Geotechnical Base Line Report
S-45-51 Emergency Bridge
Replacement over Black Mingo Creek
Williamsburg County, South Carolina
S&ME Project No. 1413-15-145



Prepared for:

South Carolina Department of Transportation

955 Park Street, Room 406

Columbia, South Carolina 29202

Prepared by:
S&ME, Inc.
620 Wando Park Boulevard
Mt Pleasant, SC 29464

December 2, 2015



December 2, 2015

South Carolina Department of Transportation 955 Park Street, Room 406 Columbia, South Carolina 29202

Attention: Mr. Trapp Harris, P.E.

Reference: Geotechnical Base Line Report

S-45-51 Emergency Bridge Replacement Over Black Mingo Creek

Williamsburg County, South Carolina S&ME Project No. 1413-15-145

Dear Mr. Harris:

We have completed our geotechnical exploration for the S-45-51 emergency bridge replacement over Black Mingo Creek in Williamsburg County, South Carolina. Our exploration was performed in general accordance with Work Order Number SME#10-18-29461.

S&ME, Inc. personnel were present at the above referenced site on November 25, 2015, to perform soil test borings (STB) and on November 30, 2015, to perform cone penetration test (CPT) soundings. Laboratory testing was assigned by S&ME, Inc. on November 27, 2015.

The borings and soundings were conducted in the existing roadway at the locations shown on Figure 1. STB-1 and CPT-2 were performed near the existing northern bridge end abutment in the southbound and northbound lanes, respectively. CPT-3 and STB-4 were performed near the existing southern bridge end abutment in the southbound and northbound lanes, respectively. The borings were conducted to the SCDOT requested depths and the soundings refused at depths shallower than requested. The soundings appear to have refused on a relatively thin cemented sand layer encountered in the borings. Groundwater levels were measured at the time of the CPT soundings. Soils encountered in the borings were visually classified in the field in general accordance with ASTM D 2488, and the borings were backfilled by S&ME with the cuttings. Groundwater levels were not obtained in the borings.

SPT hammer energy measurements were previously obtained with a Pile Driving Analyzer (PDA) on the CME 45D drill rig used to perform the borings on this project. The energy measurements were obtained on June 3, 2015. The N-values indicated on the logs are field values that have not been corrected for hammer efficiency, which is noted on the logs.

The boring logs and CPT sounding logs are attached. Test locations were initially located by S&ME personnel measuring distances from existing site features. After field work was completed, the test locations were surveyed by a licensed surveyor. The horizontal and vertical data are shown in the table in Figure 1. Station and offset were not estimated because plans were not provided.



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Williamsburg County, South Carolina S&ME Project No. 1413-15-145

Laboratory testing on samples selected by S&ME, Inc. was conducted as part of this project. The laboratory testing included Wash No. 200 sieve analyses, Atterberg Limits, moisture content, and organic content. The laboratory testing results are attached.

The in situ and laboratory testing data are intended for SCDOT's engineering interpretation of the data collected.

This data report has been prepared in accordance with generally applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made. The Geotechnical Engineer of Record for the project must review the data submitted in this report and develop their own interpretation of the testing results as they apply to design.

S&ME, Inc. appreciates this opportunity to work with SCDOT as your geotechnical consultant on this project. If you have any questions or need any further information in regard to this report, please do not hesitate to contact us at 843-884-0005.

Sincerely,

S&ME, Inc.

David L. Schoen, E.I.T. Geotechnical Professional Michael S. Ulmer, P.E.

Principal Engineer/Project Manager

December 2, 2015 2



Geotechnical Base Line Report S-45-51 Emergency Bridge Replacement Over Black Mingo Creek

Williamsburg County, South Carolina S&ME Project No. 1413-15-145

Appendix

Test Location Plan (Figure 1)
Pictures of Rig at Test Locations
Soil Test Boring Logs
Cone Penetration Test Sounding Logs
Field Testing Parameters
Lab Data Summary Sheet
Individual Lab Data Sheets





Cone Penetration Test (CPT) Sounding Location

Soil Test Boring (STB) Location

NOTE: Locations as shown is this figure are approximate. Use locations in the table for design.

Project No.: 1413-15-145

Date / Drawn By: December 2015 / DLS

Not to Scale



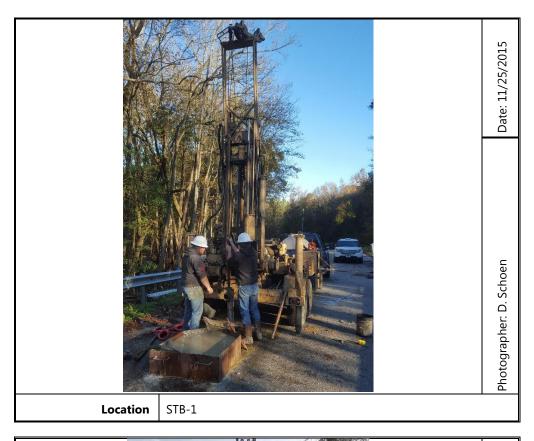
TEST LOCATION PLAN

EBRO Black Mingo Creek S-45-51 (Battery Park Rd) Williamsburg County, South Carolina Figure:



Geotechnical Base Line Report S-45-51 Emergency Bridge Replacement Over Black Mingo Creek

