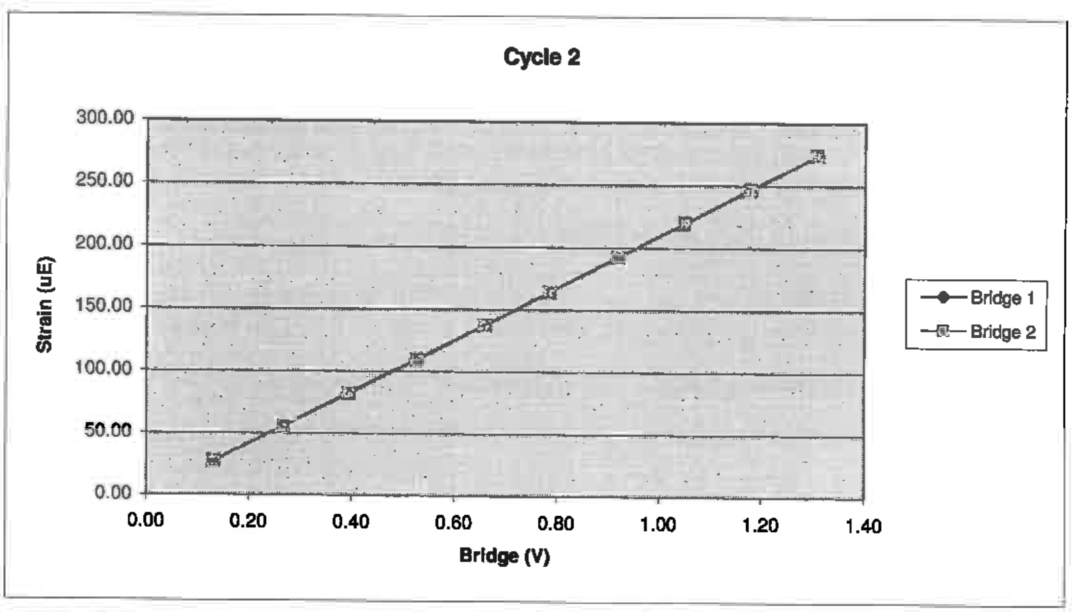


March 2015

267AWJ		Cycle 2		
Sample	Force (lb)	Strain (µE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	985.91	27.42	0.13	0.13
3	2013.22	55.80	0.27	0.27
4	2976.66	82.22	0.39	0.39
5	3986.03	109.72	0.53	0.53
6	4991.06	137.06	0.66	0.66
7	5966.52	164.10	0.79	0.79
8	6974.31	192.21	0.92	0.92
9	7944.65	219.38	1.05	1.05
10	8931.15	246.44	1.18	1.18
11	9931.65	273.99	1.31	1.31

Bridge 1		Bridge 2	
Force Calibration (lb/V)	**7594.28**	**Force Calibration (lb/V)**	**7600.39**
Offset	**-7.07**	Offset	**-19.16**
Correlation	**0.999997**	Correlation	**0.999998**
Strain Calibration (µE/V)	**209.38**	**Strain Calibration (µE/V)**	**209.55**
Offset	**-0.18**	Offset	**-0.51**
Correlation	**0.999994**	Correlation	**0.999993**

Force Strain Calibration	
EA (Kips)	**36269.26**
Offset	**-0.51**
Correlation	**0.999993**

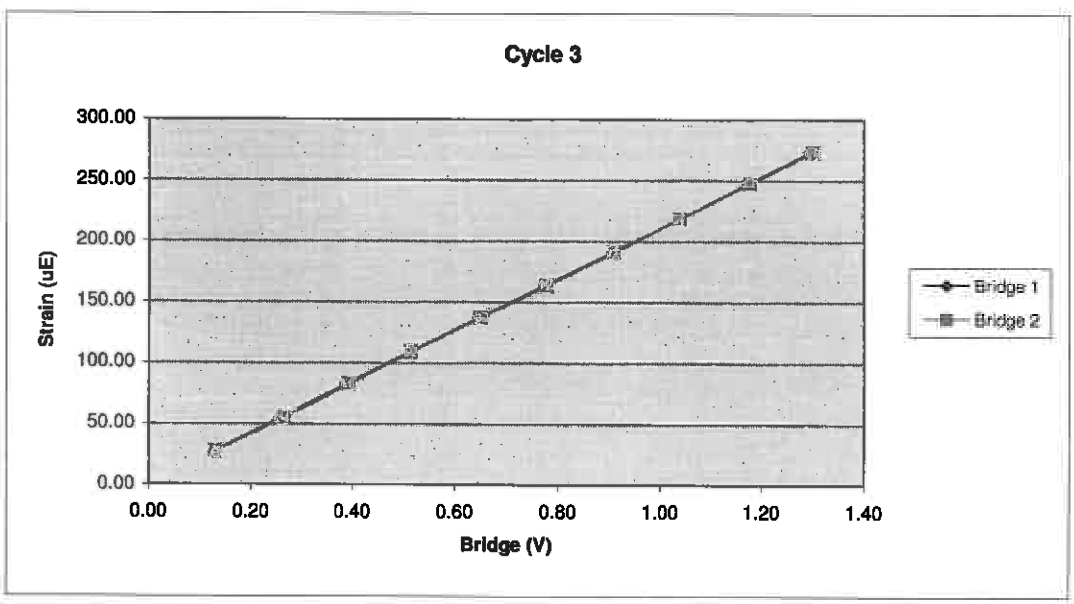


March 2015

267AWJ		Cycle 3		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	978.02	27.23	0.13	0.13
3	1983.45	54.94	0.26	0.26
4	2969.76	82.48	0.39	0.39
5	3927.08	108.47	0.51	0.51
6	4947.10	136.99	0.65	0.65
7	5912.50	163.76	0.77	0.78
8	6922.07	191.13	0.91	0.91
9	7898.71	218.67	1.04	1.04
10	8946.33	247.50	1.17	1.18
11	9882.76	273.33	1.30	1.30

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7616.04**	**Force Calibration (lb/V)**	**7621.58**
Offset	**10.36**	Offset	**-12.46**
Correlation	**0.999996**	Correlation	**0.999993**
Strain Calibration (µE/V)	**210.51**	**Strain Calibration (µE/V)**	**210.66**
Offset	**0.46**	Offset	**-0.17**
Correlation	**0.999997**	Correlation	**0.999993**

Force Strain Calibration	
EA (Kips)	**36178.74**
Offset	**-6.36**
Correlation	**0.999997**



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

Calibration Factors	267AWJ		
Bridge 1 (μE/V)	211.53	Bridge 2 (μE/V)	211.77
EA Factor (Kips)	35917.84	Area (in^2)	1.20

Calibrated by: ______________________
Calibrated Date: 3/30/2015

Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

Traceable to N.I.S.T.

