

GEOTECHNICAL DATA SUMMARY REPORT

**I-85 SBL REPLACEMENT BRIDGE OVER NORFOLK SOUTHERN RAILROAD  
CHEROKEE COUNTY, SOUTH CAROLINA  
S&ME PROJECT NO. 1261-10-391**

Prepared For:

STV/Ralph Whitehead Associates  
4975 Lacross Road Suite 314  
North Charleston, South Carolina 29406-6531

Prepared by:



301 Zima Park Drive  
Spartanburg, South Carolina 29301

March 8, 2011



March 8, 2011

STV/Ralph Whitehead Associates  
4975 Lacross Road Suite 314  
North Charleston, South Carolina 29406-6531

Attention: Mr. Dan Moses, P.E.

Reference: **GEOTECHNICAL DATA SUMMARY REPORT**  
I-85 SBL Replacement Bridge Over Norfolk Southern Railroad  
Cherokee County, South Carolina  
S&ME Project No. 1261-10-391

Dear Mr. Moses:

The purpose of this report is to provide preliminary geotechnical information to the design team. The information contained in this report pertains to design of the proposed replacement bridge. Our services are being performed in general accordance with the Subcontract for Professional Services between STV/Ralph Whitehead Associates (STV) and S&ME, Inc. for this project dated December 16, 2010 and executed on February 24, 2011.

As requested, representatives of S&ME, Inc. were present at the above referenced site between September 28 and October 14, 2010 to conduct two standard penetration test (SPT) borings (B-1 and B-2). Also shear wave velocity measurements were obtained near each end bent location using both Multi-channel Analysis of Surface Waves (MASW) methods. Borings were conducted at each end bent within the travel lanes of southbound I-85. Closure of one lane of I-85 was required to perform the field exploration.

Boring locations established laid out in the field by measuring from the existing bridge and surveyed by a licensed Surveyor employed by S&ME. Stationing and elevations were referenced from the provided information. The actual boring coordinates, stationing and elevations are shown on the *Location, Elevation Survey for S&ME, Inc.* prepared by Freeland – Clinkscales & Associates of NC, Inc.

Approximate boring locations are shown on Figure 1 – *Boring Location Plan*, while the MASE sounding locations are shown on Figure 2 – *MASW Test Location Plan*. A summary of the borings and soundings is presented in Table 1.

**Table 1 – Test Borings and Soundings**

BORING ID	DEPTH	STATION	OFFSET	TYPE	NOTE
B-1	121	2182+63.66	10.46L	SPT	WEST END BENT
B-2	100	2185+22.53	9.57R	SPT	EAST END BENT
SW-1	n/a	n/a	n/a	MASW	SOUTH
SW-2	n/a	n/a	n/a	MASW	WEST
SW-3	n/a	n/a	n/a	MASW	NORTH
SW-4	n/a	n/a	n/a	MASW	EAST

Soil sampling and penetration testing were performed in general accordance with ASTM D1586, “*Standard Test Method for Penetration Test and Split Barrel Sampling of Soils*” using rotary wash boring methods described in the Appendix and as noted on the boring logs. Bridge borings were extended to depths of 100 and 121 feet below the ground surface (bgs). Borings were drilled through the existing roadway surface. The borings were backfilled with bentonite pellets and patched with asphalt cold patch.

Ground water measurements were not attempted following termination of drilling because of the rotary wash drilling methods used. Because of the traffic and backfill requirements, stabilized ground water levels were not obtainable.

SPT hammer energy measurements were previously obtained with a Pile Driving Analyzer (PDA) on the CME 750 and Diedrich D50 drill rigs used to perform the borings on this project. The energy measurements were obtained on May 7, 2010 and November 4, 2010, respectively, with the same operators and helpers.

Soils were classified in general accordance with ASTM D 2488. Details of the subsurface conditions encountered by the SPT borings are shown on the preliminary logs and generalized subsurface profile (Figure 3 – *Generalize Subsurface Profile*) in the Appendix. These logs represent our interpretation of the subsurface conditions based on the test data. Stratification lines on the boring logs represent approximate boundaries between soil types; however, the actual transition may be gradual and the thicknesses of the strata will vary across the site. The soil samples will be retained at our laboratory until SCDOT requests them, until completion the new bridge, or 365 days after drilling, which ever is least.

Shear wave velocities were measured at the site using MASW methods (Multi-Channel Analysis of Surface Waves). Because of space limitation, traverse lines were north, south, east and west of the existing bridge structure. The testing was conducted using a 24-channel GeoMetrics Geode seismograph and the test data reduced using the OYO Corporation SeisImager software. The results of the active and passive sources were combined to produce a single shear wave velocity profile at each location and are included in the Appendix.

We performed nine Atterberg limits, grain size analysis and natural moisture contents to help classify the soils. Testing was performed in general accordance with ASTM and/or AASHTO test procedures. Results of the laboratory testing are included on the *Summary of Laboratory Test Data* and individual test data sheets in the Appendix.

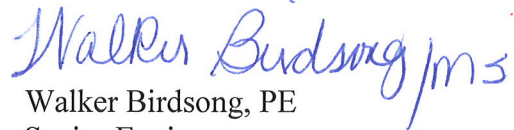
Environmental assessment of soils, water, wetland and endangered species was not included in our scope of services for this project. The boring log and sounding information are intended for SCDOT's engineering interpretation of the data collected.

S&ME appreciates this opportunity to work with STV/Ralph Whitehead as your local geotechnical consultant on this project. If you have any questions or need further information in regard to this letter, please do not hesitate to contact us at 864-547-2360.

Sincerely,  
**S&ME, Inc.**



Michael Revis, PE  
Senior Engineer  
[mrevis@smeinc.com](mailto:mrevis@smeinc.com)



Walker Birdsong, PE  
Senior Engineer  
[wbirdsong@smeinc.com](mailto:wbirdsong@smeinc.com)

# **APPENDIX I**

**Figure 1 - Boring Location Plan**

**Figure 2 – MASW Test Location Plan**

**Figure 3 – Generalized Subsurface Profile**

**Legend to Soil Classification and Symbols**

**Boring Logs**

**Field Testing Procedures**

**MASW Sounding Data**

**Summary of Laboratory Test Data**

**Laboratory Test Data Sheets**





LEGEND

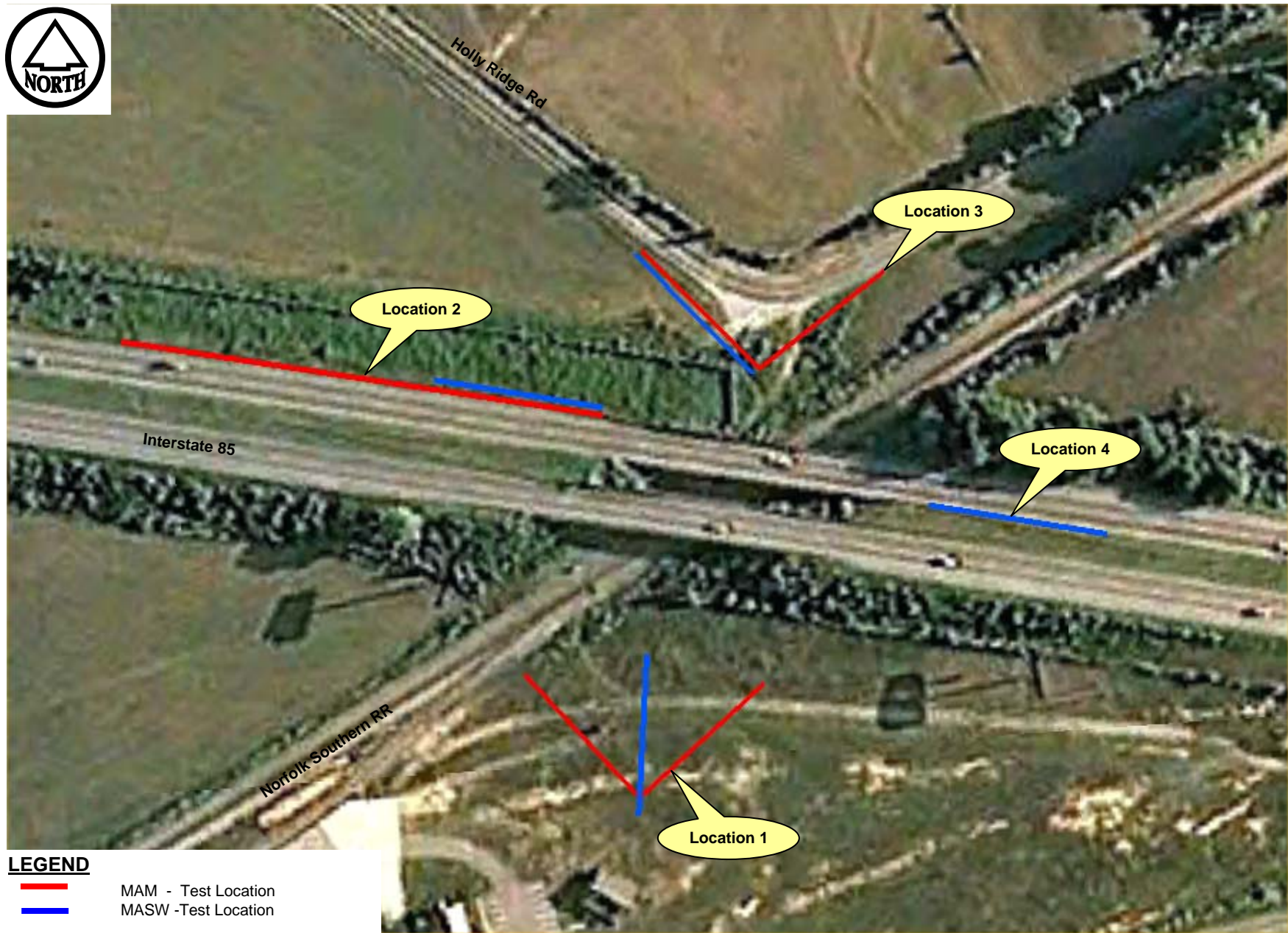
 APPROXIMATE SOIL TEST BORING LOCATION

SOURCE:

2007 CHEROKEE COUNTY AERIAL.

DRAWN BY: <b>MGR</b>		CHK'D BY: <b>DAS</b>	SCALE:  1"= 60' 	 <div><div>S&amp;ME, Inc.</div><div>281 FAIRFOREST WAY, GREENVILLE, SC 29607</div><div>301 ZIMA PARK DRIVE, SPARTANBURG, SC 29301</div><div>NC PE FIRM LICENSE NO. F-0776</div></div> <div><div>864.232.8987 Greenville</div><div>864.574.2360 Spartanburg</div><div>864.576.8730 Fax</div><div><a href="http://www.smeinc.com">www.smeinc.com</a></div></div>	BORING LOCATION PLAN <b>I-85 OVERPASS OVER NORFOLK SOUTHERN RR</b> CHEROKEE COUNTY, SOUTH CAROLINA	FIGURE NO. <b>1</b>
PROJECT NO.: <b>1261-10-391</b>		DATE: <b>7-30-10</b>				





#### LEGEND



MAM - Test Location



MASW - Test Location

SCALE: NTS

DRAWN BY: JBC

CHECKED BY:

DATE: 3-1-11

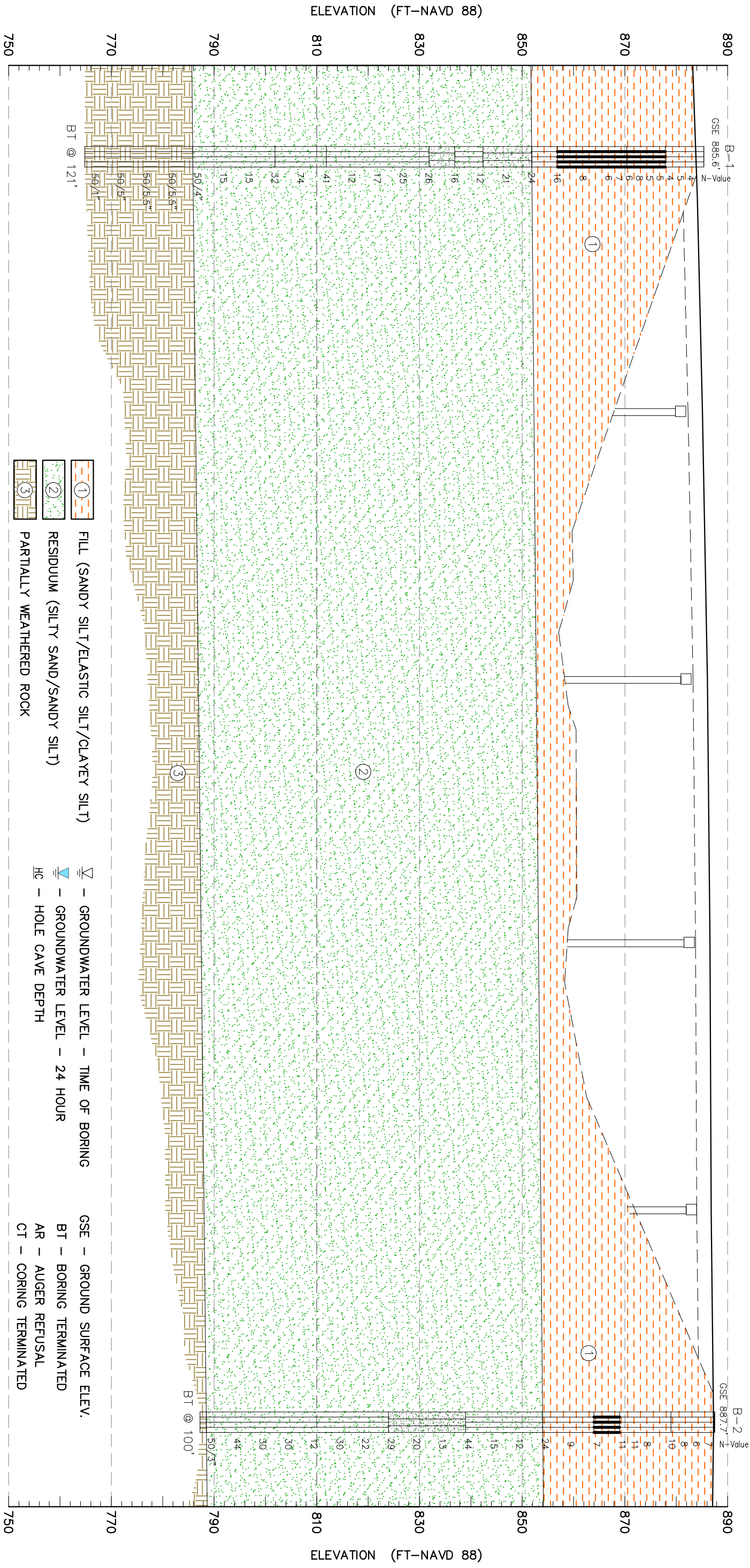


### MASW TEST LOCATION PLAN I-85 OVERPASS OVER NORFOLK SOUTHERN RR CHEROKEE COUNTY, SOUTH CAROLINA

PROJECT NO.: 1261-10-391

FIGURE NO.

2



- NOTES
1. N = STANDARD PENETRATION TEST RESISTANCE VALUE (BLOWS PER FOOT)
  2. THE DEPICTED STRATIGRAPHY IS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY
  3. THE ACTUAL SUBSURFACE CONDITIONS WILL VARY BETWEEN BORING LOCATIONS

DRAWN BY:	CHK'D BY:	SCALE:
MGR	DAS	1"= 10' (Vertical) 1"= 50' (Horizontal)
PROJECT NO.:	DATE:	
1261-10-391	3-1-11	



S&ME, Inc.  
ONE MARCUS DRIVE, SUITE 301, GREENVILLE, SC 29615  
301 ZIMA PARK DRIVE, SPARTANBURG, SC 29301  
NC PE FIRM LICENSE NO. F-0176

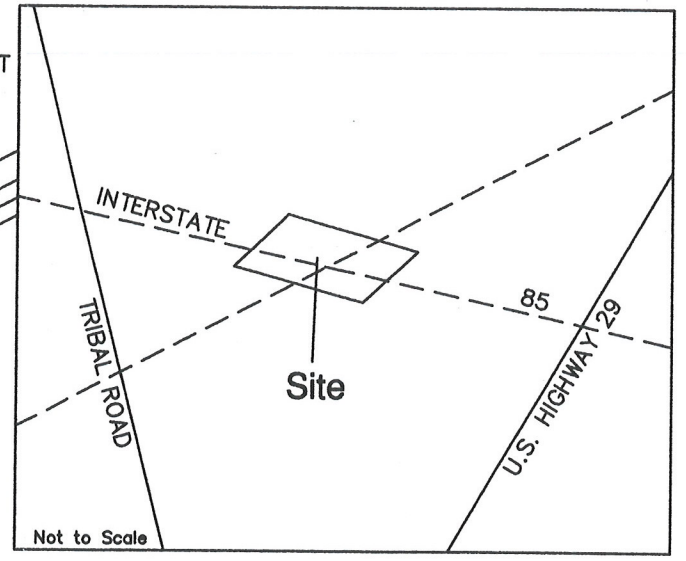
864.232.8987 Greenville  
864.574.2360 Spartanburg  
864.576.8730 Fax  
[www.smeinc.com](http://www.smeinc.com)

GENERALIZED SUBSURFACE PROFILE	FIGURE NO.
I-85 OVERPASS OVER NORFOLK SOUTHERN RR CHEROKEE COUNTY, SOUTH CAROLINA	3

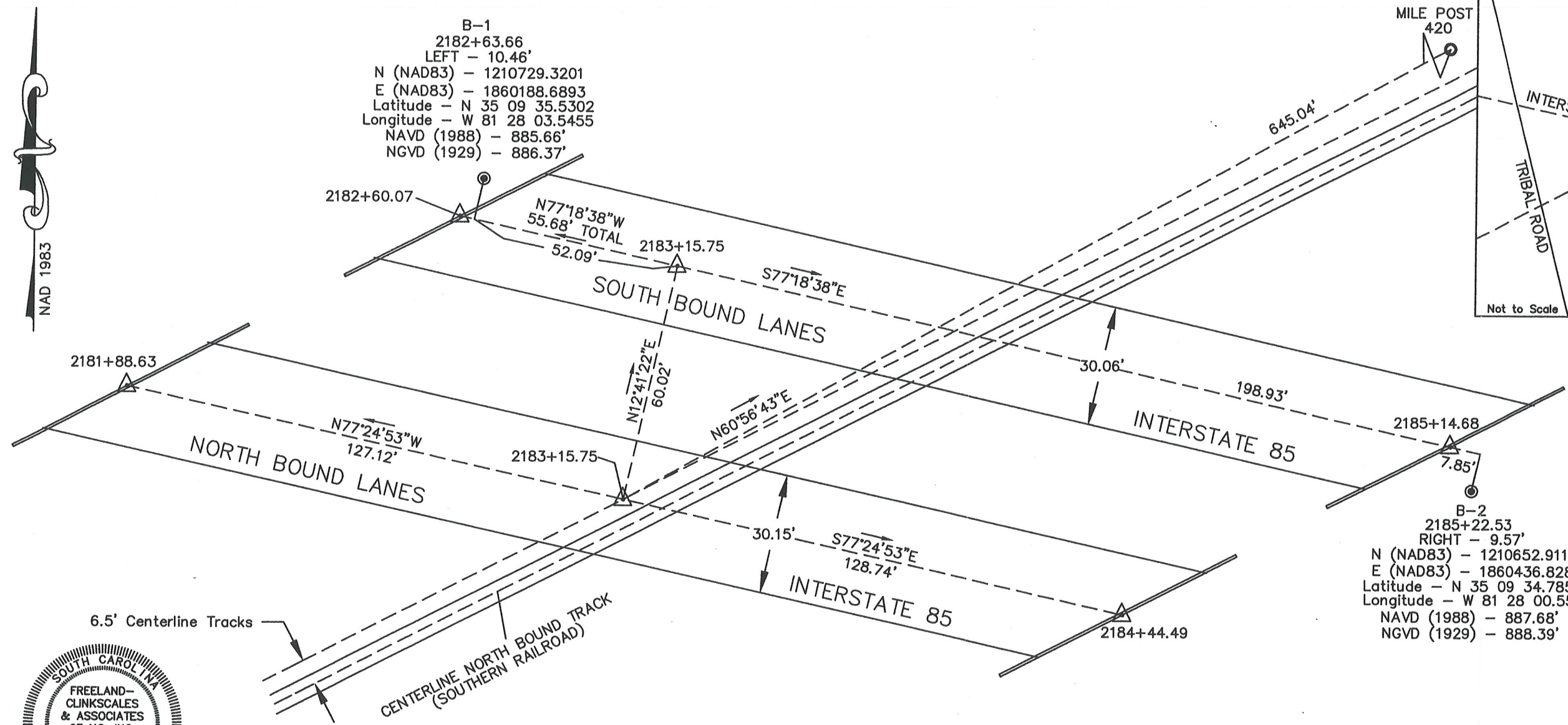


B-1  
 2182+63.66  
 LEFT - 10.46'  
 N (NAD83) - 1210729.3201  
 E (NAD83) - 1860188.6893  
 Latitude - N 35 09 35.5302  
 Longitude - W 81 28 03.5455  
 NAVD (1988) - 885.66'  
 NGVD (1929) - 886.37'