Williamsburg County, South Carolina S&ME Project No. 1413-15-145







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Jore Si	ze.	IN/A	Drille	r. Ca	aronna	Drillir	ig	Ground	iwater	TC	םי	IN/A		Z411	K	IN/A	_
													•	SPT N \	VALUE	. ●	_
Elevation (ft)	Depth (ft)	MATER	RIAL DESC	RIPTION	N	Graphic Log	Sample Depth	Sample No./Type	1st 6"	3rd 6"	N Value	0 10	PL X	MES CC	C ONTEN	LL ×	ç
-3.5	- - -	very dens LL=NP, PL=NI %200=13.9, @ cemented, 50 discrete lense	P, PI=NP, NN) tip of spoor > material no	MC=30.9, n - moderat t continuou	tely		28.5	- - - SS/9	10 50	/4"	50/4		A C				
-	32.0_	very dense, m subangular, sl (SP-SM), 2.5Y	ightly silty fin	e SAND			33.5										
-8.5 -	-							SS/10 -	13 1	8 34	52						
- - -	37.0 _ - -	stiff, moist, vel low plasticity, Pee Dee					38.5	SS/11	3 6	6 6	12	_					
-13.5 -	42.0_							_									
- -18.5	-	medium dense subangular, no Gley 1 3/10Y, LL=NP, PL=NI %200=19.5	ot reactive, si Pee Dee	Ity ŠAŇD ((SM),		43.5	SS/12	6 9) 13	3 22	* : : : : : : : : : : : : : : : : : : :	D ()			
- - -	47.0 _ -	very stiff, mois	lasticity, san	gray, weak dy CLAY (.ly CL),		48.5	-									
-23.5	-	Gley 1 3/N, Pe	ee Dee				40.5	SS/13	6 9	9	18		•				
						LE	GENI)			'	<u> </u>		Conti	nued	Next	P
UD - L		SAMF on ped Sample re, 1-1/8"	CU - Cu	ck Core, 1- ttings ntinuous Ti			HS CF	SA - Hollo FA - Conti C - Drivir	nuous F	Auger light A		R		otary Wa	ash		_



Project						Co	unty:	VVI	lliam	sbur	g			ng No			
Site De			51 EBRO Bla											Route		45-51	
). Schoen		Location:				Offse			I/A			nment		Existing	<u>j</u>
Elev.:					East:			3311			ate					5/15	_
Total D	•		Soil Depth:	N/A ft		ore De	• •	N/A			1		plete			5/201	
		meter (in):		npler Confi				er Re			Υ	<u>N</u>		Liner			(
Drill Ma		CME 45D N/A	Drill Meth		Rotar	_	Hamme Ground					с I/A	En	ergy i 24l		81% N/A	_
Core Si	ze.	IN/A	Driller.	Carolina	ווווווטו	ig	Ground	uwau	er.	IUB	· [N/A		Z4 I	ıĸ	IN/A	
													•	SPT	I VALL	JE •	_
_							, m				-		PL		МС	LL	
atio	Depth (ft)	MATEDI	AL DESCRIF	OTION	Graphic Log	Sample Depth	Type		=_		N Value		\times		-	$\overset{LL}{ o}$	
Elevation (ft)	De C	IVIATERI	AL DESCRIP	TION	Gra	Sar	Sample No./Type	1st 6"	2nd 6"	3rd 6"	> 2	0 40				NT (%)	
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_	52.0_	and a di	and the second				4					:					
		medium dense, subangular, wea	moist, dark gre akly reactive, si	enisn gray, Ity fine													
1	_	SAND (SM), GI	ey 1 3/10Y, Pec	Dee		53.5	1										
-	_						SS/14	6	9	13	22	:	•				
-28.5	_						1					:					_
1	_						1					:					
-	_						-						:				
	_						_						:				
		not reactive	.			58.5						:	i				
1	-	not reactive	•				SS/15	7	8	12	20	:	ė				
-33.5	-						+					- :	:	: :	1 1	1 1	
													:				
	62.0																
4	0∠.0_	very stiff, dark g	reenish gray, n	ot reactive,			1						:				
-	_	low plasticity, sa 3/10Y, Pee Dee), Gley 1		63.5	-						:				
	_	LL=44, PL=		C=23.1,		00.0											
		%200=66.1	•				SS/16	5	8	20	28		**	X		A	
-38.5	_						†						:		: :		_
-	_						-						:				
	_												:				
													:				
1	_					68.5	1						:				
4	-	stiff, weakly	reactive				SS/17	4	5	7	12	•	:				
-43.5	_						100/11	<u> </u>					- :				_
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		hard				73.5							:				
1	_						SS/18	50/4"			50/4"	:	:				
-48.5	-						+					:	:		: :	: :	
_	_						_					:					
					<u> </u>	GENI	<u> </u>					:	:	Con	tinue	d Next	P
			ER TYPE								RILLIN	G ME	THOE)		A INGAL	
SS - S UD - L	Split Spc	oon bed Sample	NQ - Rock C CU - Cutting	ore, 1-7/8"			SA - Hollo FA - Cont						W - F C - F	Rotary \			



