

REVISED

GEOTECHNICAL BASE LINE REPORT

Route S-30-340 Replacement Bridge over Mountain Creek
Laurens County, South Carolina



PREPARED FOR

SCDOT

955 Park Street

Columbia, South Carolina 29201

PREPARED BY

F&ME Consultants, Inc.

1825 Blanding Street

Columbia, South Carolina 29201

SCDOT Project ID: P038302

F&ME Project #: G6100.05.06

October 23, 2019

October 23, 2019

Trapp Harris, P.E.
Design-Build Group Geotechnical Engineer
South Carolina Department of Transportation
955 Park Street
Columbia, South Carolina 29201

Re: Closed and Load-Restricted Bridge Package 2020-1
REVISED Geotechnical Base Line Report
Route S-30-340 Bridge over Mountain Creek
Laurens County, South Carolina
SCDOT Project ID: P038302
F&ME Project No.: G6100.050.06

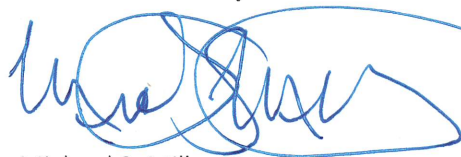
Dear Mr. Harris:

Submitted herein is F&ME Consultants, Inc. (FME) revised Geotechnical Base Line Report (GBLR) for the Route S-30-340 Replacement Bridge over Mountain Creek. Revisions to our previously submitted report include the corrosion series laboratory test results. This report contains findings from our subsurface field exploration, results from the laboratory testing program, and conceptual geotechnical assessment of approach embankments and bridge foundation systems.

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

Sincerely,

F&ME Consultants, Inc.

A handwritten signature in blue ink, appearing to read 'Michael S. Miller', written over a circular professional engineer stamp.

Michael S. Miller, P.E.
Senior Geotechnical Engineer



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1.0 INTRODUCTION

FME performed geotechnical soil test borings and laboratory testing for the Route S-30-340 Replacement Bridge over Mountain Creek located in Laurens County, South Carolina. A Site Location Plan is presented as Figure 1 in Section 1 in the Appendix of this report. The South Carolina Department of Transportation (SCDOT) Scope of Services Work Request for the geotechnical subsurface exploration and laboratory testing was issued on March 1, 2019.

The field investigation consisted of performing soil test borings (STB's) with associated Standard Penetration Testing (SPT) and rock core sampling. Laboratory testing was performed on selected soil and rock core samples collected from the test borings. The exploration methods and laboratory procedures were conducted in general accordance with the current American Association of State Highway and Transportation Officials (AASHTO), American Society of Testing and Materials (ASTM) Standards, and the SCDOT Geotechnical Design Manual (GDM). This Geotechnical Base Line Report was prepared in general accordance with the 2019 SCDOT Geotechnical Design Manual (GDM), Version 2.0. along with PCDM-11 Supplemental Design Criteria for Low Volume Bridge Replacement Projects.

2.0 FIELD EXPLORATION SUMMARY

From June 5 to June 13, 2019, F&ME performed three (3) soil test borings (STB's). Boring B-701A was performed as an off-set following loss of the drill stem in test boring B-701. Boring B-701A was performed as an auger probe to an approximate depth of seventy-eight point five (78.5) feet at which depth the boring was then advanced with standard spilt spoon sampling being performed. The test boring locations were performed in proximity to the existing bridge end bent locations. The intent of the subsurface investigation was to provide a broad indication of the subsurface conditions at the site.

The STB's were advanced using a CME 45B trailer mounted drill rig with an automatic standard penetration test (SPT) hammer system. Rotary wash drilling techniques were used during drilling to maintain a stable borehole. In test borings B-701 and B-702, standard split-spoon sampling was performed continuously over the first ten (10) feet of the boring depth and at five (5) foot intervals thereafter. SPT were performed at five (5) foot intervals following auger probe advance to depth corresponding to where boring B-701 was terminated.

Boring B-702 was advanced to drilling equipment refusal at a depth of about seventy-eight point six (78.6) feet at which depth rock coring was attempted. Rock coring was performed for ten (10) feet, with no rock recovery. Following rock core collection attempts, boring B-702 was advanced as a soil test boring. Details of each STB are included on the individual Soil Test Boring Logs in Section 4 in the Appendix of this report.

2.1 Soil Test Borings (STB's)

The following table is a summary of the STB designations, exploration depths, locations, and ground surface elevations of the test boring locations.