QBTA: ON [ALT-F1/BB=60] Pile Dynamics, Inc. TG F2 DPF

Pile Dynamics 19-Sep-14 08:34	FS — 10	BN 71 SL 124/ 3440/ 2

PJ:
PN: HOPBAR

A 4 -- VS
F 2 3.3

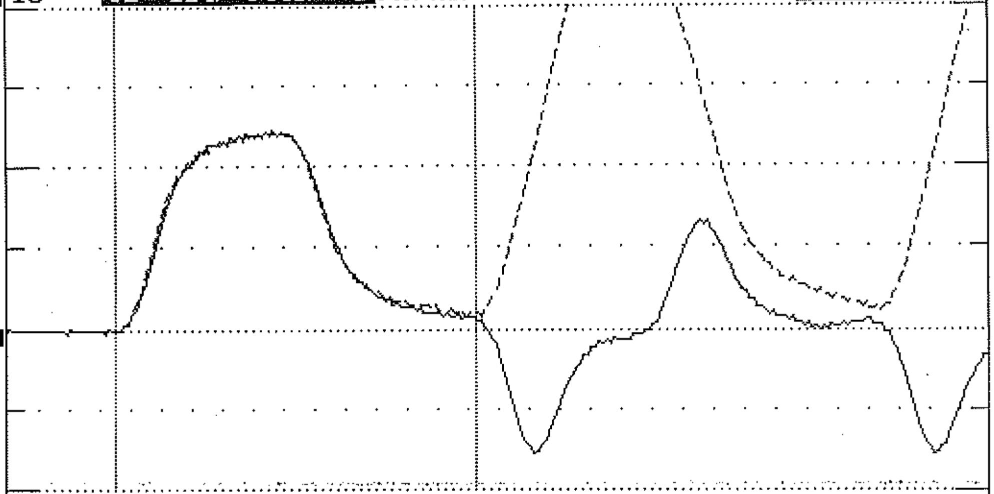
LE 39.6 ft
AR 1.7 in2
EM 30000 Ksi
SP 0.492 K/ft3
WS 16810 ft/s
WC 16862 ft/s

JC 0.40
FM 1.00
VM 1.00

EA/C 30.3 Ks/ft
UN KIPS*0.1
FR 20000 MB 30

DL -44
VT -1
PK 1 TM-PEAK

F1/2 500/ 213
F3/4 213/ 213
A1/2 999/ 999
A3/4 999/ 342



TS 12 E B PD: k1737 LP 0.00 ft
TB 8.0 T1 9.4 2L/C 4.7 VA 1000 VE 1022 LI 1.0

ACCEPT SQ-OFF FL-OFF PR-OFF

VMX= 3.9 FMX= 62 AMX= 120
EMX= 0.2 MEX= 121 FVP= 1.00

ACCELEROMETER CALIBRATION N.I.S.T. Traceable

SERIAL NUMBER: K1737

CALIBRATION FACTOR: .0684 MV/G

PAK (*5000): 342 DATE: 19SEPT14

PDA OPERATOR: [illegible]

contact Pile Dynamics USA
with your questions
tel USA - 216 - 831- 6131
fax USA - 216 - 831- 0916

<-AT:PIEZORESISTIVE OP: laine [ver:4.05] AT:PIEZOELECTRIC->

Smart Sensor

Smart Chip Programmed By X.M.W. **on** 19SEPT14 **CRC Value** 95C7

QBTA: ON [ALT-F1/BB=60] Pile Dynamics, Inc. TG F2 DPF

Pile Dynamics 19-Sep-14 08:37	FS — 10	BN 76 SL 128/ 3440/ 99 PJ: PN: HOPBAR A 4 F 2 -- VS 3.3

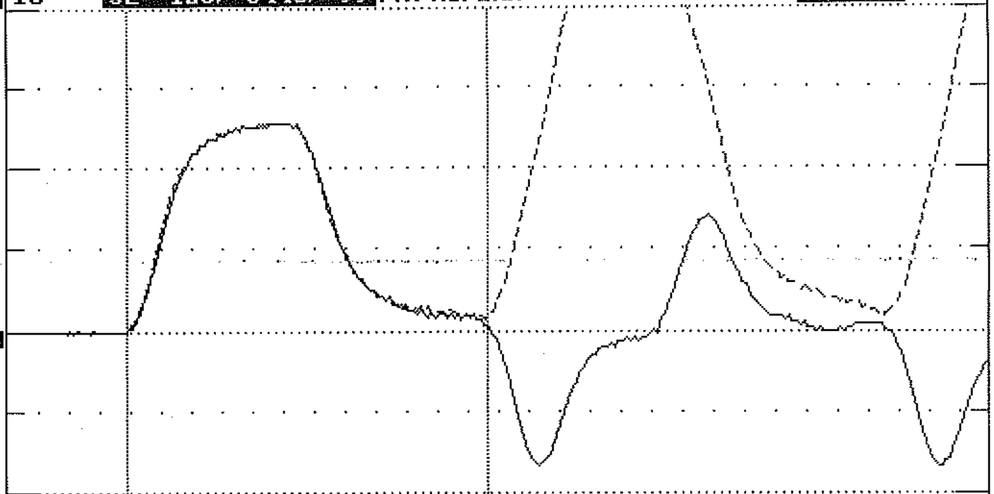
LE 39.6 ft
AR 1.7 in2
EM 30000 Ksi
SP 0.492 K/ft3
WS 16810 ft/s
WC 16862 ft/s

JC 0.40
FM 1.00
VM 1.00

EA/C 30.3 Ks/ft
UN KIPS*0.1
FR 20000 MB 30

DL -38
VT -1
PK 1 TM-PEAK

F1/2 500/ 213
F3/4 213/ 213
A1/2 999/ 999
A3/4 999/ 360



TS 12 E B PD: k1732 LP 0.00 ft
TB 8.0 T1 9.6 2L/C 4.7 VA 1000 VE 1022 LI 1.0

ACCEPT SQ-OFF FL-OFF PR-OFF

VMX= 4.2 FMX= 65 AMX= 129
EMX= 0.3 MEX= 127 FVP= 1.00

contact Pile Dynamics USA
with your questions
tel USA - 216 - 831- 6131
fax USA - 216 - 831- 0916