Project			C 45	E1 F	DDC) Dia-	J. Miss		rool	C0	unty:		VVII	liam	รมน	ııg		DOL	ing No Route		<u>В-4</u> 45-51	
Site De		on: . Schoe		-51 E			k Ming						ffoo	4.	- 1	N/A		Λlic				~
	26.5 f		North		DOI		ocatio 31.2		N/A East:		2		ffse	0.64			Start		gnmen		Existin 25/15	<u>y</u>
rotal D		100			Dept		N/A			ore De		+0.	N/A				Com		eq.		25/15 25/201	5
		meter (3	Вор		pler Co				•	nei		quir		Y		•	Liner			(1
Drill Ma			E 45D		Drill	Metho			Rotar		Hamr						$\overline{}$		nergy			
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																			ı ı		'	
																			SPT	N VAL	JE •	
Elevation (ft)	Depth (ft)	N	1ATEF	RIAL I	DES	CRIP	TION		Graphic Log	Sample Depth	Sample No /Type	adf man	1st 6"	2nd 6"	3rd 6"	N Value	0 10		FINES 30 40			
- -53.5 - -	- - -	ver	y stiff							78.5	SS/1	9	6	7	10	17		•				
- -58.5 - -	- - - -	har	rd							83.5	SS/2	20	5	14	36	50	-			•		
- -63.5 - -	- -	LL= %200=	=43, PL 55.8	.=18, F	PI=25,	NMC:	=23.2,			88.5	SS/2	:1	7	17	14	31	-	XO	•	(
- -68.5 -	- - -	ver	y stiff							93.5	SS/2	22	6	8	9	17	-	•				
- - -73.5	100.0	har			IATE) AT 4	00 5555	- -		98.5	SS/2	:3	7	17	50/1'	50/1	-					
-	_	ROF	ung II		IA I EL	AI 1	00 FEE1	I		05:												
			CALAR	ם בח	TVDE				LE	GENI)					יי ו וום	UC NAT	TUC	ND.			
UD - U	Split Spo	on oed Samp re, 1-1/8"		С	IQ - R	uttings	ore, 1-7/8 ous Tube			CF	SA - Ho FA - Co C - Dri	ntin	uous	Fligh	ger			:W -	Rotary Rock C			



S-45-51 ERBO Black Mingo Creek Williamsburg County, South Carolina S&ME Project No: 1413-15-145

Cone Penetration Test

CPT-2

Date: Nov. 30, 2015

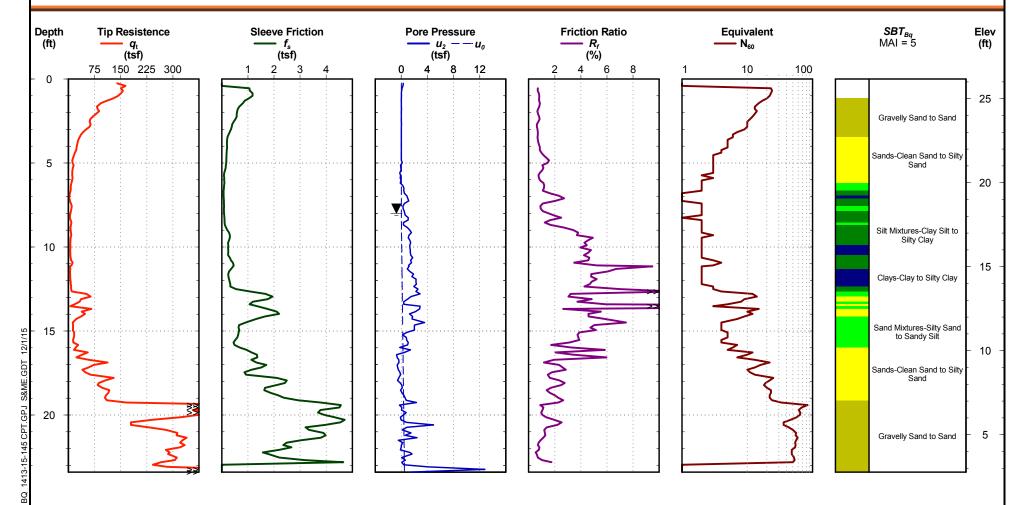
Estimated Water Depth: 8 ft Rig/Operator: CPT Truck/A. Feix **Northing:** 686102.64 **Easting:** 2433149.33

Elevation: 26.17 ft

Total Depth: 23.4 ft

Termination Criteria: Maximum Reaction Force

Cone Size: 1.75



Electronic Filename: 1413-15-145_SCDOT_S-45-51 RBO Black M



S-45-51 ERBO Black Mingo Creek Williamsburg County, South Carolina S&ME Project No: 1413-15-145

Cone Penetration Test

Date: Nov. 30, 2015

Estimated Water Depth: 8.5 ft

Rig/Operator: CPT Truck/A. Feix

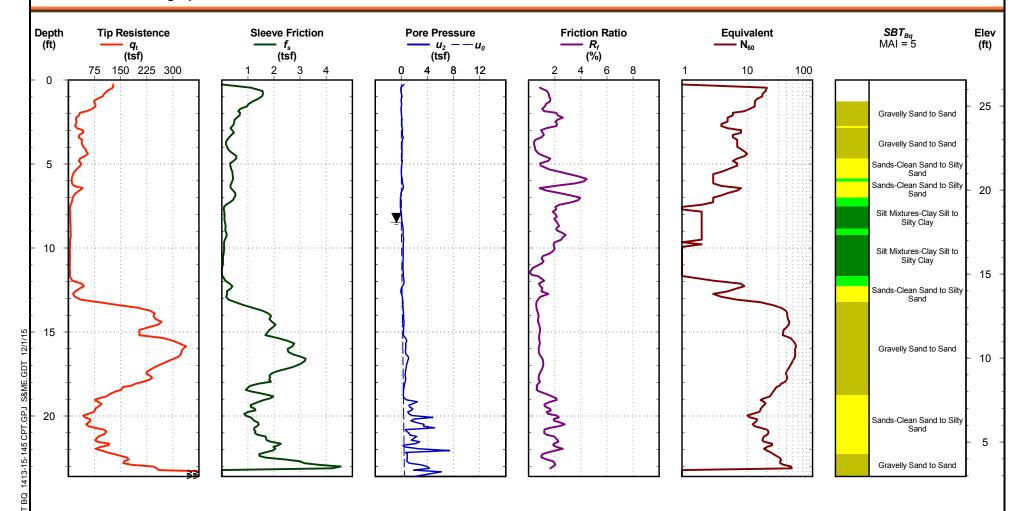
Northing: 685920.66 **Easting:** 2433109.09