MILE POST  
 420



LOCATION MAP



B-2  
 2185+22.53  
 RIGHT - 9.57'  
 N (NAD83) - 1210652.9117  
 E (NAD83) - 1860436.8281  
 Latitude - N 35 09 34.7857  
 Longitude - W 81 28 00.5533  
 NAVD (1988) - 887.68'  
 NGVD (1929) - 888.39'

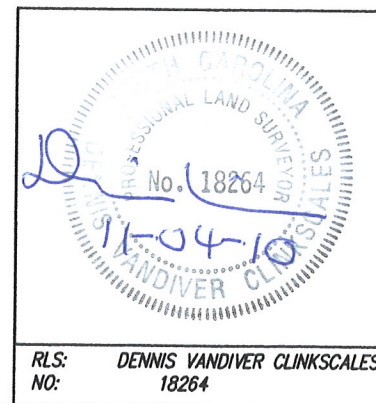
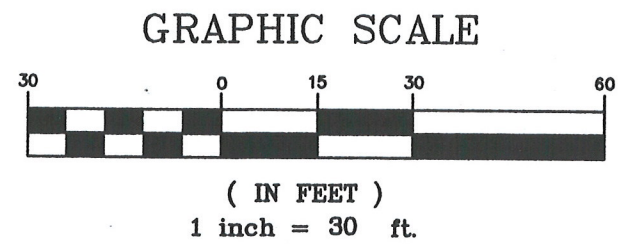


NOTE:

- (1) STATION WAS OBTAINED BY USING SCDOT PLAN DOCKET #: 11.340 ROUTE NUMBER 29 SHEET #: 8 OF 16 DATED: FEBURARY 1957.
- (2) THREE OPUS POINTS WERE PERFORMED ON SITE BY USING TOPCON GPS UNITS ON SITE TO OBTAIN STATE PLANE COORDINATES, LATITUDE AND LONGITUDE AND ELEVATION ABOVE SEA ON MONDAY OCTOBER 4, 2010.

I HEREBY STATE TO THE BEST OF MY PROFESSIONAL KNOWLEDGE, INFORMATION, AND BELIEF, THE SURVEY SHOWN HEREON WAS IN ACCORDANCE WITH THE REQUIREMENTS OF THE STANDARDS PRACTICE MANUAL FOR SURVEYING IN SOUTH CAROLINA, AND AND MEETS OR EXCEEDS THE REQUIREMENTS FOR CLASS "A" AS SPECIFIED THEREIN.

LEGEND		
○	IPF	IRON PIN FOUND
○	IPS	IRON PIN SET
☆		SATELLITE DISH
PT		CALCULATED POINT
⊗	FH	FIRE HYDRANT
□		POWER BOX
■	CI	CURB INLET
⊙	SSMH	SANITARY SEWER MANHOLE
-X-		FENCE LINE
-OE-		OVERHEAD ELECTRIC
-STD-		STORM DRAIN LINE
-SS-		SANITARY SEWER LINE



STATE OF SOUTH CAROLINA  
 CHEROKEE COUNTY

LOCATION, ELEVATION SURVEY  
 FOR

S&ME, INC.

LAST BRIDGE OVER RAILROAD ON I-85  
 BETWEEN MILE MARKER 107 & 108

FREELAND - CLINKSCALES  
 & ASSOCIATES OF NC, INC.  
 ENGINEERS \* LAND SURVEYORS  
 440 SAINT ANDREWS STREET  
 SPARTANBURG, SC 29302  
 (864)- 542-1540  
 (864)- 271-1111 (GREENVILLE)

REF. PLAT BOOK	
REF. DEED BOOK	
TM#	
PARTY CHIEF	DVC
DRAWN	DVC
DATE	11-04-10
DWG. NO.	S10100

# LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

## SOIL TYPES

(Shown in Graphic Log)



Fill



Asphalt



Concrete



Topsoil



Gravel



Sand



Silt



Clay



Organic



Silty Sand



Clayey Sand



Sandy Silt



Clayey Silt



Sandy Clay



Silty Clay



Partially Weathered Rock



Cored Rock

## WATER LEVELS

(Shown in Water Level Column)



= Water Level At Termination of Boring



= Water Level Taken After 24 Hours



= Loss of Drilling Water

HC = Hole Cave

## CONSISTENCY OF COHESIVE SOILS

### CONSISTENCY

Very Soft

Soft

Firm

Stiff

Very Stiff

Hard

Very Hard

### STD. PENETRATION RESISTANCE BLOWS/FOOT

0 to 2

3 to 4

5 to 8

9 to 15

16 to 30

31 to 50

Over 50

## RELATIVE DENSITY OF COHESIONLESS SOILS

### RELATIVE DENSITY

Very Loose

Loose

Medium Dense

Dense

Very Dense

### STD. PENETRATION RESISTANCE BLOWS/FOOT

0 to 4

5 to 10

11 to 30

31 to 50

Over 50

## SAMPLER TYPES

(Shown in Samples Column)



Shelby Tube



Split Spoon



Rock Core



No Recovery

## TERMS

**Standard Penetration Resistance** - The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586.

**REC** - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

**RQD** - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%.





# SCDOT Soil Test Boring Log

<b>File No.:</b>	N/A	<b>Project No. (PIN):</b>	1261-10-391	<b>County:</b>	Cherokee	<b>Eng./Geo.:</b>	T. Ford
<b>Site Description:</b>	I-85 Replacement Bridge over Norfolk Southern Railroad					<b>Route:</b>	I-85
<b>Boring No.:</b>	B-1	<b>Boring Location:</b>	2182+63.66	<b>Offset:</b>	10.46L	<b>Alignment:</b>	
<b>Elev.:</b>	885.7 ft	<b>Latitude:</b>	35.159869	<b>Longitude:</b>	81.46765	<b>Date Started:</b>	9/28/10
<b>Total Depth:</b>	121 ft	<b>Soil Depth:</b>	121 ft	<b>Core Depth:</b>	ft	<b>Date Completed:</b>	10/12/2010
<b>Bore Hole Diameter (in):</b>		<b>Sampler Configuration</b>		<b>Liner Required:</b>	Y (N)	<b>Liner Used:</b>	Y (N)
<b>Drill Machine:</b>	CME-750	<b>Drill Method:</b>	RW	<b>Hammer Type:</b>	Automatic	<b>Energy Ratio:</b>	
<b>Core Size:</b>	N/A	<b>Driller:</b>	T. Ford	<b>Groundwater:</b>	TOB	<b>24HR</b>	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ●
	0.0									PL X MC O LL X ▲ FINES CONTENT (%)
880.7	1.0	Asphalt (6 inches) and Crushed Stone (6 inches)		1.0	SS-1	6	2	2	4	●
	3.5			3.5	SS-2	2	2	3	5	●
875.7	7.5	FILL: SANDY SILT (ML) soft to firm, brown-orange, trace roots and sand [dry]		6.0	SS-3	3	2	2	4	●
	8.5			8.5	SS-4	1	2	3	5	●
870.7	15.0	FILL: ELASTIC SILT WITH SAND (MH) soft to firm, orange tan [dry]		10.5	SS-5	2	2	3	5	●
	13.5			13.5	SS-6	2	3	5	8	●
865.7	15.0			15.0	SS-7	2	2	4	6	●
860.7	16.5	FILL: SANDY ELASTIC SILT (MH) firm, tan-orange-brown, micaceous		16.5	SS-8	2	3	4	7	●
	18.0			18.0	SS-9	3	3	3	6	●
	23.5			23.5	SS-10	3	3	5	8	●
855.7	28.5	FILL: SANDY SILT (ML) very stiff, tan-orange-brown, micaceous [damp]		28.5	SS-11	2	5	11	16	●
850.7	33.5			33.5	SS-12	4	8	16	24	●
845.7	43.0	RESIDUUM: SILTY SAND (SM) medium dense, orange-tan, fine to coarse [damp]		38.5	SS-13	4	9	12	21	●
840.7	43.0			43.5	SS-14	5	5	7	12	●
835.7	48.5	RESIDUUM: SANDY SILT (ML) stiff, tan white [moist]		48.5	SS-15	5	7	9	16	●
830.7	53.5	RESIDUUM: SILTY SAND (SM) medium dense, brown, fine to medium [moist]		53.5	SS-16	7	11	15	26	●
825.7	53.5			58.5	SS-17	7	11	14	25	●
820.7		RESIDUUM: SANDY SILT (ML) very stiff to stiff, tan-brown [moist to wet]		63.5	SS-18	5	6	11	17	●
815.7				68.5	SS-19	WOR	4	8	12	●
810.7	73.5	RESIDUUM: SANDY SILT (ML) hard to very hard, tan gray brown [wet]		73.5	SS-20	8	17	24	41	●
805.7				78.5	SS-21	17	34	40	74	●
800.7	83.5	RESIDUUM: SANDY SILT (ML) hard to stiff, tan gray [wet]		83.5	SS-22	7	12	20	32	●
795.7				88.5	SS-23	5	7	8	15	●
790.7				93.5	SS-24	7	6	9	15	●
785.7	99.5	PARTIALLY WEATHERED ROCK: SANDY SILT (ML) very hard, tan gray white [wet]		98.5	SS-25	17	28	50/4"	50/4"	>>●
780.7				103.5	SS-26	8	16	50/5.5"	50/5.5"	>>●
775.7				108.5	SS-27	20	34	50/5.5"	50/5.5"	>>●
770.7				113.5	SS-28	27	50/5"		50/5"	>>●
765.7	121.0	Tri-Cone Termination at 121 Feet		118.5	SS-29	50/1"			50/1"	>>●