ACCELEROMETER CALIBRATION N.I.S.T. Traceable

SERIAL NUMBER: K1732

CALIBRATION FACTOR: .072 MV/G

PAK (*5000): 360 DATE: 19SEPT14

PDA OPERATOR: Aaron M. Wright

<-AT:PIEZORESISTIVE OP: laine [ver:4.05] AT:PIEZOELECTRIC->

Smart Sensor

Smart Chip Programmed By A.M.W. **on** 19SEPT14 **CRC Value** 2D4A

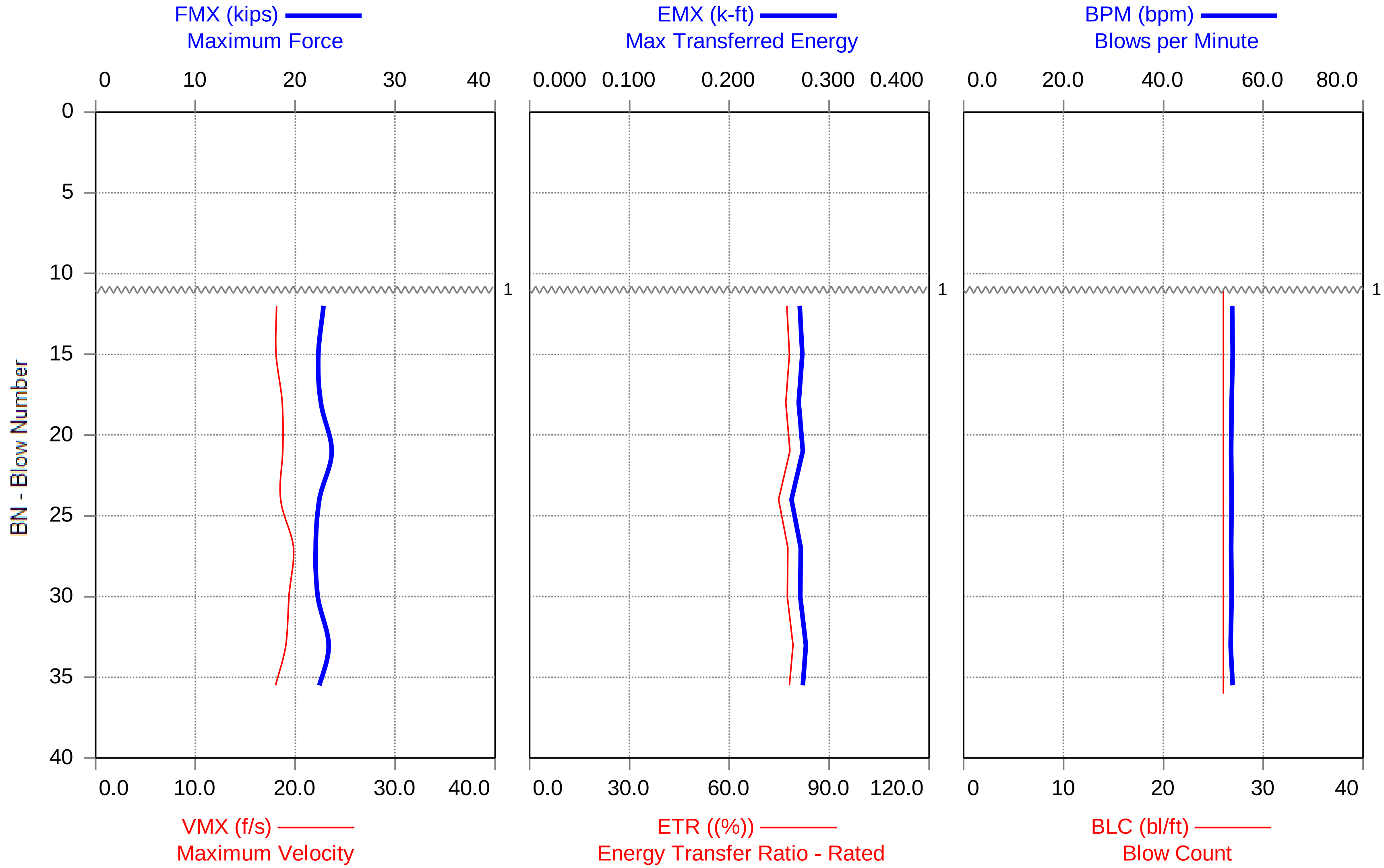
Exhibit A-3 SPT Calibration Data Plots

Pile Dynamics, Inc. - PDIPLOT2 Ver 2016.1.56.1 - Case Method & iCAP® Results

Printed: 27-June-2016 Test started: 14-June-2016

CME-55 CAL JUNE 2016 - B-1, 48.5 ft to 50 ft

CME-55, SERIAL# 359485



1 - Blows 1-10 = Seating Blows, Blow 11 = First Blow of N value

CME-55 CAL JUNE 2016 - B-1, 48.5 ft to 50 ft CME-55, SERIAL# 359485
OP: CF Date: 14-June-2016

AR: 1.18 in^2 SP: 0.492 k/ft^3
LE: 53.83 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00 []

FMX: Maximum Force BPM: Blows per Minute
VMX: Maximum Velocity DMX: Maximum Displacement
EMX: Max Transferred Energy CSX: Max Measured Compr. Stress
ETR: Energy Transfer Ratio - Rated DFN: Final Displacement