Elevation: 26.55 ft

Total Depth: 23.6 ft

Termination Criteria: Maximum Reaction Force

Cone Size: 1.75



SPT FIELD TESTING PROCEDURES

Soil Classifications

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our exploration, samples obtained during drilling operations are examined and visually classified according to color, texture, and relative density or consistency (based on standard penetration resistance). The consistency and relative density designations are as follows:

	<u>SANDS</u>	SILTS A	ND CLAYS
N (SPT)	Relative Density	N (SPT)	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Medium Dense	5 - 8	Firm
		9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
50+	Very Dense	31 - 50	Hard
		50+	Very Hard

Soil Test Borings

All boring and sampling operations were conducted in accordance with ASTM Designation D 1586. Initially, the borings were advanced by either mechanically augering or wash boring through the soils. Where necessary, a heavy drilling fluid is used below the water table to stabilize the side and bottom of the drill hole. At regular intervals soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140 pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Standard Penetration Resistance". The penetration resistance, when properly evaluated, is an index to the soil strength.

FIELD TESTING PROCEDURES

Cone Penetrometer Test (CPT) Sounding

The cone penetrometer test soundings (ASTM D 5778) were performed by hydraulically pushing an electronically instrumented cone penetrometer through the soil at a constant rate. As the cone penetrometer tip was advanced through the soil, nearly continuous readings of point stress, sleeve friction and pore water pressure were recorded and stored in the on-site computers. Using theoretical and empirical relationships, CPT data can be used to determine soil stratigraphy and estimate soil properties and parameters such as effective stress, friction angle, Young's Modulus and undrained shear strength.

The consistency and relative density designations, which are based on the cone tip resistance, q_t for sands and cohesive soils (silts and clays) are as follows:

SAND	<u>S</u>	SILTS AND CL	AYS
Cone Tip Resistance, q _t (tsf)	Relative Density	Cone Tip Resistance, q _t (tsf)	Consistency
<20	Very Loose	<5	Very Soft
20 – 40	Loose	5 – 10	Soft
40 – 120	Medium Dense	10 – 15	Firm
		15 – 30	Stiff
120 – 200	Dense	30 –60	Very Stiff
>200	Very Dense	>60	Hard

CPT Correlations

References are in parenthesis next to the appropriate equation.

General

```
p_a = atmospheric pressure (for unit normalization)
```

 q_t = corrected cone tip resistance (tsf)

 f_s = friction sleeve resistance (tsf)

 $R_f = 100\% * (f_s/q_t)$

 u_2 = pore pressure behind cone tip (tsf)

 u_0 = hydrostatic pressure

 $B_q = (u_2-u_0)/(q_t-\sigma_{v0})$

 $Q_t = (q_t - \sigma_{v0}) / \sigma'_{v0}$

 $F_r = 100\% * f_s/(q_t - \sigma_{v0})$ $I_c = ((3.47 - \log Q_t)^2 + (\log F_r + 1.22)^2)^{0.5}$

$$N_{60} = (q_t/pa)/[8.5(1-l_c/4.6)]$$
 (6)

(6) Jefferies, M.G. and Davies, M.P., (1993), "Use of CPTu to estimate equivalent SPT N60", ASTM Geotechnical Testing Journal, Vol. 16, No. 4

CPT Soil Classification Legend

Zone	Qt/N	Description
1	2	Sensitive, Fine Grained
2	1	Organic Soils-Peats
3	1.5	Clays-Clay to Silty Clay
4	2	Silt Mixtures-Clayey Silt to Silty Clay
5	3	Sand Mixtures-Silty Sand to Sandy Silt
6	4.5	Sands-Clean Sand to Silty Sand
7	6	Gravelly Sand to Sand
8	1	Very Stiff Clay to Clayey Sand*
9	2	Very Stiff, Fine Grained*

	Robertson's Soil Behavior Type (SBT), 1990)	
Group #	Description		С
Gloup #	Description	Min	Max
1	Sensitive, fine grained	N	/A
2	Organic soils - peats	3.60	N/A
3	Clays - silty clay to clay	2.95	3.60
4	Silt mixtures - clayey silt to silty clay	2.60	2.95
5	Sand mixtures - silty sand to sandy silt	2.05	2.60
6	Sands - clean sand to silty sand	1.31	2.05
7	Gravelly sand to dense sand	N/A	1.31
8	Very stiff sand to clayey sand (High OCR or cemented)	N	/A
9	Very stiff, fine grained (High OCR or cemented)	N	/A

Soil behavior type is based on empirical data and may not be representative of soil classification based on plasticity and grain size distribution.

Relative Density and Consistency Table							
SANDS		SILTS and CLAYS					
Cone Tip Stress, qt (tsf)	Relative Density	Cone Tip Stress, qt (tsf)	Consistency				
Less than 20	Very Loose	Less than 5	Very Soft				
20 - 40	Loose	5 - 15	Soft to Firm				
40 - 120	Medium Dense	15 - 30	Stiff				
120 - 200	Dense	30 - 60	Very Stiff				
Greater than 200	Very Dense	Greater than 60	Hard				

Laboratory Data Summary Sheet S-45-51 Emergency Bridge Replacement Over Black Mingo Creek S&ME Project No. 1413-15-145 SCDOT Project ID: P029461