## LEGEND

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

# SCDOT Soil Test Boring Log

File No.:	N/A	Project No. (PIN):	1261-10-391	County:	Cherokee	Eng./Geo.:	T. Ford
Site Description:	I-85 Replacement Bridge over Norfolk Southern Railroad					Route:	I-85
Boring No.:	B-2	Boring Location:	2185+22.53	Offset:	9.57R	Alignment:	
Elev.:	887.7 ft	Latitude:	35.159661	Longitude:	81.466819	Date Started:	10/13/2010
Total Depth:	100 ft	Soil Depth:	100 ft	Core Depth:	ft	Date Completed:	10/14/2011
Bore Hole Diameter (in):		Sampler Configuration		Liner Required:	Y (N)	Liner Used:	Y (N)
Drill Machine:	D-50	Drill Method:	RW	Hammer Type:	Automatic	Energy Ratio:	
Core Size:	N/A	Driller:	T. Ford	Groundwater:	TOB	24HR	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ●
	0.0									PL X      MC O      LL X ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
882.7	1.1	Asphalt (7 inches) and Crushed Stone (6 inches)		1.0	SS-1	3	4	3	7	●
	3.5			3.5	SS-2	2	2	4	6	●
	6.0			6.0	SS-3	2	3	5	8	●
877.7	8.5	FILL: SILT WITH SAND (ML) firm, tan orange, with some clay and rock fragments <1" diameter [dry]		8.5	SS-4	4	4	6	10	●
	11.0			11.0	SS-5					
872.7	13.5	FILL: SANDY SILT (ML) stiff to firm, tan brown orange [dry]		13.5	SS-6	5	3	5	8	●
	16.0			16.0	SS-7	3	5	6	11	●
867.7	18.5	FILL: CLAYEY SILT (MH) stiff, brown gray, some sand, trace organics [dry]		18.5	SS-8	4	5	6	11	●
	23.5			23.5	SS-9	2	3	4	7	●
862.7		FILL: SANDY SILT (ML) firm to stiff, brown gray orange, trace organics [dry]		28.5	SS-10	3	4	5	9	●
857.7				33.5	SS-11	7	9	15	24	●
852.7		RESIDUUM: SANDY SILT (ML) very stiff to stiff, purple brown tan, trace mica [dry]		38.5	SS-12	6	5	7	12	●
847.7				43.5	SS-13	7	6	9	15	●
842.7				48.5	SS-14	13	22	22	44	●
837.7		RESIDUUM: SILTY SAND (SM) Dense to medium dense, tan orange, fine to coarse [dry]		53.5	SS-15	12	9	7	13	●
832.7				58.5	SS-16	13	9	11	20	●
827.7				63.5	SS-17	7	11	18	29	●
822.7		RESIDUUM: SANDY SILT (ML) Stiff to hard, white gray tan [damp to wet]		68.5	SS-18	8	10	12	22	●
817.7				73.5	SS-19	5	13	17	30	●
812.7				78.5	SS-20	4	4	8	12	●
807.7				83.5	SS-21	10	17	13	30	●
802.7				88.5	SS-22	7	10	20	30	●
797.7				93.5	SS-23	10	13	31	44	●
792.7				98.5	SS-24	47	50/3"	50/3"	>>	●
787.7	99.0	PARTIALLY WEATHERED ROCK: SANDY SILT (ML) very hard, gray tan [wet]								
782.7	100.0	Tri-Cone Termination at 100 Feet								

## LEGEND

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



## FIELD TESTING PROCEDURES

### SOIL TEST BORINGS

All borings and sampling were conducted in accordance with ASTM D-1586-99 test method. Initially, the borings were advanced by either mechanically augering or wash boring through the overburden soils. When necessary, a heavy drilling fluid is used below the water table to stabilize the sides and bottom of the borehole. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel or split-spoon 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 as the "Standard Penetration Resistance" or N-value. The penetration resistance, when properly evaluated, can be correlated to consistency, relative density, strength and compressibility of the sampled soils.

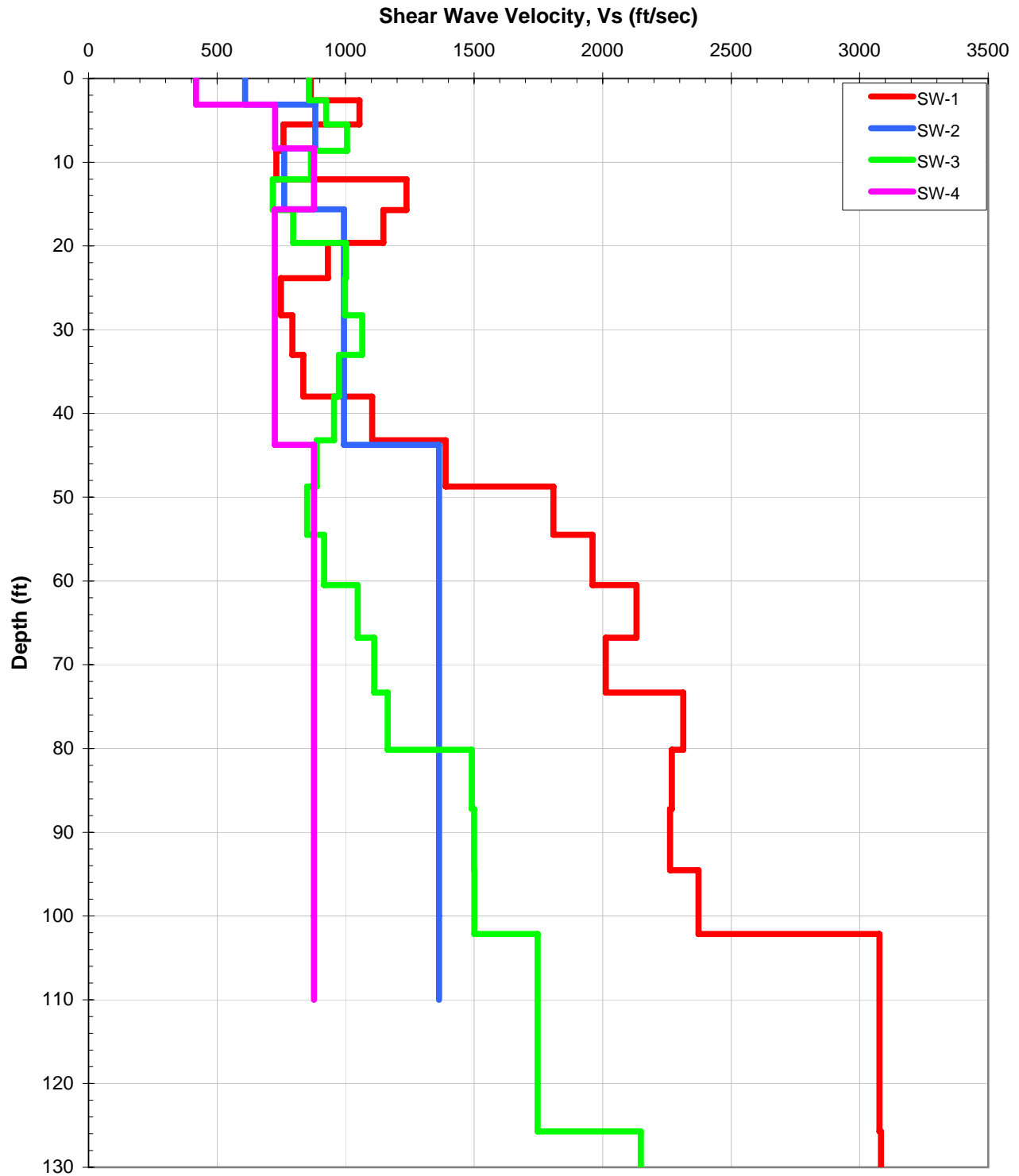
### WATER LEVEL READINGS

Water level readings are normally taken in conjunction with borings and are recorded on the Boring Logs following termination of drilling (designated by  $\nabla$  ) and at a period of 24 hours following termination of drilling (designated by  $\nabla$  ). These readings indicate the approximate location of the hydrostatic water table at the time of our field exploration. The groundwater table may be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should also be expected with variations in surface run-off, evaporation, construction activity and other factors.

Occasionally the boreholes sides will cave, preventing the water level readings from being obtained or trapping drilling water above the cave-in zone. In these instances, the hole cave-in depth (designated by HC) is measured and recorded on the Boring Logs. Water level readings taken during the field operations do not provide information on the long-term fluctuations of the water table. When this information is required, piezometers are installed to prevent the boreholes from caving.



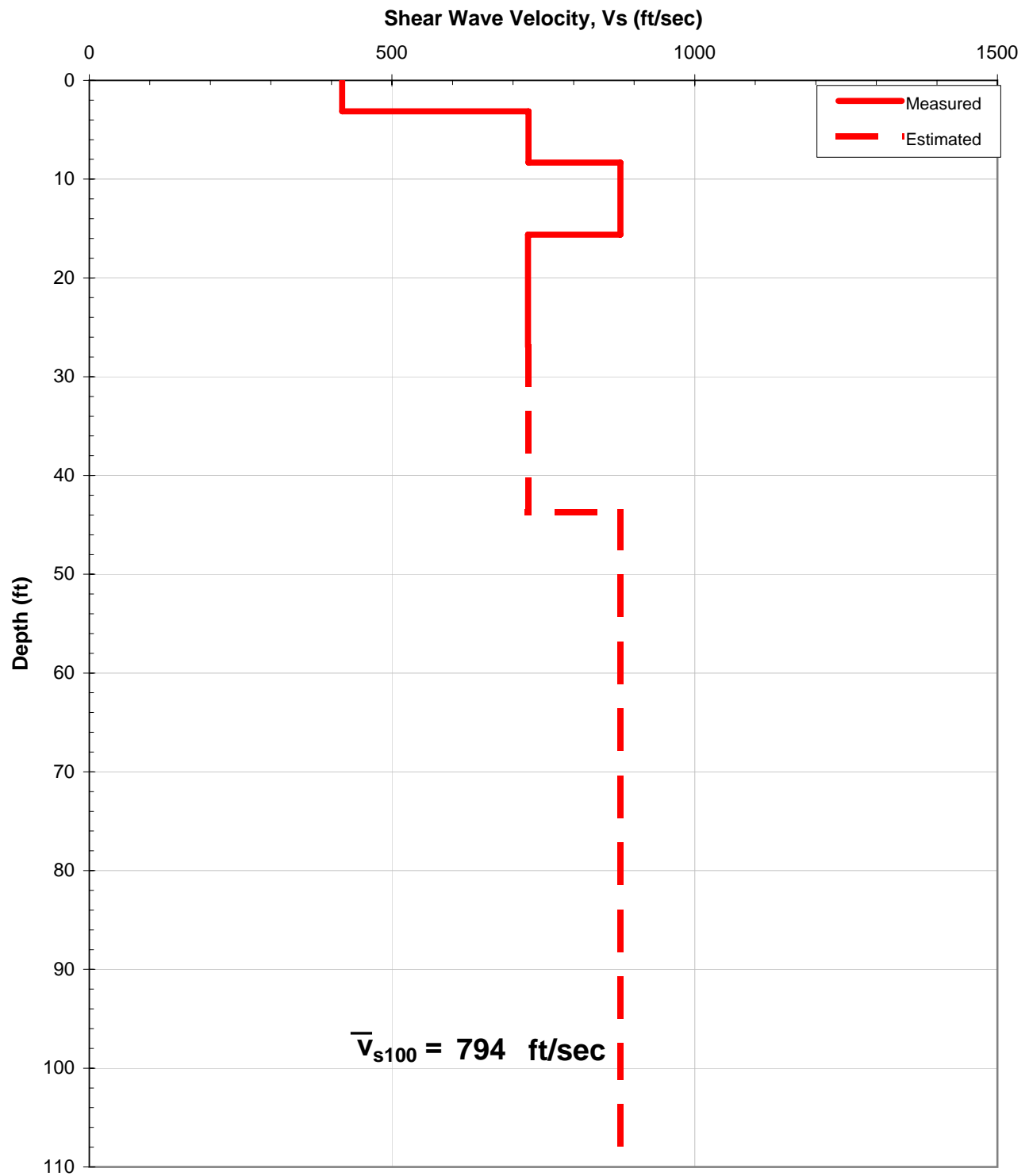
Shear Wave Velocity Profiles  
I-85 RBO Norfolk Southern RR  
Gaffney, South Carolina  
1261-10-391