BL#	Depth	BLC	FMX	VMX	EMX	ETR	BPM	DMX	CSX	DFN
	ft	bl/ft	kips	f/s	k-ft	(%)	bpm	in	ksi	in
11	49.04	26	23	18.2	0.267	76.4	54.0	0.63	19.5	0.46
12	49.08	26	23	18.1	0.269	76.8	53.6	0.63	19.3	0.46
13	49.12	26	23	18.1	0.275	78.5	53.6	0.63	19.3	0.46
14	49.15	26	22	18.1	0.277	79.3	53.3	0.62	19.1	0.46
15	49.19	26	23	18.1	0.273	78.0	53.8	0.61	19.1	0.46
16	49.23	26	22	18.0	0.269	77.0	54.4	0.60	18.6	0.46
17	49.27	26	23	19.4	0.278	79.5	53.3	0.59	19.7	0.46
18	49.31	26	22	18.1	0.268	76.6	53.4	0.56	18.8	0.46
19	49.35	26	22	18.6	0.261	74.7	54.4	0.57	18.9	0.46
20	49.38	26	25	19.3	0.280	79.9	52.9	0.58	21.2	0.46
21	49.42	26	22	18.1	0.267	76.3	54.4	0.60	18.8	0.46
22	49.46	26	24	18.9	0.275	78.5	53.5	0.60	20.1	0.46
23	49.50	26	23	19.3	0.266	75.9	53.4	0.58	19.4	0.46
24	49.54	26	22	18.2	0.269	76.9	53.5	0.60	19.0	0.46
25	49.58	26	22	18.1	0.251	71.7	54.2	0.54	18.6	0.46
26	49.62	26	22	19.7	0.269	76.8	53.4	0.59	18.9	0.46
27	49.65	26	21	20.4	0.272	77.8	53.5	0.59	17.7	0.46
28	49.69	26	23	19.3	0.274	78.2	53.9	0.58	19.4	0.46
29	49.73	26	23	19.1	0.274	78.2	53.5	0.60	19.4	0.46
30	49.77	26	21	20.5	0.265	75.7	53.6	0.58	18.0	0.46
31	49.81	26	23	18.5	0.275	78.4	54.0	0.60	19.3	0.46
32	49.85	26	23	19.3	0.275	78.6	53.0	0.60	19.4	0.46
33	49.88	26	24	19.1	0.274	78.2	54.3	0.57	19.9	0.46
34	49.92	26	24	18.7	0.281	80.4	52.9	0.60	20.0	0.46
35	49.96	26	22	17.8	0.271	77.4	54.3	0.59	18.7	0.46
36	50.00	26	23	18.2	0.276	78.8	53.5	0.60	19.3	0.46
		Average	23	18.7	0.271	77.5	53.7	0.59	19.2	0.46
		Std. Dev.	1	0.7	0.006	1.8	0.4	0.02	0.7	0.00
		Maximum	25	20.5	0.281	80.4	54.4	0.63	21.2	0.46
		Minimum	21	17.8	0.251	71.7	52.9	0.54	17.7	0.46

Total number of blows analyzed: 26

BL# Sensors

11-36 F3: [AWJ 1] 211.5 (1.00); F4: [AWJ 2] 211.8 (1.00); A3: [K1737] 342.0 (1.00);
A4: [K1732] 360.0 (1.00)

BL# Comments

11 Blows 1-10 = Seating Blows, Blow 11 = First Blow of N value

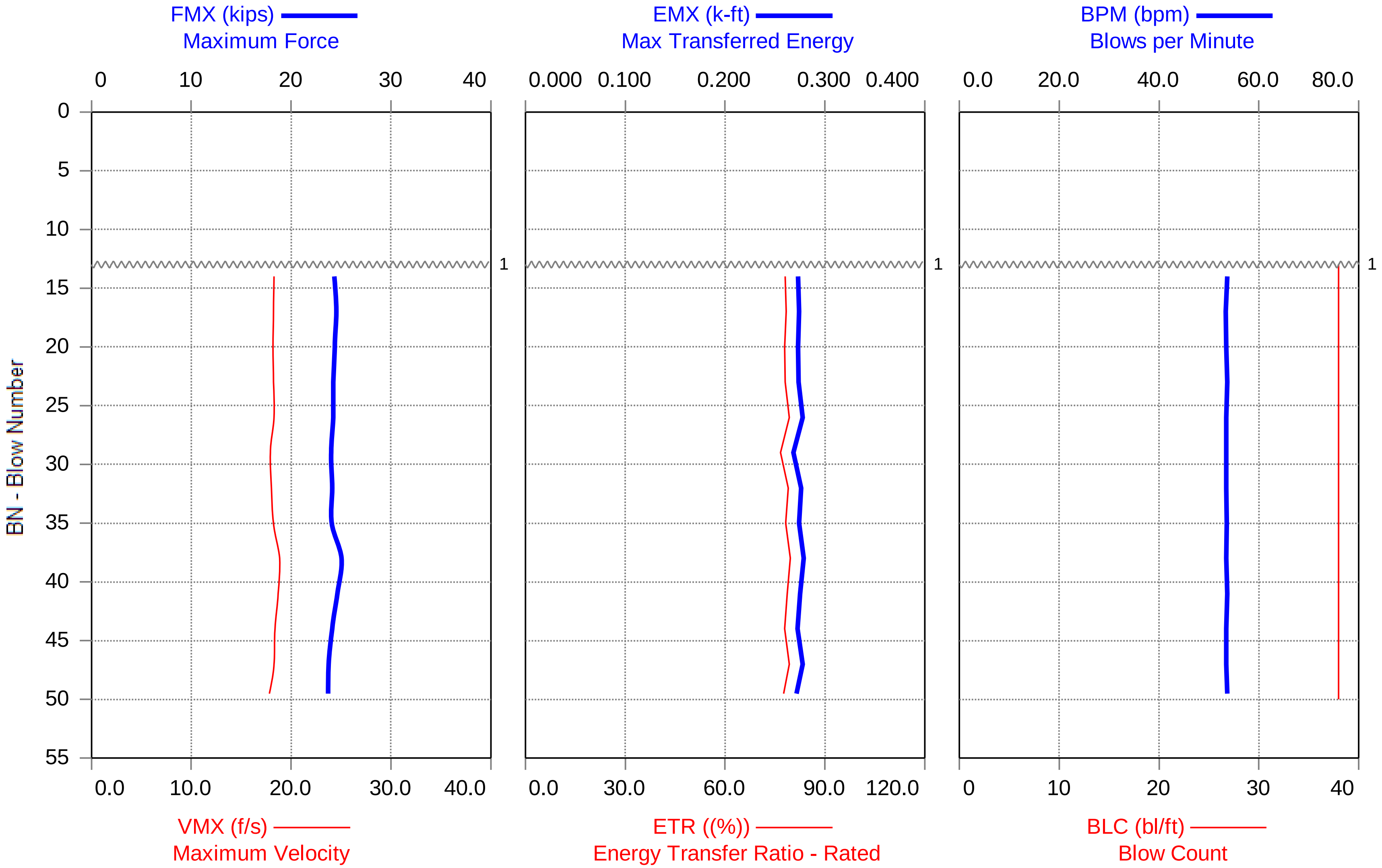
Pile Dynamics, Inc. - PDIPLOT2 Ver 2016.1.56.1 - Case Method & iCAP® Results