2-Dec-15

BORING	SAMPLE	SAMPLE	DEPTH	ELEVATION	WATER	PASSING	ATTE	RBERG	LIMITS	Organic		
ID	NUMBER	TYPE	(FT)	NAVD 88 (FT)	CONTENT (%)	200 SIEVE (%)	LL	PL	PI	Content (%)	USCS	AASHTO
STB-1	3	SS	5.0 to 6.5	21.3 to 19.8	17.5	15.8	NP	NP	NP	-	SM	A-2-4
STB-1	5	SS	9.0 to 10.5	17.3 to 15.8	-	-	167	86	81	-	SM*	nd
STB-1	6	SS	13.5 to 15.0	12.8 to 11.3	205.0	6.4	nd	nd	nd	26.3	PT	A-8
STB-1	7	SS	18.5 to 20.0	7.8 to 6.3	15.2	22.8	NP	NP	NP	-	SM	A-2-4
STB-1	8	SS	23.5 to 25.0	2.8 to 1.3	20.4	13.1	NP	NP	NP	-	SM	A-2-4
STB-1	12	SS	43.5 to 45.0	-17.3 to -18.8	32.6	25.0	NP	NP	NP	-	SM	A-2-4
STB-1	16	SS	63.5 to 65.0	-37.3 to -38.8	27.0	65.6	39	23	16	-	CL	A-6
STB-4	4	SS	7.0 to 8.5	19.5 to 18.0	29.6	33.8	48	23	25	-	SC	A-2-7
STB-4	5	SS	9.0 to 10.5	17.5 to 16.0	67.4	33.1	99	47	52	-	SM*	A-2-7
STB-4	9	SS	28.5 to 30.0	-2.0 to -3.5	30.9	13.9	NP	NP	NP	-	SM	A-2-4
STB-4	12	SS	43.5 to 45.0	-17.0 to -18.5	32.2	19.5	NP	NP	NP	-	SM	A-2-4
STB-4	16	SS	63.5 to 65.0	-37.0 to -38.5	23.1	66.1	44	20	24	-	CL	A-7-6
STB-4	21	SS	88.5 to 90.0	-62.0 to -63.5	23.3	55.8	43	18	25	-	CL	A-7-6

SS = Split Spoon

NP = Non Plastic

nd = not determined (insufficient lab testing to determine)

^{* =} organic laden



Revision No. 0

Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

Another code ASTM D 4318 AASHTO T 89 AASHTO T 90 Quality Assurance

S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464

Project #: 1413-15-145 Report Date: 12-2-15

S-45-51 EBRO Black Mingo Creek 11-28-15 **Project Name:** Test Date(s)

Client Name: **SCDOT**

955 Park Street, Room 406: Columbia, SC 29201 Client Address:

Sample Date: 11-25-15 Boring #: STB-1 Sample #: SS-5

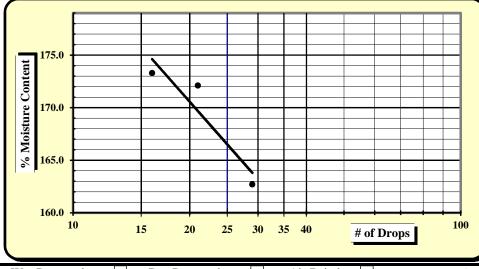
Location: n/a Offset: n/a Depth 9-10.5 FT

Sample Description: very dark gray, orgnaic laden silty SAND (SM)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	6976	7/22/2015	Grooving tool	10473	7/28/2015
I I Apparatus	6238	7/28/2015	Grooving tool		

13796 Oven 7/28/2015 Grooving tool

Oven	772072012 G1007Mg to01									
Pan #			Liquid Limit					Plastic Limit		
	Tare #:	1	2	3	4	5	6	7	8	9
A	Tare Weight	21.31	20.73	14.50				21.18	22.15	
В	Wet Soil Weight + A	37.78	35.37	28.33				25.35	25.89	
С	Dry Soil Weight + A	27.58	26.11	19.56				23.41	24.17	
D	Water Weight (B-C)	10.20	9.26	8.77				1.94	1.72	
Е	Dry Soil Weight (C-A)	6.27	5.38	5.06				2.23	2.02	
\mathbf{F}	% Moisture (D/E)*100	162.7%	172.1%	173.3%				87.0%	85.1%	
N	# OF DROPS	29	21	16						
LL	$LL = \mathbf{F} * FACTOR$									
Ave.	Average								86.1%	



	One Point I	iquid Limit	
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic Liquid Limit 167 Plastic Limit 86 Plastic Index 81 Group Symbol **MH** Multipoint Method ✓

One-point Method

Estimate the % Retained on the #40 Sieve: Wet Preparation **Dry Preparation** Air Dried

Notes / Deviations / References: Note and deviations from the test method are recorded.

> Kim Gonzalez Technician Name

Telford Wood Date

Technical Responsibility

Date



Revision No. 0 **Liquid Limit, Plastic Limit, and Plastic Index** Revision Date: 11/20/07

Another code ASTM D 4318 AASHTO T 89 AASHTO T 90 Quality Assurance S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464 Project #: 1413-15-145 Report Date: 12-2-15 S-45-51 EBRO Black Mingo Creek 11-28-15 Project Name: Test Date(s) Client Name: **SCDOT** 955 Park Street, Room 406: Columbia, SC 29201 Client Address: Sample Date: 11-25-15 Boring #: STB-1 Sample #: SS-16 Offset: n/a Location: n/a Depth 63.5-65 FT Sample Description: very dark gray, sandy CLAY (CL, A-6) Type and Specification S&ME ID # Cal Date: Type and Specification S&ME ID # Cal Date: Balance (0.01 g) 7/22/2015 Grooving tool 10473 7/28/2015 6976 LL Apparatus 6238 7/28/2015 Grooving tool 7/28/2015 Oven 13796 Grooving tool Liquid Limit Pan # Plastic Limit 2 Tare #: 1 3 4 5 6 7 8 9 Tare Weight 21.17 20.97 21.11 Α В Wet Soil Weight + A 50.93 26.25 26.42 25.22 \mathbf{C} Dry Soil Weight + A 42.59 25.44 D Water Weight (B-C) 8.34 0.98 1.03 E Dry Soil Weight (C-A) 21.42 4.25 4.33 F % Moisture (D/E)*100 38.9% 24.2% 22.6% N # OF DROPS 25 LL $LL = \mathbf{F} * FACTOR$ Ave. 23.4% Average One Point Liquid Limit 40.0 Factor Ν Factor N 20 0.974 26 1.005 21 0.979 27 1.009 % Moisture Content 22 0.985 28 1.014 0.99 1.018 23 29 24 0.995 1.022 35.0 25 1.000 NP. Non-Plastic Liquid Limit 39 Plastic Limit 23 Plastic Index **16** 30.0 Group Symbol CL 100 15 20 25 30 35 40 # of Drops Multipoint Method One-point Method ✓ Estimate the % Retained on the #40 Sieve: Wet Preparation **Dry Preparation** Air Dried Notes / Deviations / References: Note and deviations from the test method are recorded. Kim Gonzalez Telford Wood Technician Name Technical Responsibility Date Date