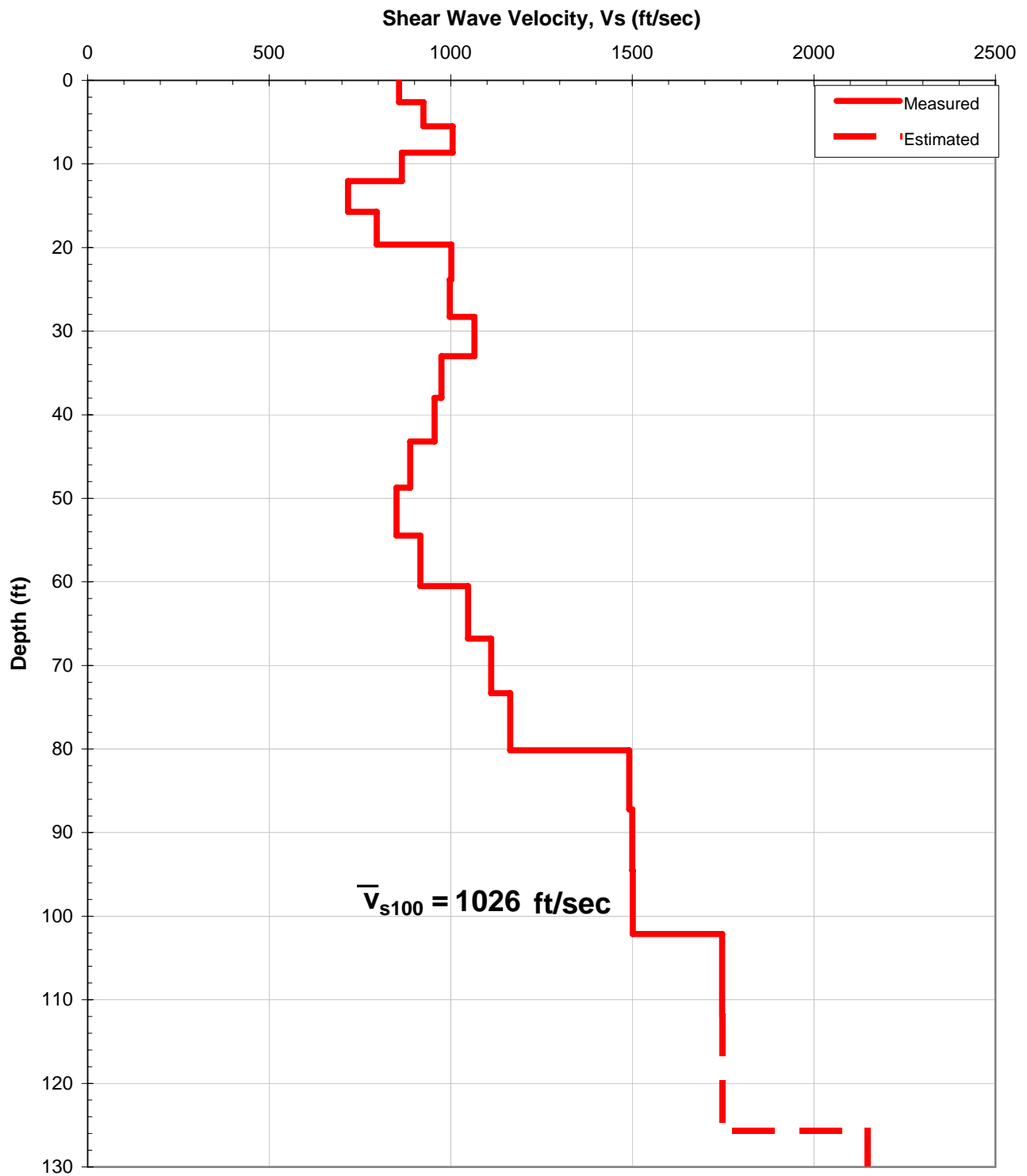


Shear Wave Velocity Profile SW-4  
I-85 RBO Norfolk Southern RR  
Gaffney, South Carolina  
1261-10-391



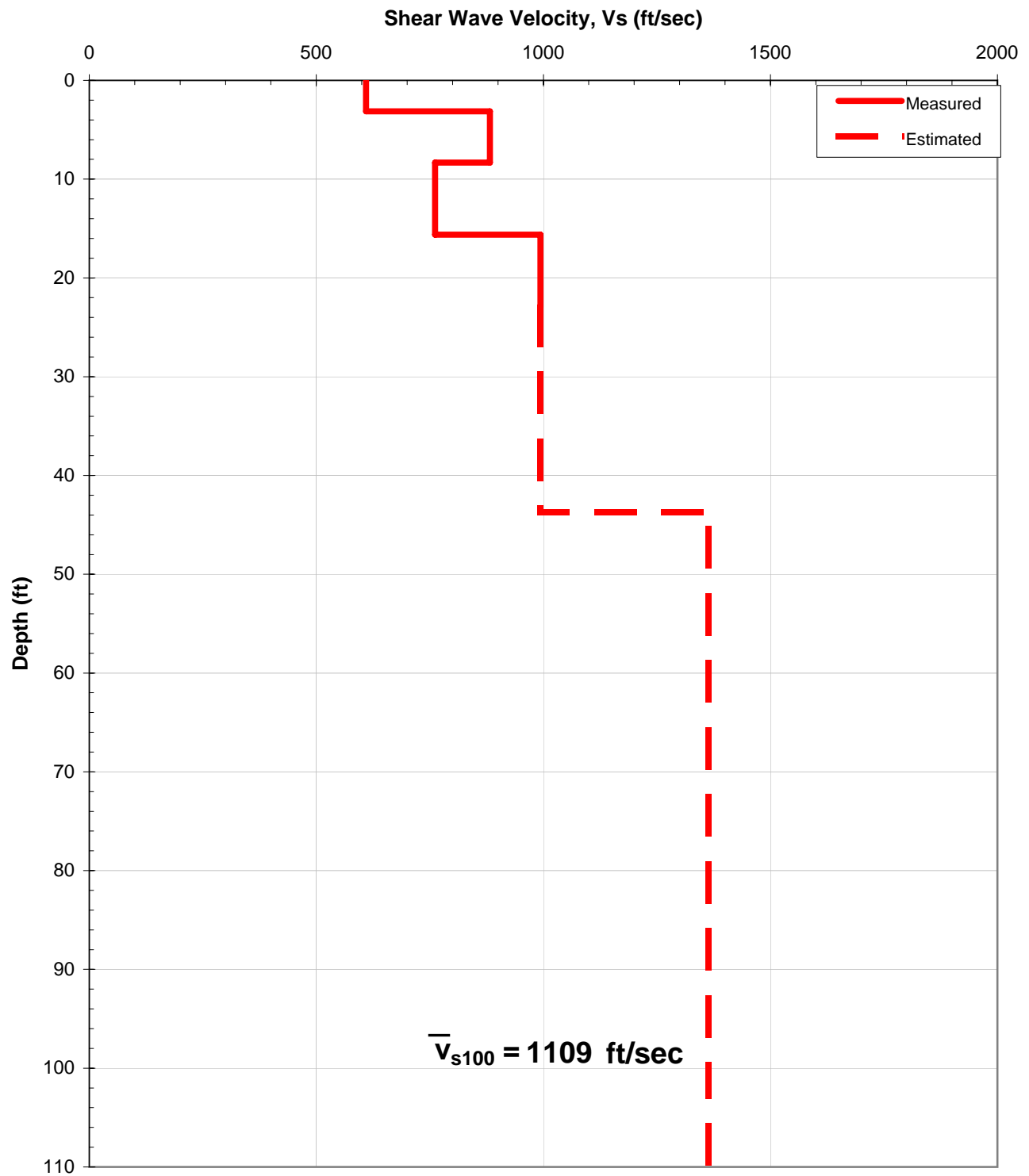


Shear Wave Velocity Profile SW-3  
I-85 RBO Norfolk Southern RR  
Gaffney, South Carolina  
1261-10-391