Table 1 – Soil Test Boring Summary Table

SOIL TEST BORINGS (STB)							
Test Hole No.	Surface Condition	Soil Depth (ft.)	Rock Core Depth (ft.)	Total Boring Depth (ft.)	Latitude	Longitude	Elev. (ft.-MSL)
B-701	Paved Roadway	73.6	0.0	73.6	34.589297	-82.141812	655.7
B-701A	Paved Roadway	78.5 (probe) 20.1 (SPT)	0.0	98.6	34.589299	-82.141818	655.7
B-702	Roadway Shoulder	88.6	10.0	98.6	34.589250	-82.141648	655.4
Totals	-	260.8	10.0	270.8	-		

2.2 Groundwater

Groundwater depths were recorded at the time of boring (TOB) for soil test borings B-701, B-701A and B-702, with the recorded measurements noted on the individual Soil Test Boring Logs in Section 4 of the Appendix to this report. In test borings B-701A and B-702 groundwater measurements were made twenty-four (24) hours following boring completion. Soil test boring B-701 was backfilled following TOB groundwater measurements. The following table is a summary of the groundwater measurements for the soil test borings at time of boring and at twenty-four (24) hours following boring, when recorded.

Table 2 – Groundwater Depth Summary Table

GROUNDWATER DEPTH			
Boring No.	Date of TOB Groundwater Measurement	TOB Groundwater Depth (ft.)	24-hr. Groundwater Depth (ft.)
B-701	6/5/2019	15.0	Backfilled
B-701A	6/13/2019	8.8	11.0
B-702	6/11/2019	8.6	11.0

3.0 LABORATORY TESTING

Following completion of F&ME's field investigation, select split-spoon samples were tested in FME's AASHTO accredited laboratory to determine applicable physical and engineering properties. One (1) split-spoon sample was sent to an off-site AASHTO accredited laboratory for corrosion series testing. All laboratory testing was performed in general accordance with procedures set forth in the most current AASHTO and ASTM standards.

The laboratory testing performed for the split-spoon samples are detailed in the table below. Data sheets containing the results of the laboratory testing program are provided in Section 6 of the Appendix.

Table 3 – Laboratory Testing Summary Table

LABORATORY SOIL TESTING		
Type of Test	Quantity	Procedure
Grain Size Analysis with Hydrometer	6	AASHTO T88
Grain Size Analyses with Wash 200	2	AASHTO T11
Atterberg Limits	4	AASHTO T89/T90
Natural Moisture Content	6	ASTM D2216
pH	1	AASHTO T289
Resistivity	1	AASHTO T288
Chloride Content	1	AASHTO T291
Sulfate Content	1	AASHTO T290

4.0 SUBSURFACE STRATIGRAPHY

The following table summarizes the soil and rock stratigraphy based on conditions as encountered in the soil test borings performed during this geotechnical subsurface investigation.

Table 4 – Stratigraphy Summary Table

SOIL STRATIGRAPHY					
Strata	Elevation of Top Layer (ft-MSL)	Depth to Top of Layer (ft.)	USCS Soil Type	Avg. SPT N Value (bpf)	Comments
Fill	655	0	SM	4	-
Alluvium	649	6	SM	3	-
Residuum	642	13	SP-SM, SM	49	-
PWR	599	56	SM	100+	-

5.0 CONCEPTUAL GEOTECHNICAL ASSESSMENT

Relative to the SCDOT's Supplemental Design Criteria for Low Volume Bridge Replacement Projects, the soil subgrade below the new embankment areas are anticipated to be adequate for embankment construction.

We anticipate that pile foundations will be preferred for support of the bridge abutments. The Strength Case axial loadings will likely govern the geotechnical driven pile design. We anticipate that the soil thickness above weathered rock is sufficient to resist the assumed lateral loading conditions, and drilled pile will not be likely. We anticipate that the piles will be driven to a practical refusal driving condition on partially weathered rock. To avoid excessive pile driving stresses, we anticipate that pile driving termination criteria will be based on encountering a pile driving practical refusal condition. Shallow foundation concepts are likely not feasible due to the estimated bearing depth and the presence of groundwater at that depth.

If a multi-span concept is pursued, the selection of the interior bent foundation type will be predicated on the scour depth relative to the bent location(s). For an assumed scour depth and channel geometry, FME anticipates that driven pile concepts may or may not be feasible based on the soil thickness above weathered rock to resist the lateral loads. We anticipate that drilled shafts will be the most feasible foundation type for the interior bent(s). The drilled shafts will consist of construction casing and excavation below the casing tip elevation. We expect the Strength Case axial loadings will govern the drilled shaft design.