state #



Revision No. 0

Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464

Project #: 1413-15-145 Report Date: 12-2-15

Project Name: S-45-51 EBRO Black Mingo Creek Test Date(s) 11-28-15

Client Name: SCDOT

Client Address: 955 Park Street, Room 406: Columbia, SC 29201

Boring #: STB-4 Sample #: SS-4 Sample Date: 11-25-15

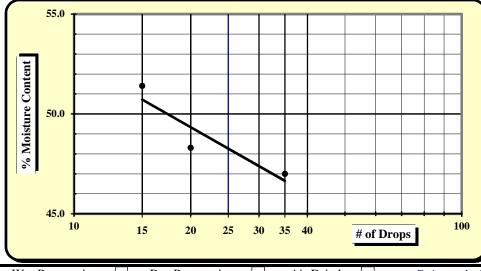
Location: n/a Offset: n/a Depth 7-8.5 FT

Sample Description: reddish yellow and strong brown, clayey SAND (SC, A-2-7)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:	
Balance (0.01 g)	6976	7/22/2015	Grooving tool	10473	7/28/2015	
LL Apparatus	6238	7/28/2015	Grooving tool			Ī

Oven 13796 7/28/2015 Grooving tool

Oven	77 13770 7720/2013 G100 VIIIg tool									
Pan #	!		Liquid Limit					Plastic Limit		
	Tare #:	1	2	3	4	5	6	7	8	9
A	Tare Weight	21.27	21.48	21.95				14.66	14.36	
В	Wet Soil Weight + A	43.92	44.51	46.32				19.90	18.15	
С	Dry Soil Weight + A	36.68	37.01	38.05				18.93	17.42	
D	Water Weight (B-C)	7.24	7.50	8.27				0.97	0.73	
Е	Dry Soil Weight (C-A)	15.41	15.53	16.10				4.27	3.06	
\mathbf{F}	% Moisture (D/E)*100	47.0%	48.3%	51.4%				22.7%	23.9%	
N	# OF DROPS	35	20	15						
LL	$LL = \mathbf{F} * FACTOR$									
Ave.	Average								23.3%	



One Point Liquid Limit									
N	Factor	N	Factor						
20	0.974	26	1.005						
21	0.979	27	1.009						
22	0.985	28	1.014						
23	0.99	29	1.018						
24	0.995	30	1.022						
25	1.000								

NP, Non-Plastic
Liquid Limit
48
Plastic Limit
23
Plastic Index
CL
Multipoint Method

One-point Method

Wet Preparation ✓ Dry Preparation ☐ Air Dried ☐ Estimate the % Retained on the #40 Sieve: 109

Notes / Deviations / References: Note and deviations from the test method are recorded.

Kim Gonzalez
Technician Name

<u>Telford Wood</u>

Date Technical Responsibility

Date

state #



Revision No. 0 **Liquid Limit, Plastic Limit, and Plastic Index**

Revision Date: 11/20/07 Another code ASTM D 4318 AASHTO T 89 AASHTO T 90 Quality Assurance S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464 Project #: 1413-15-145 Report Date: 12-2-15 S-45-51 EBRO Black Mingo Creek 11-28-15 Project Name: Test Date(s) Client Name: **SCDOT** 955 Park Street, Room 406: Columbia, SC 29201 Client Address: Boring #: STB-4 Sample #: SS-5 Sample Date: 11-25-15 Location: n/a Offset: n/a Depth 9.5-10 FT Sample Description: very dark gray, organic laden silty SAND (SM, A-2-7) Type and Specification S&ME ID # Cal Date: Type and Specification S&ME ID # Cal Date: Balance (0.01 g) 7/22/2015 Grooving tool 10473 7/28/2015 6976 LL Apparatus 6238 7/28/2015 Grooving tool 7/28/2015 Oven 13796 Grooving tool Pan # Liquid Limit Plastic Limit 2 Tare #: 1 3 5 6 7 8 9 Tare Weight 22.46 21.06 21.12 20.91 21.25 Α В Wet Soil Weight + A 39.37 44.85 43.81 25.63 25.19 \mathbf{C} Dry Soil Weight + A 30.96 33.11 32.41 24.19 23.85 D Water Weight (B-C) 8.41 11.74 11.40 1.44 1.34 E 12.05 11.29 2.94 Dry Soil Weight (C-A) 8.50 2.94 F % Moisture (D/E)*100 98.9% 97.4% 101.0% 49.0% 45.6% N # OF DROPS 25 34 16 LL $LL = \mathbf{F} * FACTOR$ Ave. 47.3% Average One Point Liquid Limit 105.0 Factor Factor N 20 0.974 26 1.005 21 0.979 27 1.009 % Moisture Content 22 0.985 28 1.014 0.99 1.018 23 29 24 0.995 1.022 30 100.0 25 1.000 NP. Non-Plastic Liquid Limit 99 Plastic Limit 47 Plastic Index 95.0 **MH** Group Symbol 100 15 20 25 30 35 40 # of Drops Multipoint Method ✓ One-point Method Estimate the % Retained on the #40 Sieve: Wet Preparation **Dry Preparation** Air Dried Notes / Deviations / References: Note and deviations from the test method are recorded. Kim Gonzalez Telford Wood Technician Name Technical Responsibility Date Date