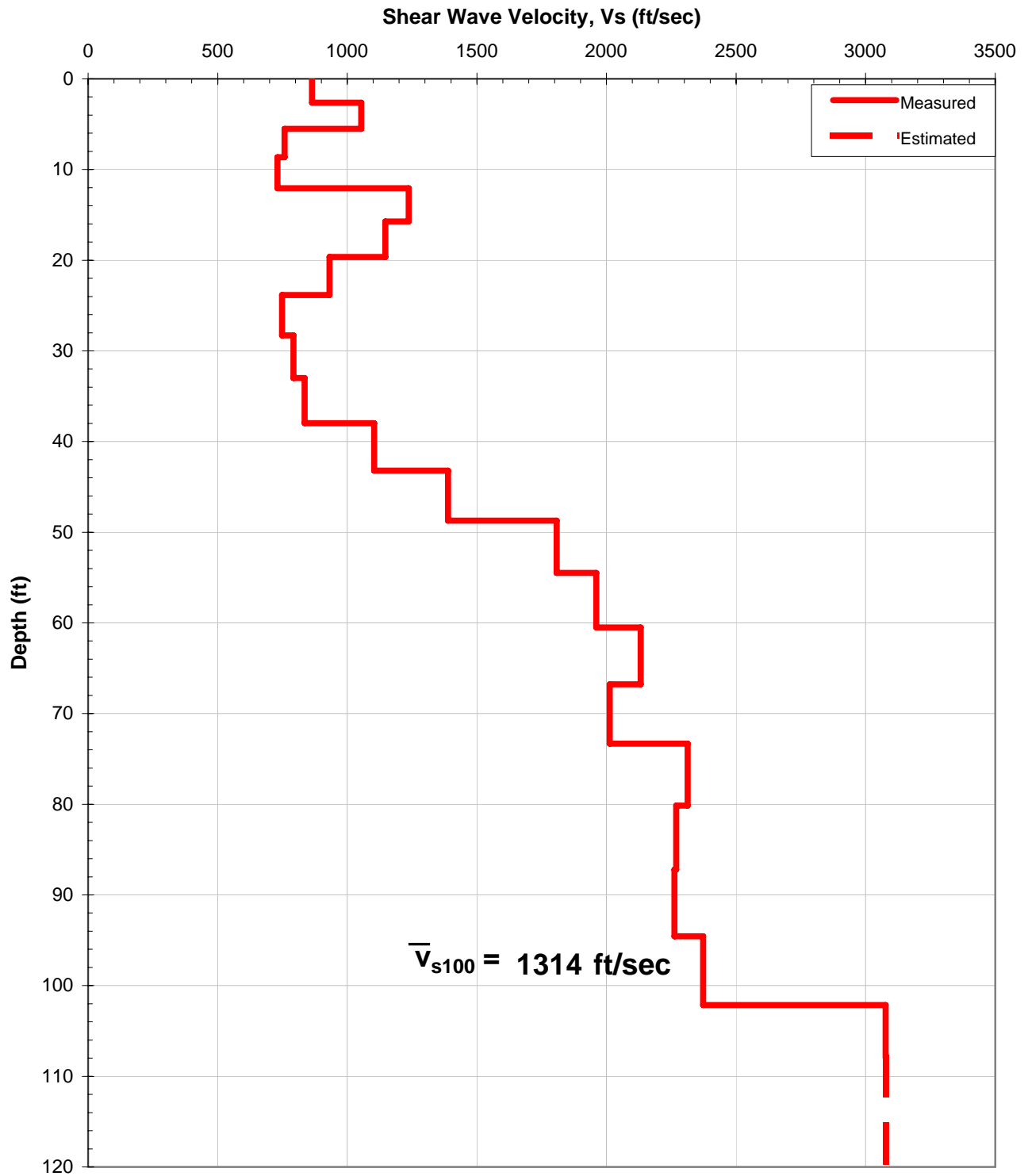
Shear Wave Velocity Profile SW-2  
I-85 RBO Norfolk Southern RR  
Gaffney, South Carolina  
1261-10-391







Shear Wave Velocity Profile SW-1  
I-85 RBO Norfolk Southern RR  
Gaffney, South Carolina  
1261-10-391



**SUMMARY OF LABORATORY TEST DATA**  
**I-85 SBL Replacement Bridge Over Norfolk Southern Railroad**  
**Cherokee County, South Carolina**  
**S&ME Project No. 1261-10-391**

Sample ID	Sample Depth (feet)	USCS Symbol	AASHTO Symbol	SPT (N) (bpf)	Natural Moisture (%)	Percent Finer #200 (%)	Atterberg Limits		Standard Proctor	
							LL (%)	PI (%)	MDD, $\gamma_d$ (pcf)	OMC (%)
B-1	6-7.5	ML	A-7-5	4	30.1	69	45	14		
B-1	10.5-12	MH	A-7-5	5	30.8	74	54	18		
B-1	18-19.5	MH	A-7-5	6	26.4	62	51	16		
B-1	28.5-30	ML	A-4	16	23.7	61	35	7		
B-1	38.5-40	SM	A-4	21	11.4	40	24	7		
B-2	6-7.5	ML	A-7-5	8	27.8	75	44	13		
B-2	13.5-15	ML	A-7-5	11	35.2	70	44	12		
B-2	23.5-25	ML	A-6	7	26.7	63	39	13		
B-2	33.5-35	ML	A-7-5	24	26.7	60	43	11		

**Notes:**

USCS = Unified Soil Classification System      AASHTO = American Association of State Highways and Transportation Officials  
 SPT = Standard Penetration Test   bpf = blows per foot   B = Bulk Sample   UD = Undisturbed Sample  
 LL = Liquid Limit   PI = Plasticity Index   NP = Non-Plastic  
 MDD = Maximum Dry Density   OMC = Optimum Moisture Content   pcf = pounds per cubic foot

Report Date: 1/7/11  
Test Date(s): 12/15 - 12/30/10

**B-1 (6-7.5') Grain.xls**

# Particle-Size Analysis of Soils

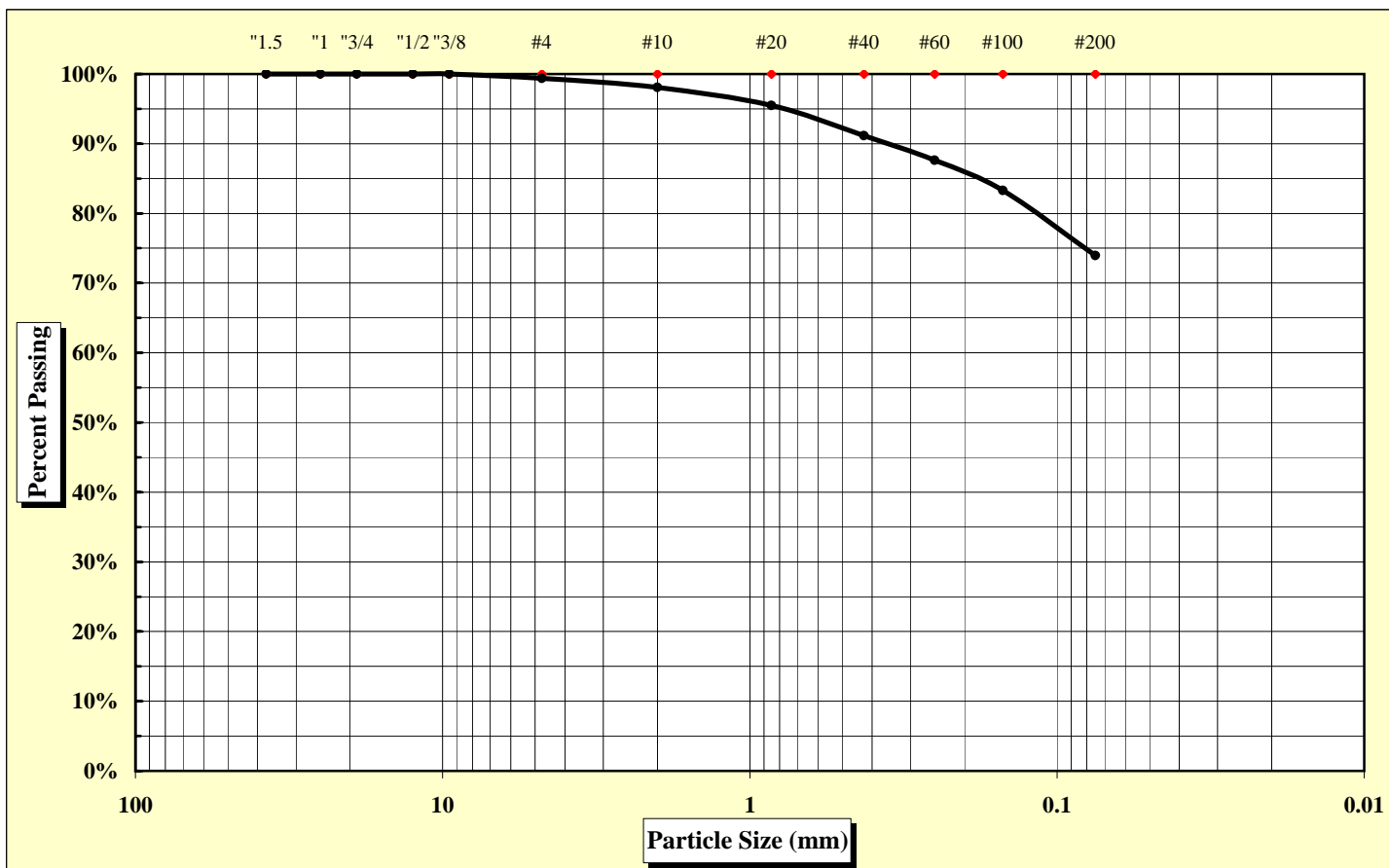


AASHTO T 88 (without Hydrometer)

S&ME Project #: **1261-10-391**  
 Project Name: **I-85 Replacement Bridge over Norfolk Southern RR**  
 Client Name: **STV / Ralph Whitehead Associates**  
 Client Address: **4975 Lacross Road Suite 314, North Charleston, SC 29406**

Report Date: **1/7/11**  
 Test Date(s): **12/15 - 12/30/10**

Boring #:	B-1	Sample #:	368	Sample Date:	9/28/10
Location:	sample 5	Offset:	N/A	Elevation:	10.5-12'
Sample Description:	ELASTIC SILT WITH SAND (MH/A-7-5) - orange tan				



As Defined by AASHTO		Fine Sand	
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Maximum Particle Size	4.75 mm	Gravel	1.9%	Fine Sand	17.2%
		Coarse Sand	6.9%	Silt & Clay	73.9%
Liquid Limit	54	Plastic Limit	36	Plastic Index	18
		Moisture Content	30.8%	Group Index	15

**References:** AASHTO T 88: Particle-Size Analysis of Soils  
 AASHTO T 89: Determining the Liquid Limit of Soils  
 AASHTO T 2: Practice for Sampling Aggregates  
 AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes  
 AASHTO T 265: Laboratory Determination of Moisture Content of Soils  
 AASHTO T 90: Determining the Plastic Limit & Plastics Index of Soils  
 AASHTO T 248: Practice for Reducing Samples of Aggregate to Testing Size

Technical Responsibility: **Brian Vaughan, P.E.**

QC Manager

S&ME, INC.