Printed: 27-June-2016

Test started: 14-June-2016

CME-55 CAL JUNE 2016 - B-1, 45.5 ft to 47 ft

CME-55, SERIAL# 359485



1 - Blows 1-12 = Seating Blows, Blow 13 = First blow of N value

CME-55 CAL JUNE 2016 - B-1, 45.5 ft to 47 ft CME-55, SERIAL# 359485
OP: CF Date: 14-June-2016

AR: 1.18 in² SP: 0.492 k/ft³
LE: 50.83 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00 []

FMX: Maximum Force BPM: Blows per Minute
VMX: Maximum Velocity DMX: Maximum Displacement
EMX: Max Transferred Energy CSX: Max Measured Compr. Stress
ETR: Energy Transfer Ratio - Rated DFN: Final Displacement

BL#	Depth	BLC	FMX	VMX	EMX	ETR	BPM	DMX	CSX	DFN
	ft	bl/ft	kips	f/s	k-ft	(%)	bpm	in	ksi	in
13	46.03	38	24	17.8	0.263	75.2	54.2	0.48	20.1	0.32
14	46.05	38	26	19.3	0.288	82.2	53.1	0.51	21.9	0.31
15	46.08	38	23	17.8	0.269	76.7	53.8	0.50	19.9	0.32
16	46.11	38	25	18.3	0.274	78.3	53.3	0.50	21.1	0.31
17	46.13	38	24	18.1	0.274	78.2	53.2	0.50	20.6	0.32
18	46.16	38	24	18.3	0.275	78.6	53.5	0.49	20.6	0.32
19	46.18	38	24	17.9	0.270	77.1	53.6	0.49	20.2	0.32
20	46.21	38	23	17.5	0.265	75.8	54.2	0.49	19.7	0.31
21	46.24	38	26	19.1	0.283	80.9	52.7	0.50	22.0	0.31
22	46.26	38	23	17.4	0.266	76.0	54.0	0.48	19.5	0.32
23	46.29	38	25	18.6	0.276	78.9	53.7	0.49	21.0	0.31
24	46.32	38	25	18.7	0.278	79.5	53.4	0.49	21.2	0.31
25	46.34	38	23	17.7	0.269	76.9	53.9	0.48	19.6	0.32
26	46.37	38	24	18.6	0.276	78.8	52.5	0.49	20.5	0.32
27	46.39	38	25	18.5	0.289	82.5	54.1	0.54	21.4	0.32
28	46.42	38	25	18.5	0.275	78.5	53.4	0.49	21.2	0.32
29	46.45	38	23	17.3	0.265	75.6	53.2	0.48	19.8	0.32
30	46.47	38	24	17.9	0.266	76.0	53.9	0.49	20.0	0.32
31	46.50	38	25	18.4	0.274	78.3	53.7	0.48	21.2	0.31
32	46.53	38	24	17.8	0.273	78.0	53.0	0.48	20.2	0.31
33	46.55	38	23	17.8	0.282	80.6	53.5	0.53	19.9	0.32
34	46.58	38	26	18.9	0.279	79.8	53.2	0.50	21.7	0.32
35	46.61	38	23	17.7	0.266	76.0	54.9	0.48	19.7	0.32
36	46.63	38	23	18.1	0.276	79.0	52.7	0.50	19.7	0.32
37	46.66	38	26	18.7	0.274	78.3	53.7	0.49	21.9	0.31
38	46.68	38	25	19.5	0.286	81.7	53.7	0.50	21.5	0.32
39	46.71	38	24	18.3	0.276	78.8	53.1	0.49	20.2	0.32
40	46.74	38	26	18.8	0.274	78.2	53.8	0.48	21.7	0.32
41	46.76	38	25	19.3	0.282	80.7	53.5	0.49	21.4	0.32
42	46.79	38	23	18.1	0.270	77.0	53.7	0.48	19.6	0.32
43	46.82	38	24	18.6	0.274	78.4	53.2	0.49	20.5	0.32
44	46.84	38	23	17.7	0.270	77.1	53.2	0.49	19.4	0.31
45	46.87	38	25	18.8	0.274	78.2	53.9	0.50	21.4	0.32
46	46.89	38	23	18.0	0.277	79.1	53.5	0.50	19.6	0.32
47	46.92	38	25	19.1	0.284	81.2	53.1	0.51	21.3	0.32
48	46.95	38	23	17.8	0.272	77.7	53.9	0.49	19.5	0.31
49	46.97	38	25	18.4	0.277	79.0	53.6	0.50	21.1	0.32
50	47.00	38	23	17.3	0.267	76.2	53.7	0.48	19.1	0.32
		Average	24	18.3	0.274	78.4	53.5	0.49	20.6	0.32
		Std. Dev.	1	0.6	0.006	1.8	0.5	0.01	0.8	0.00
		Maximum	26	19.5	0.289	82.5	54.9	0.54	22.0	0.32
		Minimum	23	17.3	0.263	75.2	52.5	0.48	19.1	0.31