Revision No. 0 Liquid Limit, Plastic Limit, and Plastic Index

Revision Date: 11/20/07

S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464

Project #: 1413-15-145 Report Date: 12-2-15

Project Name: S-45-51 EBRO Black Mingo Creek Test Date(s) 11-28-15

Client Name: SCDOT

Client Address: 955 Park Street, Room 406: Columbia, SC 29201

Boring #: STB-4 Sample #: SS-16 Sample Date: 11-25-15

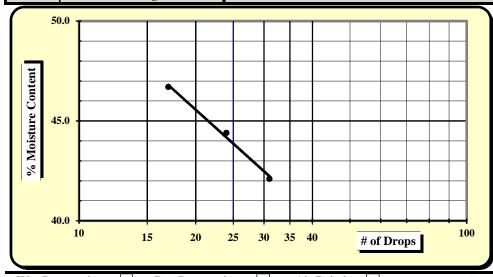
Location: n/a Offset: n/a Depth 63.5-65 FT

Sample Description: dark greenish gray, sandy CLAY (CL, A-7-6)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	6976	7/22/2015	Grooving tool	10473	7/28/2015
LL Apparatus	6238	7/28/2015	Grooving tool		

Oven 13796 7/28/2015 Grooving tool

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	1	2	3	4	5	6	7	8	9
A	Tare Weight	21.16	22.82	22.68				14.46	14.99	
В	Wet Soil Weight + A	42.03	46.32	44.86				17.85	16.84	
C	Dry Soil Weight + A	35.85	39.09	37.80				17.29	16.54	
D	Water Weight (B-C)	6.18	7.23	7.06				0.56	0.30	
Е	Dry Soil Weight (C-A)	14.69	16.27	15.12				2.83	1.55	
F	% Moisture (D/E)*100	42.1%	44.4%	46.7%				19.8%	19.4%	
N	# OF DROPS	31	24	17						
LL	$LL = \mathbf{F} * FACTOR$									
Ave.	Average								19.6%	



	One Point I	iquid Limit	
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic

Liquid Limit
44

Plastic Limit
20

Plastic Index
24

Group Symbol
CL

Multipoint Method
One-point Method

Notes / Deviations / References: Note and deviations from the test method are recorded.

Kim Gonzalez Telford Wood

Technician Name Date Technical Responsibility

Date

state #



Revision No. 0

Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

Another code ASTM D 4318 AASHTO T 89 AASHTO T 90 Quality Assurance

S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464

Project #: 1413-15-145 Report Date: 12-2-15

S-45-51 EBRO Black Mingo Creek 11-28-15 Project Name: Test Date(s)

Client Name: **SCDOT**

955 Park Street, Room 406: Columbia, SC 29201 Client Address:

Sample Date: 11-25-15 Boring #: STB-4 Sample #: SS-21

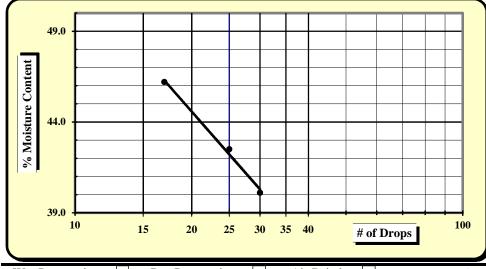
Location: n/a Offset: n/a Depth 88.5-90 FT

Sample Description: dark greenish gray, sandy CLAY (CL, A-7-6)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	6976	7/22/2015	Grooving tool	10473	7/28/2015
LL Apparatus	6238	7/28/2015	Grooving tool		

Oven 13796 7/28/2015 Grooving tool

0 1011	1017	<u> </u>	172072010	0100	, ing toor					
Pan #		Liquid Limit				Plastic Limit				
	Tare #:	1	2	3	4	5	6	7	8	9
A	Tare Weight	21.45	21.06	21.24				22.64	21.77	
В	Wet Soil Weight + A	46.53	47.48	44.61				26.74	26.61	
С	Dry Soil Weight + A	39.35	39.60	37.23				26.11	25.85	
D	Water Weight (B-C)	7.18	7.88	7.38				0.63	0.76	
Е	Dry Soil Weight (C-A)	17.90	18.54	15.99				3.47	4.08	
\mathbf{F}	% Moisture (D/E)*100	40.1%	42.5%	46.2%				18.2%	18.6%	
N	# OF DROPS	30	25	17						
LL	$LL = \mathbf{F} * FACTOR$									
Ave.	Average								18.4%	



One Point Liquid Limit						
N	Factor	N	Factor			
20	0.974	26	1.005			
21	0.979	27	1.009			
22	0.985	28	1.014			
23	0.99	29	1.018			
24	0.995	30	1.022			
25	1.000					

NP, Non-Plastic Liquid Limit 43 Plastic Limit 18 Plastic Index 25 Group Symbol CL Multipoint Method ✓

One-point Method

Estimate the % Retained on the #40 Sieve: Wet Preparation **Dry Preparation** Air Dried

Notes / Deviations / References: Note and deviations from the test method are recorded.