301 Zima Park Drive Spartanburg, SC 29301

B-1 (10.5-12') Grain.xls



# Particle-Size Analysis of Soils

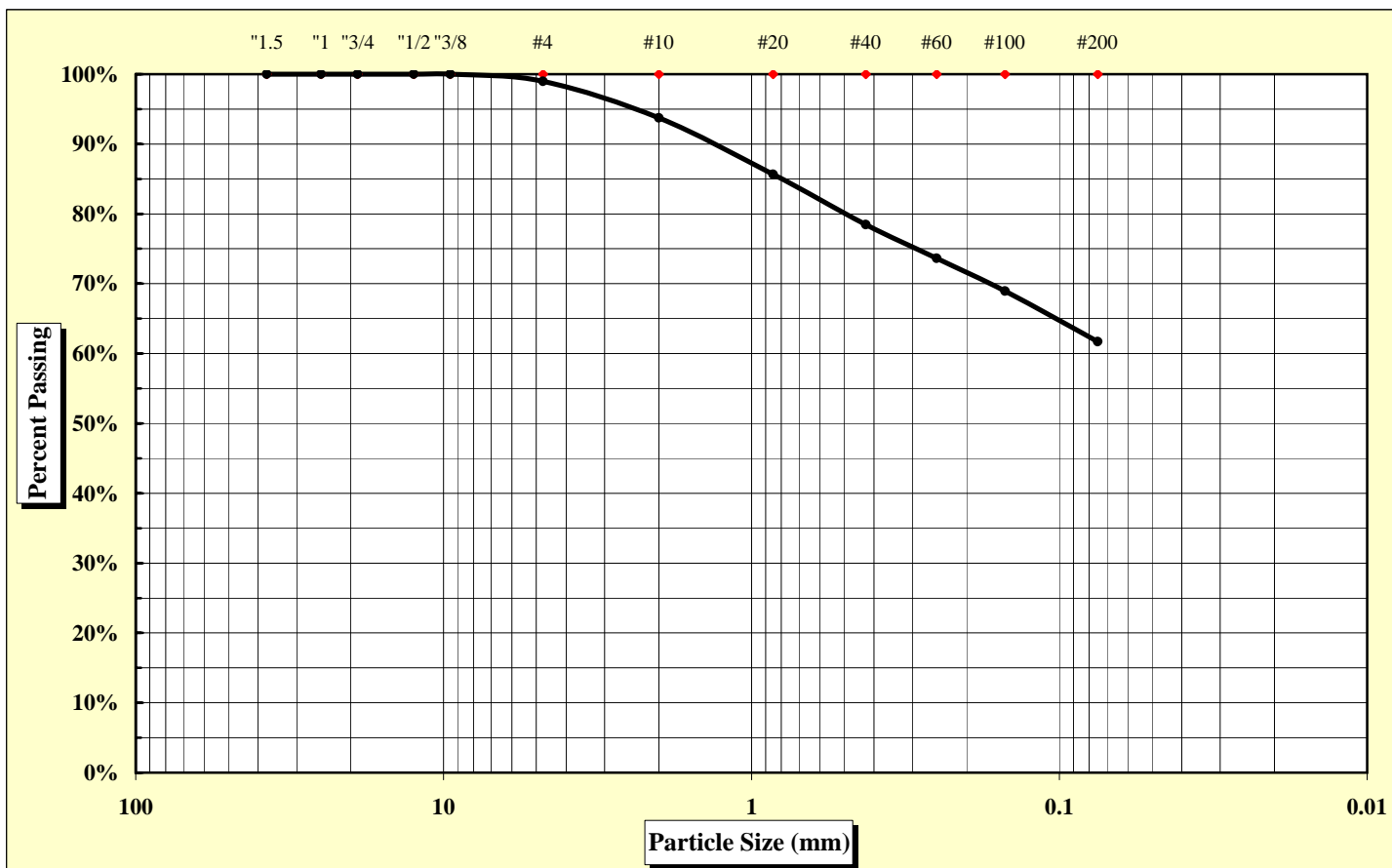


AASHTO T 88 (without Hydrometer)

S&ME Project #: **1261-10-391**  
 Project Name: **I-85 Replacement Bridge over Norfolk Southern RR**  
 Client Name: **STV / Ralph Whitehead Associates**  
 Client Address: **4975 Lacross Road Suite 314, North Charleston, SC 29406**

Report Date: **1/7/11**  
 Test Date(s): **12/15 - 12/30/10**

Boring #:	B-1	Sample #:	368	Sample Date:	9/28/10
Location:	sample 9	Offset:	N/A	Elevation:	18-19.5'
Sample Description:	SANDY ELASTIC SILT (MH/A-7-5) - tan orange brown, micaceous				



As Defined by AASHTO		Fine Sand	
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Maximum Particle Size	9.50 mm	Gravel	6.3%	Fine Sand	16.8%
		Coarse Sand	15.3%	Silt & Clay	61.7%
Liquid Limit	51	Plastic Limit	35	Plastic Index	16
		Moisture Content	26.4%	Group Index	10

**References:** AASHTO T 88: Particle-Size Analysis of Soils  
 AASHTO T 89: Determining the Liquid Limit of Soils  
 AASHTO T 2: Practice for Sampling Aggregates  
 AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes  
 AASHTO T 265: Laboratory Determination of Moisture Content of Soils  
 AASHTO T 90: Determining the Plastic Limit & Plastics Index of Soils  
 AASHTO T 248: Practice for Reducing Samples of Aggregate to Testing Size

Technical Responsibility: Brian Vaughan, P.E.  
 S&ME, INC.  
 301 Zima Park Drive Spartanburg, SC 29301  
 QC Manager  
 B-1 (18-19.5') Grain.xls

# Particle-Size Analysis of Soils

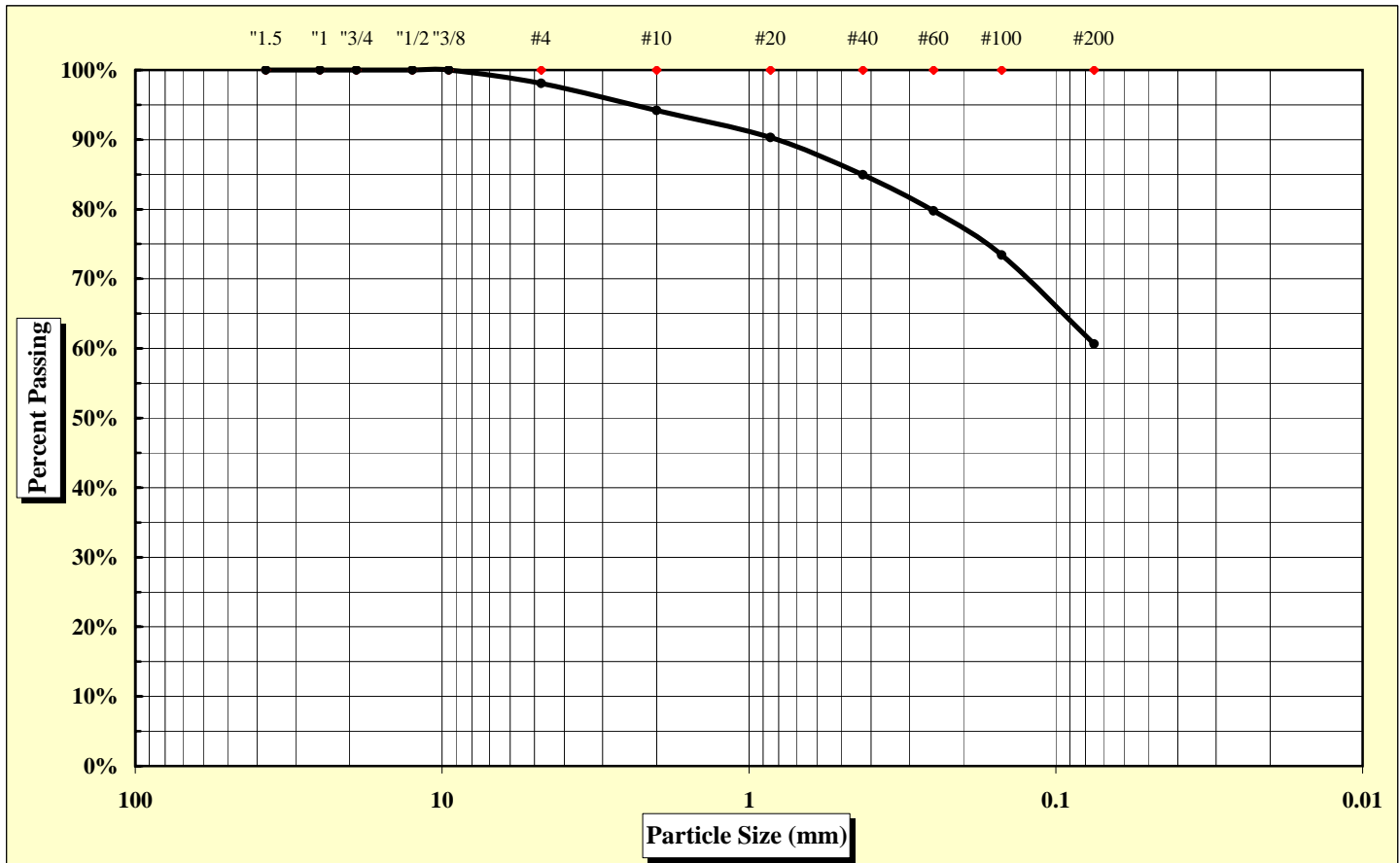


AASHTO T 88 (without Hydrometer)

S&ME Project #: **1261-10-391**  
 Project Name: **I-85 Replacement Bridge over Norfolk Southern RR**  
 Client Name: **STV / Ralph Whitehead Associates**  
 Client Address: **4975 Lacross Road Suite 314, North Charleston, SC 29406**

Report Date: **1/7/11**  
 Test Date(s): **12/15 - 12/30/10**

Boring #:	B-1	Sample #:	368	Sample Date:	9/28/10
Location:	sample 10	Offset:	N/A	Elevation:	28.5-30'
Sample Description: <b>SANDY SILT (ML/A-4) - tan orange brown, micaceous</b>					



As Defined by AASHTO		Fine Sand	
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 mm and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Maximum Particle Size	9.50 mm	Gravel	5.8%	Fine Sand	24.3%
		Coarse Sand	9.3%	Silt & Clay	60.6%
Liquid Limit	35	Plastic Limit	28	Plastic Index	7
		Moisture Content	23.7%	Group Index	3

<b>References:</b>	AASHTO T 88: Particle-Size Analysis of Soils	AASHTO T 265: Laboratory Determination of Moisture Content of Soils
	AASHTO T 89: Determining the Liquid Limit of Soils	AASHTO T 90: Determining the Plastic Limit & Plastics Index of Soils
	AASHTO T 2: Practice for Sampling Aggregates	AASHTO T 248: Practice for Reducing Samples of Aggregate to Testing Size
	AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes	

Technical Responsibility:	<u>Brian Vaughan, P.E.</u>	QC Manager
	<i>Signature</i>	<i>Position</i>
S&ME, INC.	301 Zima Park Drive Spartanburg, SC 29301	B-1 (28.5-30') Grain.xls