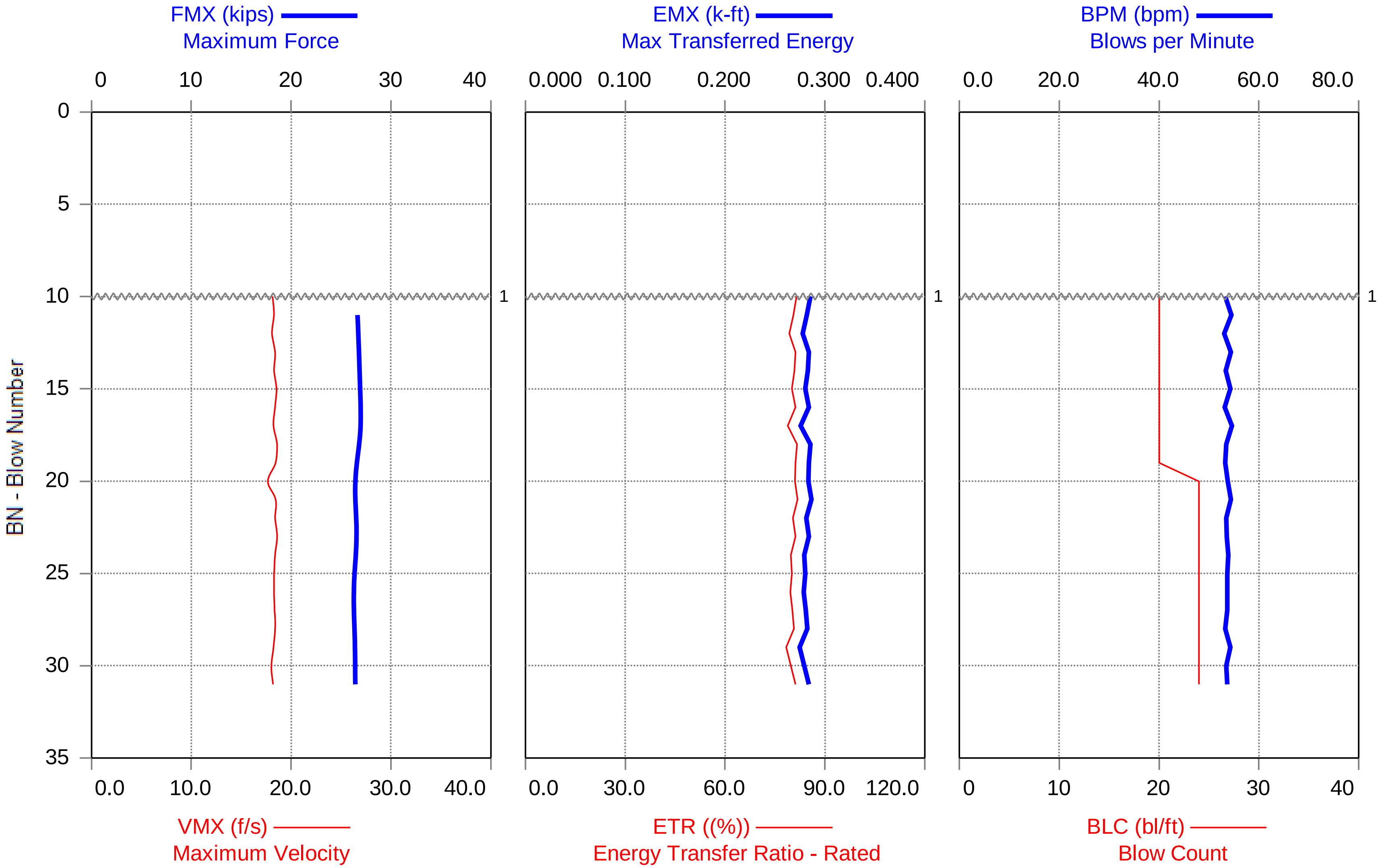
Total number of blows analyzed: 38

Pile Dynamics, Inc. - PDIPLOT2 Ver 2016.1.56.1 - Case Method & iCAP® Results

Printed: 27-June-2016 Test started: 14-June-2016

CME-55 CAL JUNE 2016 - B-1, 40.5 ft to 42 ft

CME-55, SERIAL# 359485



1 - Blows 1-9 = Seating blows, Blow 10 = First blow of N value

CME-55 CAL JUNE 2016 - B-1, 40.5 ft to 42 ft CME-55, SERIAL# 359485
OP: CF Date: 14-June-2016

AR: 1.18 in² SP: 0.492 k/ft³
LE: 45.83 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00 []

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Max Transferred Energy
ETR: Energy Transfer Ratio - Rated
BPM: Blows per Minute
DMX: Maximum Displacement
CSX: Max Measured Compr. Stress
DFN: Final Displacement

BL#	Depth	BLC	FMX	VMX	EMX	ETR	BPM	DMX	CSX	DFN
	ft	bl/ft	kips	f/s	k-ft	(%)	bpm	in	ksi	in
10	41.05	20	27	18.2	0.285	81.5	53.2	0.81	22.5	0.60
11	41.10	20	27	18.3	0.282	80.5	54.5	0.79	23.0	0.60
12	41.15	20	26	18.1	0.278	79.3	53.0	0.75	22.2	0.60
13	41.20	20	27	18.4	0.284	81.1	54.4	0.76	22.8	0.60
14	41.25	20	27	18.3	0.283	80.8	53.3	0.71	22.6	0.60
15	41.30	20	27	18.5	0.280	80.1	54.3	0.71	22.8	0.60
16	41.35	20	27	18.4	0.284	81.2	53.1	0.68	22.8	0.60
17	41.40	20	27	18.2	0.276	78.8	54.6	0.64	22.7	0.60
18	41.45	20	27	18.6	0.286	81.6	53.4	0.65	23.1	0.60
19	41.50	20	27	18.4	0.284	81.1	53.2	0.64	22.9	0.60
20	41.54	24	26	17.7	0.284	81.0	53.8	0.63	22.2	0.50
21	41.58	24	26	18.5	0.286	81.8	54.4	0.62	22.1	0.50
22	41.63	24	27	18.4	0.281	80.4	53.4	0.61	22.8	0.50
23	41.67	24	27	18.6	0.284	81.1	53.6	0.61	22.8	0.50
24	41.71	24	26	18.4	0.279	79.7	53.9	0.60	21.9	0.50
25	41.75	24	26	18.3	0.280	80.1	53.7	0.60	22.2	0.50
26	41.79	24	26	18.3	0.279	79.6	53.7	0.59	22.2	0.50
27	41.83	24	26	18.4	0.281	80.3	53.7	0.59	22.4	0.50
28	41.88	24	27	18.4	0.283	80.7	53.2	0.59	22.7	0.50
29	41.92	24	26	18.2	0.274	78.4	54.3	0.57	22.4	0.50
30	41.96	24	26	18.0	0.279	79.8	53.5	0.59	22.0	0.50
31	42.00	24	26	18.2	0.284	81.2	53.7	0.59	22.4	0.50
		Average	27	18.3	0.282	80.5	53.7	0.65	22.5	0.55
		Std. Dev.	0	0.2	0.003	0.9	0.5	0.07	0.3	0.05
		Maximum	27	18.6	0.286	81.8	54.6	0.81	23.1	0.60
		Minimum	26	17.7	0.274	78.4	53.0	0.57	21.9	0.50

Total number of blows analyzed: 22

BL# Sensors

10-31 F3: [AWJ 1] 211.5 (1.00); F4: [AWJ 2] 211.8 (1.00); A3: [K1737] 342.0 (1.00);
A4: [K1732] 360.0 (1.00)