> Kim Gonzalez Technician Name

Telford Wood Technical Responsibility

Date

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Date

Form No: TR-D1140-3

Revision No. 0

Revision Date: 10/26/07

Material Finer than the #200 Sieve



ASTM D1140 Quality Assurance

			ASIM DIT	40		Quality A	ssurance	
		S&ME, Iı	nc. Branch, B	ranch Addres	S			
Project #: 1					12-2	12-2-15		
Project Name: S	-45-51 EBRO BI	ack Mingo Cr	eek		Test Date(s):	11-2	8-15	
	CDOT							
	55 Park Street, R	oom 406: Col	umbia, SC 29					
1 /	O. Schoen			S	ample Dates:		25-15	
Sampling Method:	Split Spo	oon			Drill Rig:		E 45D	
Method;	A L B			Tare Wt. +	oaked	Soak Ti		
Sample Identification	n Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Dry Wt. after Wash	Water Wt.	Percent Moisture	% Passing #200	
Boring #, Sample #, Dept	th grams	grams	grams	grams	grams	%	%	
STB-1, SS-3, 5-6.5	5' 60.34	366.52	320.88	279.69	45.64	17.5%	15.8%	
STB-1,SS6, 13.5-1	5' 60.89	255.24	124.61	120.55	130.63	205.0%	6.4%	
STB-1, SS-7, 18.5-2	60.33	392.13	348.25	282.64	43.88	15.2%	22.8%	
STB-1,SS8,23.5-2	5' 60.62	407.04	348.25	310.43	58.79	20.4%	13.1%	
STB-1,SS12,43.5-4	60.99	401.19	317.46	253.41	83.73	32.6%	25.0%	
STB-1,SS16,63.5-6	60.29	357.29	294.11	140.73	63.18	27.0%	65.6%	
STB-4,SS-4,7-8.5	61.09	393.28	317.36	230.83	75.92	29.6%	33.8%	
STB-4,SS-5,9-10.5	5' 61.08	356.73	237.74	179.18	118.99	67.4%	33.1%	
STB-4,SS-9,28.5-3	0' 61.30	416.63	332.85	295.14	83.78	30.9%	13.9%	
STB-4,SS-12,43.5-4	45' 60.04	360.49	287.34	242.97	73.15	32.2%	19.5%	
STB-4,SS-16,63.5-0	60.72	356.42	300.98	142.14	55.44	23.1%	66.1%	
STB-4,SS-21,88.5-9	90' 62.01	364.74	307.57	170.48	57.17	23.3%	55.8%	
Balance ID. 69	076 Calibrati	on Date: 7	-21-15 #2	00 Sieve 1	0482 Cali	bration Date:	6-24-15	
Notes / Deviations / Ref	erences:							
Kim Gor	<u>ızalez</u>				Nicet 2		12/2/2015	
Technician		Sign	Signature		fication Type/No.	<u>12/2/2010</u> Date		
Telford V	Wood	Asped.	Ewood	Locati	on Coordinate	or.	12/2/2015	
Technical Resp		Signature		Locali	<u>Location Coordinator</u> Position			
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Form No: TR-D2974-1

Revision No. 0

Revision Date: 07/10/08

Moisture, Ash, and Organic Matter



ASTM D-2974

Quality Assurance

S&ME, Inc. Atlanta, 11420 Johns Creek Parkway, Duluth, GA 30097					
Project #:	1413-15-145	Report Date:	12-1-15		
Project Name:	S-45-51 EBRO Black Mingo Creek	Test Date(s):	11-28-15		
Client Name:	SC DOT				
611 + 11					

Client Address: 955 Park Street, Room 406; Columbia, SC 29201

Sample Date: 11-25-15 Boring No. STB-1 Sample No. **SS-6** Location: Offset: Depth 13.5-15' n/a n/a

very dark gray, PEAT (PT) Sample Description:

Equipment: Balance: 0.01 g.Readability, 500g. Minimum Capaccity

Balance: *S&ME ID #:* 25128 Cal. Date: 3/14/15 Due: 03/14/16

Method A: Moisture Content Determination

Required Oven Temperature: 105 + 5° C

	Oven Temperature: 105 °C	Tare #	90
t	Tare Weight (Dish plus Aluminum Foil Cover)	grams	60.74
а	Mass of As-Received Specimen + Tare Wt.	grams	186.76
b	Mass of Oven Dry Specimen + Tare Wt.	grams	107.33
w	Water Weight	(a-b)	79.43
A	Mass of As-Received Specimen	(a-t)	126.02
В	Mass of Oven Dry Specimen	(b-t)	46.59
% Mo	sisture Content as a % of As Received or Total Mass	(w/A)*100	63.0%
%	6 Moisture Content as a % of Oven-dried Mass	(w/B)*100	170.5%

Oven *S&ME ID #:* 25130 Cal. Date: 6/23/15 6/22/16 Due:

Method C (440°C) or D (750°C): Ash Content and Organic Matter Determination

	Muffle Furnace: 440 °C	Tare #	L
t	Tare Weight (Dish plus Aluminum Foil Cover)	grams	80.42
b	Mass of Oven Dry Specimen + Tare Wt.	grams	124.03
С	Ash Weight + Tare Wt.	grams	112.58
С	Ash Weight	c-t	32.16
В	Mass of Oven Dry Specimen	(b-t)	43.61
D	% Ash Content	(C/B)*100	73.7%
	% Organic Matter	100-D	26.3%

S&ME ID #: 9/15/2015 Muffle Furnace: 26317 Cal. Date:

Notes / Deviations / References:

Kim Gonzalez

Technician Name

Technical Responsibility

Signature

Nicet 2 Level/Certification

Telford Wood

Location Coordinator

12/1/2015 Date