Report Date: 1/7/11  
Test Date(s): 12/15 - 12/30/10

Technical Responsibility: Brian Vaughan, P.E. QC Manager  
*Signature* *Position*  
**S&ME,INC.** **301 Zima Park Drive Spartanburg, SC 29301** **B-1 (38.5-40') Grain.xls**

# Particle-Size Analysis of Soils

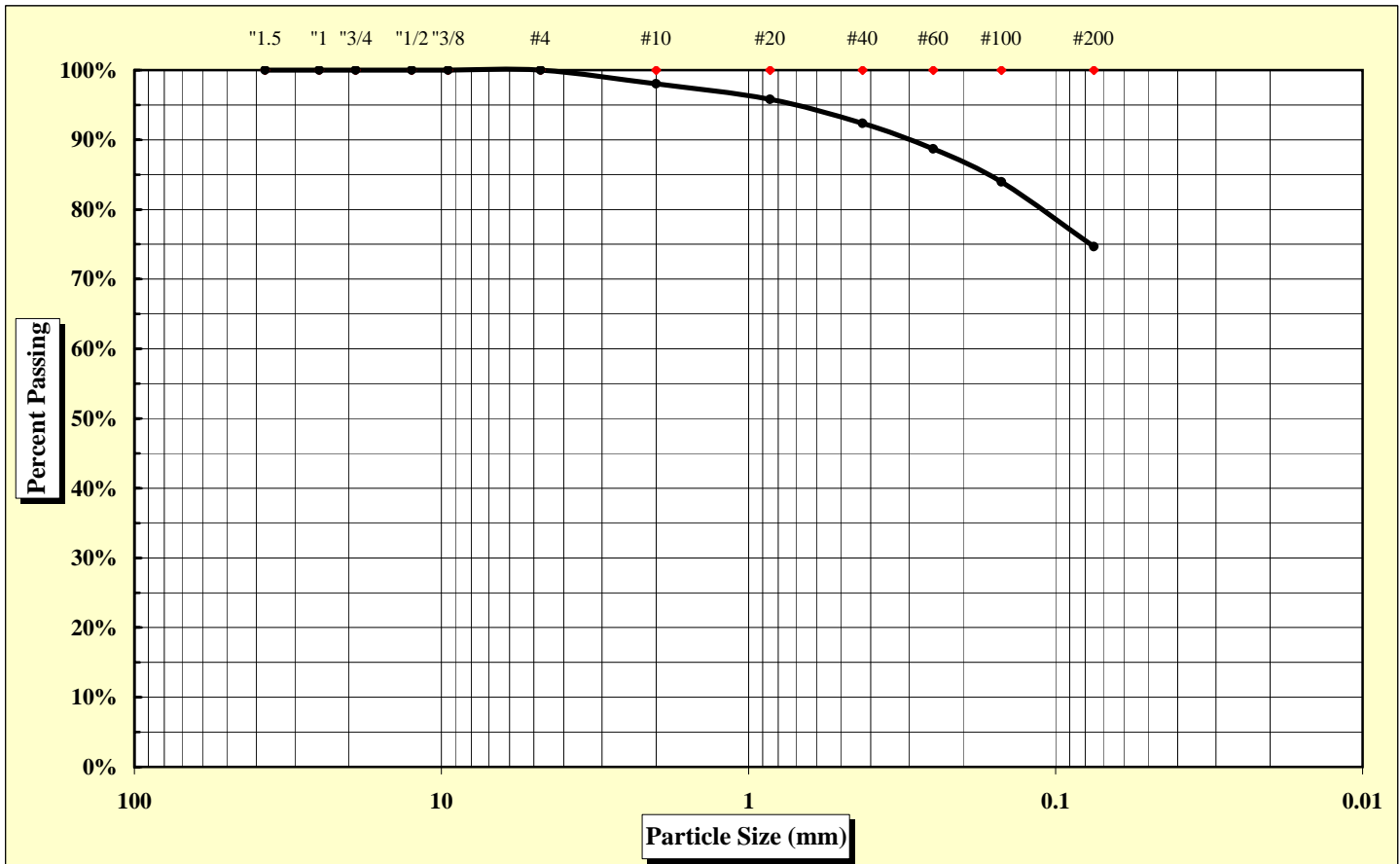


AASHTO T 88 (without Hydrometer)

S&ME Project #: **1261-10-391**  
 Project Name: **I-85 Replacement Bridge over Norfolk Southern RR**  
 Client Name: **STV / Ralph Whitehead Associates**  
 Client Address: **4975 Lacross Road Suite 314, North Charleston, SC 29406**

Report Date: **1/7/11**  
 Test Date(s): **12/15 - 12/30/10**

Boring #:	B-2	Sample #:	368	Sample Date:	10/13/10
Location:	sample 3	Offset:	N/A	Elevation:	6-7.5'
Sample Description:	SILT WITH SAND (ML/A-7-5) - tan orange, with some clay & rock frags				





# Particle-Size Analysis of Soils

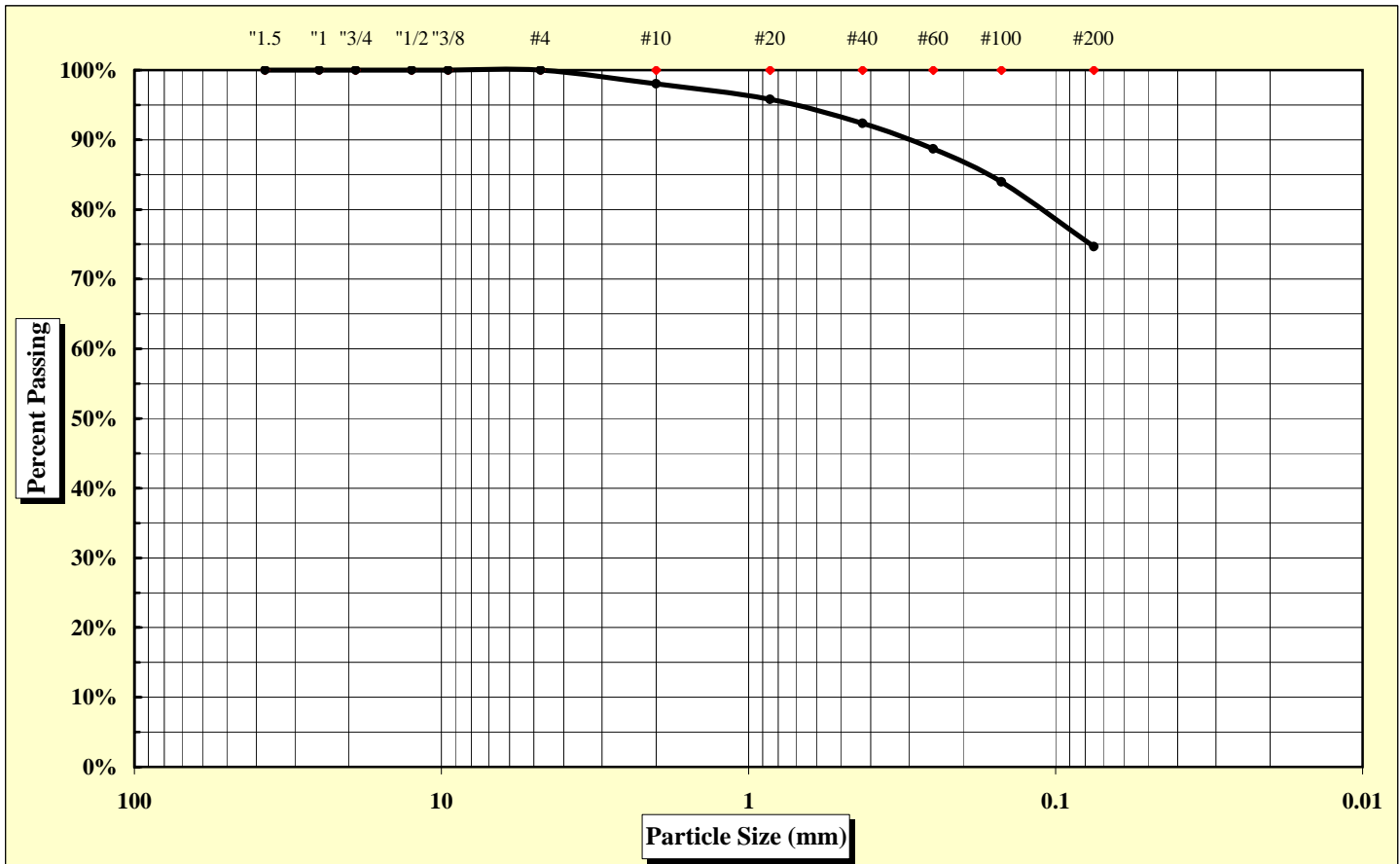


AASHTO T 88 (without Hydrometer)

S&ME Project #: **1261-10-391**  
 Project Name: **I-85 Replacement Bridge over Norfolk Southern RR**  
 Client Name: **STV / Ralph Whitehead Associates**  
 Client Address: **4975 Lacross Road Suite 314, North Charleston, SC 29406**

Report Date: **1/7/11**  
 Test Date(s): **12/15 - 12/30/10**

Boring #:	B-2	Sample #:	368	Sample Date:	10/13/10
Location:	sample 3	Offset:	N/A	Elevation:	6-7.5'
Sample Description: <b>SILT WITH SAND (ML/A-7-5) - tan orange, with some clay &amp; rock frags</b>					



Report Date: 1/7/11  
Test Date(s): 12/15 - 12/30/10

Technical Responsibility: Brian Vaughan, P.E. QC Manager

*Signature* *Position*

S&ME, INC. 301 Zima Park Drive Spartanburg, SC 29301 B-2 (13.5-15') Grain.xls

Report Date: 1/7/11  
Test Date(s): 12/15 - 12/30/10

Technical Responsibility: Brian Vaughan, P.E. QC Manager

*Signature* *Position*

S&ME,INC. 301 Zima Park Drive Spartanburg, SC 29301 B-2 (23.5-25') Grain.xls

# Particle-Size Analysis of Soils



AASHTO T 88 (without Hydrometer)

S&ME Project #: **1261-10-391**  
 Project Name: **I-85 Replacement Bridge over Norfolk Southern RR**  
 Client Name: **STV / Ralph Whitehead Associates**  
 Client Address: **4975 Lacross Road Suite 314, North Charleston, SC 29406**

Report Date: **1/7/11**  
 Test Date(s): **12/15 - 12/30/10**

Boring #:	B-2	Sample #:	368	Sample Date:	10/13/10
Location:	sample 11	Offset:	N/A	Elevation:	33.5-35'
Sample Description: <b>SANDY SILT (ML/A-7-5) - purple brown tan, trace mica</b>					