BL# Comments

10 Blows 1-9 = Seating blows, Blow 10 = First blow of N value

Time Summary

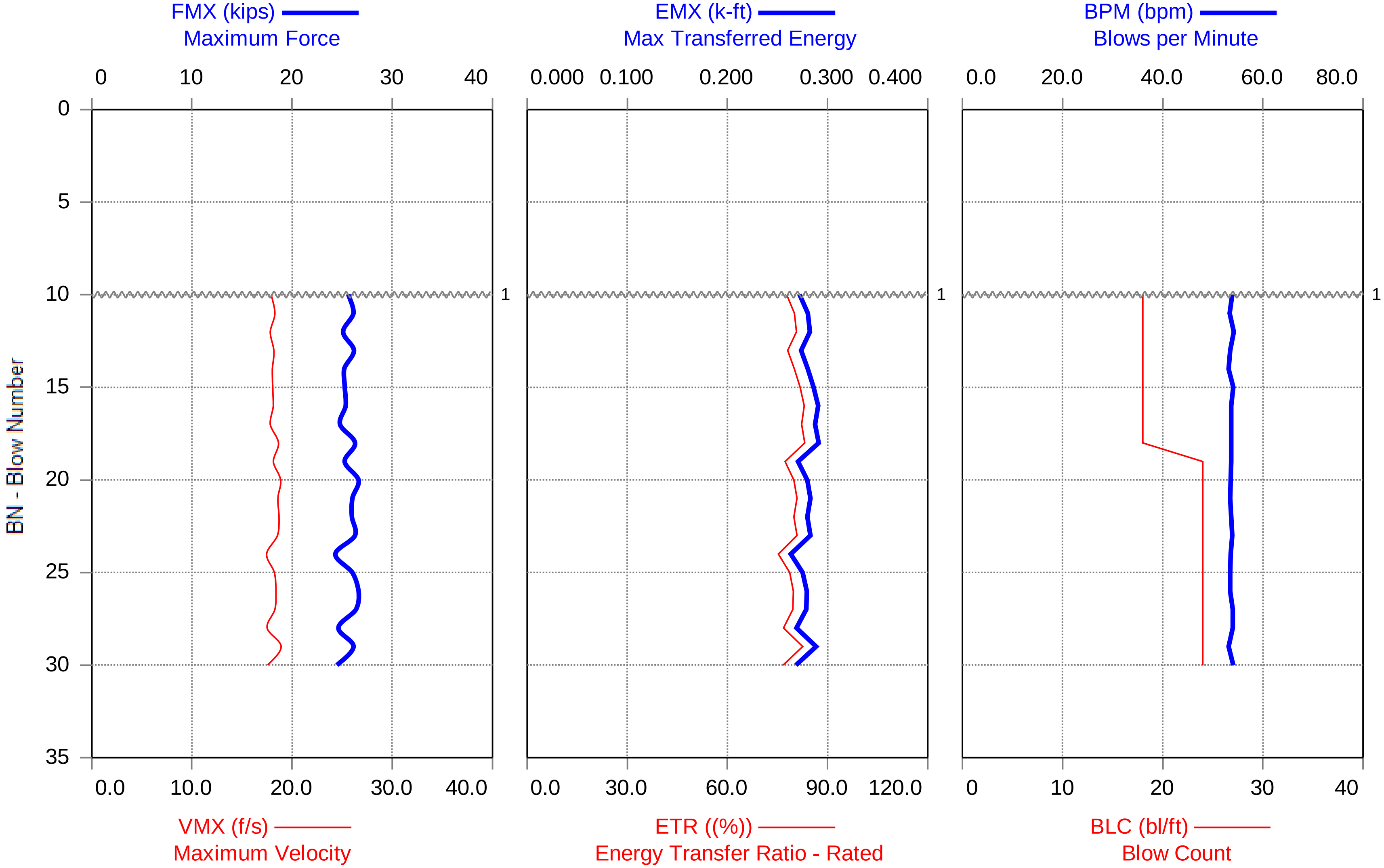
Drive 26 seconds 4:41 PM - 4:42 PM BN 7 - 31

Pile Dynamics, Inc. - PDIPLOT2 Ver 2016.1.56.1 - Case Method & iCAP® Results

Printed: 27-June-2016 Test started: 14-June-2016

CME-55 CAL JUNE 2016 - B-1, 43.5 ft to 45 ft

CME-55, SERIAL# 359485



1 - Blows 1-9 = Seating Blows, Blow 10 = First blow of N value

CME-55 CAL JUNE 2016 - B-1, 43.5 ft to 45 ft CME-55, SERIAL# 359485
OP: CF Date: 14-June-2016

AR: 1.18 in² SP: 0.492 k/ft³
LE: 48.83 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00 []

FMX: Maximum Force BPM: Blows per Minute
VMX: Maximum Velocity DMX: Maximum Displacement
EMX: Max Transferred Energy CSX: Max Measured Compr. Stress
ETR: Energy Transfer Ratio - Rated DFN: Final Displacement

BL#	Depth	BLC	FMX	VMX	EMX	ETR	BPM	DMX	CSX	DFN
	ft	bl/ft	kips	f/s	k-ft	(%)	bpm	in	ksi	in
10	44.06	18	26	17.9	0.272	77.8	53.9	0.75	21.7	0.66
11	44.11	18	26	18.3	0.280	80.1	53.3	0.76	22.1	0.66
12	44.17	18	25	17.8	0.282	80.6	54.2	0.80	21.3	0.67
13	44.22	18	26	18.2	0.273	78.1	53.5	0.72	22.2	0.67
14	44.28	18	25	18.0	0.280	80.0	53.1	0.73	21.4	0.67
15	44.33	18	25	18.1	0.286	81.7	54.1	0.75	21.4	0.67
16	44.39	18	25	18.1	0.290	83.0	53.7	0.74	21.5	0.67
17	44.44	18	25	17.8	0.288	82.2	53.7	0.70	21.0	0.67
18	44.50	18	26	18.7	0.291	83.2	53.7	0.68	22.3	0.67
19	44.54	24	25	18.1	0.271	77.3	53.7	0.58	21.4	0.50
20	44.58	24	27	18.9	0.280	79.9	53.6	0.59	22.6	0.50
21	44.63	24	26	18.6	0.283	80.8	53.5	0.61	22.1	0.50
22	44.67	24	26	18.7	0.280	80.0	53.7	0.59	22.0	0.50
23	44.71	24	26	18.5	0.283	80.9	53.9	0.62	22.3	0.50
24	44.75	24	24	17.5	0.263	75.2	53.6	0.56	20.6	0.50
25	44.79	24	26	18.2	0.275	78.6	53.5	0.59	22.0	0.50
26	44.83	24	27	18.4	0.279	79.8	53.5	0.59	22.6	0.50
27	44.88	24	26	18.3	0.279	79.6	54.0	0.59	22.4	0.50
28	44.92	24	25	17.5	0.269	76.9	54.0	0.58	20.9	0.50
29	44.96	24	26	18.9	0.289	82.5	53.1	0.61	22.2	0.50
30	45.00	24	25	17.6	0.268	76.6	54.1	0.56	20.8	0.50
		Average	26	18.2	0.279	79.7	53.7	0.65	21.7	0.57
		Std. Dev.	1	0.4	0.007	2.1	0.3	0.08	0.6	0.08
		Maximum	27	18.9	0.291	83.2	54.2	0.80	22.6	0.67
		Minimum	24	17.5	0.263	75.2	53.1	0.56	20.6	0.50

Total number of blows analyzed: 21

BL# Sensors

10-30 F3: [AWJ 1] 211.5 (1.00); F4: [AWJ 2] 211.8 (1.00); A3: [K1737] 342.0 (1.00);
A4: [K1732] 360.0 (1.00)

BL# Comments

10 Blows 1-9 = Seating Blows, Blow 10 = First blow of N value

Time Summary

Drive 29 seconds 4:50 PM - 4:51 PM BN 4 - 30

Exhibit A-4 Field Log

Terracon

SPT HAMMER CALIBRATION FIELD WORKSHEET

ARRIVAL TIME: 2:15
DEPART TIME: 5:15
TOTAL TRAVEL: —
TOTAL TIME: ~ 3 hrs
CLIENT REP: Ken Zur
MILEAGE: —

PROJECT NAME: None
PROJECT NO.: None
BORING NO.: B-1 (Test)
CLIENT: Terracon

DATE: 6/14/2016
TERRACON REP: Ken Zur
PDA MODEL/SN: PAX 37662
DRILLING CONT.: Terracon

DRILL RIG DATA

Type/Transport: ATV-Track
Manufacturer: CME
Model No.: 55
Serial No: 359485
Year Built: Aug 2008
Modifications: None
Maint. Schedule: As-Required

SPT HAMMER DATA

Type: Auto
Manufacturer: CME
Lifting Mechanism: Chain
Model No.: —
Serial No: —
Hammer Weight: 140 lbs
Hammer Operator(s): Craig Feedrychoski

PDA INPUT DATA

Operator:	OP	KSZ	Elastic Modulus (ksi):	EM	30,000 ksi
Project No./Location:	PJ	Columbia Office	Specific Weight (kips/ft^3):	SP	0.492
Rig Model & SN:	PN	CME-55	Wave Speed (ft/sec):	WS	16,808
Hammer Type, LM, Rods:	PD	Auto	Increment Length (ft):	LI	
Drill Rod Area (in^2):	AR	1.18	Sampling Freq. (kHz):	FR	50 kHz

TRANSDUCER INFORMATION

Gage	SN	Calibration
F1:	267AWJ1	211.59
F2:	267AWJ2	211.77
A1:	K1737	342
A2:	K1732	360

NOTES:

Sampler 34" (2.83')
Rod 1'
Total 3.83'

SPT TESTING INFORMATION

Start Time	Soil	Depth (ft) Start	Depth (ft) End	LE (ft)	Rods & Lengths	PDA Blows Start	PDA Blows End	SPT Blows 1st 6"	SPT Blows 2nd 6"	SPT Blows 3rd 6"	SPT Blows 4th 6"
2:47	SP	23.5	25	28.83	5(5')	0	50	13	19	22	
2:57	SP	28.5	30	33.83	6(5')	0	38	10	14	17	
				"Rain	Delay"						
4:12	SP	33.5	35	38.83	7(5')	0	38	10	12	14	
4:26	SP	38.5	40	43.83	8(5')	0	42	10	13	16	
4:40	SP	40.5	42	45.83	8(5')+1(2')	0	27	9	10	12	
4:51	SP	43.5	45	48.83	9(5')	0	29	9	9	12	

PICTURE NUMBERS AND INFO:

Terracon

SPT HAMMER CALIBRATION FIELD WORKSHEET

ARRIVAL TIME: ______
DEPART TIME: ______
TOTAL TRAVEL: ______
TOTAL TIME: ______
CLIENT REP: ______
MILEAGE: ______

PROJECT NAME: ______
PROJECT NO.: ______
BORING NO.: ______
CLIENT: ______

DATE: ______
TERRACON REP: ______
PDA MODEL/SN: ______
DRILLING CONT.: ______

DRILL RIG DATA

Type/Transport: ______
Manufacturer: ______
Model No.: ______
Serial No: ______
Year Built: ______
Modifications: ______
Maint. Schedule: ______

" Same as Page 1

SPT HAMMER DATA

Type: ______
Manufacturer: ______
Lifting Mechanism: ______
Model No.: ______
Serial No: ______
Hammer Weight: ______
Hammer Operator(s): ______

PDA INPUT DATA

Operator: OP ______
Project No./Location: PJ ______
Rig Model & SN: PN ______
Hammer Type, LM, Rods: PD ______
Drill Rod Area (in^2): AR ______

Elastic Modulus (ksi): EM ______
Specific Weight ($kips/ft^3$): SP ______
Wave Speed (ft/sec): WS ______
Increment Length (ft): LI ______
Sampling Freq. (kHz): FR ______

TRANSDUCER INFORMATION

Gage	SN	Calibration
F1:		
F2:		
A1:		
A2:		

NOTES:

SPT TESTING INFORMATION

Start Time	Soil	Depth (ft)		LE (ft)	Rods & Lengths	PDA Blows		SPT Blows			
		Start	End			Start	End	1st 6"	2nd 6"	3rd 6"	4th 6"
5:00	SP	45.5	47	50.83	9(5')&1(2')	0	~~27~~50	12	19	19	
	SP	48.5	50	53.83	10(5')	0	34	10	13	13	

PICTURE NUMBERS AND INFO:

First 4 tests had problems - accelerometers installed incorrectly (one opposite of other) also LE & LP incorrectly inputted. Final 4 should be correct.