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APPENDIX

SECTION 1	SITE LOCATION PLAN
SECTION 2	BORING LOCATION PLAN
SECTION 3	DRILL RIG PHOTOS
SECTION 4	TEST BORING LOGS
SECTION 5	GENERALIZED SUBSURFACE PROFILE
SECTION 6	LABORATORY TEST RESULTS

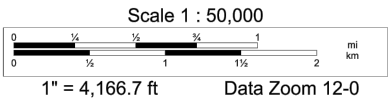
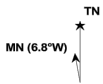
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SECTION 1 SITE LOCATION PLAN

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROAD / ROUTE NO.	SHEET NO.
3	SC	LAURENS	P038302	S-30-340	





F&ME CONSULTANTS, INC.
COLUMBIA, SC

MOUNTAIN CREEK
LAURENS COUNTY, SOUTH CAROLINA

SITE LOCATION PLAN

F&ME JOB NO. G6100.050

SCALE: AS NOTED

FIGURE 1

4			
3			
2			
1			
REV.	BY	DATE	DESCRIPTION OF REVISION
TOPO.		DATE	
DWG.	CTC	DATE 6.3.19	GROUP - -
R/W		DATE	

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SECTION 2 BORING LOCATION PLAN

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROAD/ROUTE NO.	SHEET NO.
3	SC	LAURENS	P038302	S-30-340	



LEGEND:

SOIL TEST BORING LOCATION

4			
3			
2			
1			
REV.	BY	DATE	DESCRIPTION OF REVISION
TOPO.		DATE	
DWG.	CTC	DATE 6.3.19	GROUP
R/W		DATE	

F&ME CONSULTANTS, INC.

COLUMBIA, SC

MOUNTAIN CREEK

LAURENS COUNTY, SOUTH CAROLINA

BORING LOCATION PLAN

F&ME JOB NO. G6100.050

SCALE: 1"=30'

FIGURE 2

S-30-340 Replacement Bridge over Mountain Creek

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SECTION 3 DRILL RIG PHOTOS

Drill Rig Setup Photographs

B-701



S-30-340 Replacement Bridge over Mountain Creek

Geotechnical Base Line Report

APPENDIX

SECTION 4 TEST BORING LOGS

Soil Test Boring Log Descriptors

Correlation of Penetration Resistance with Relative Density and Consistency














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

Particle Size Identification

















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

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

Gravel	Sieve Size
Fines Content	< #200

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

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



SCDOT Soil Test Log

Project ID:	P038302	County:	Laurens	Boring No.:	B-701
Site Description:	S-30-340 Replacement Bridge over Mountain Creek			Route:	S-30-340
Eng./Geo.:	R.Wessinger	Boring Location:	N/A	Offset:	N/A
Elev.:	655.8 ft	Latitude:	34.589297	Longitude:	-82.141812
Date Started:	6/5/2019				
Total Depth:	73.6 ft	Soil Depth:	73.6 ft	Core Depth:	N/A ft
Date Completed:	6/5/2019				
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)	Drill Machine:	CME 45B	Drill Method:	RW/RC
Hammer Type:	Automatic	Energy Ratio:	92%	Core Size:	N/A
Driller:	L. Guempel	Groundwater:	TOB	15 ft	24HR
					Backfilled

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value	● SPT N VALUE ●	PL MC LL	▲ FINES CONTENT (%)
	0.0	ASPHALT ROADWAY											
	0.8	ASPHALT (10-in.)		0.8									
	2.0	GRADED AGGREGATE BASE COARSE (GABC) (1.2-ft.)		2.0	SS-1	8	3			3	●		
		FILL		4.0	SS-2	3	1	2	2	3	●		
650.8		Very Loose, Moist, Strong Brown, Non-Plastic to Low Plasticity, Silty Fine to Medium SAND (SM), Munsell=7.5YR 5/6		6.0	SS-3	1	1	2	2	3	●		
		ALLUVIUM		8.0	SS-4	1	1	1	1	2	●		
645.8		Very Loose, Moist, Brown/Gray, Non-Plastic to Low Plasticity, Silty Fine to Medium SAND (SM), Munsell= 7.5YR 5/4 & 7.5YR 6/1			SS-5	1	2	1	2	3	●		▲
		@SS-5: %200= 46.8											
	13.5	RESIDUUM		13.5	SS-6	WOH	1	4		5	●	▲	○
640.8		Loose to Very Loose, Moist to Wet, Gray/White, Non-Plastic, Silty Fine to Coarse SAND (SM/A-2-4), Micaceous, Munsell=7.5YR 6/1 & 7.5YR 8/1											
		@SS-6: LL=NP, PL=NP, PI=NP, NMC=37.3, %200=24.4		18.5									
635.8		@18.5-ft.: Strong Brown, Fine to Medium Sands, Munsell=7.5YR 5/6			SS-7	3	2	2		4	●		
				23.5									
630.8		@SS-8: NMC=31.7%, %200=28.4			SS-8	2	2	6		8	●	▲	○
				28.5									
625.8		Dense to Very Dense, Moist to Dry, Reddish Yellow/White, Fine to Coarse SAND (SP-SM) with Silt, Munsell= 7.5YR 7/8 & 7.5YR 8/1		28.5	SS-9	13	19	21		40	●		
		@SS-10: NMC=14.3%		33.5									
620.8					SS-10	19	35	50		85	○		●
				38.5									

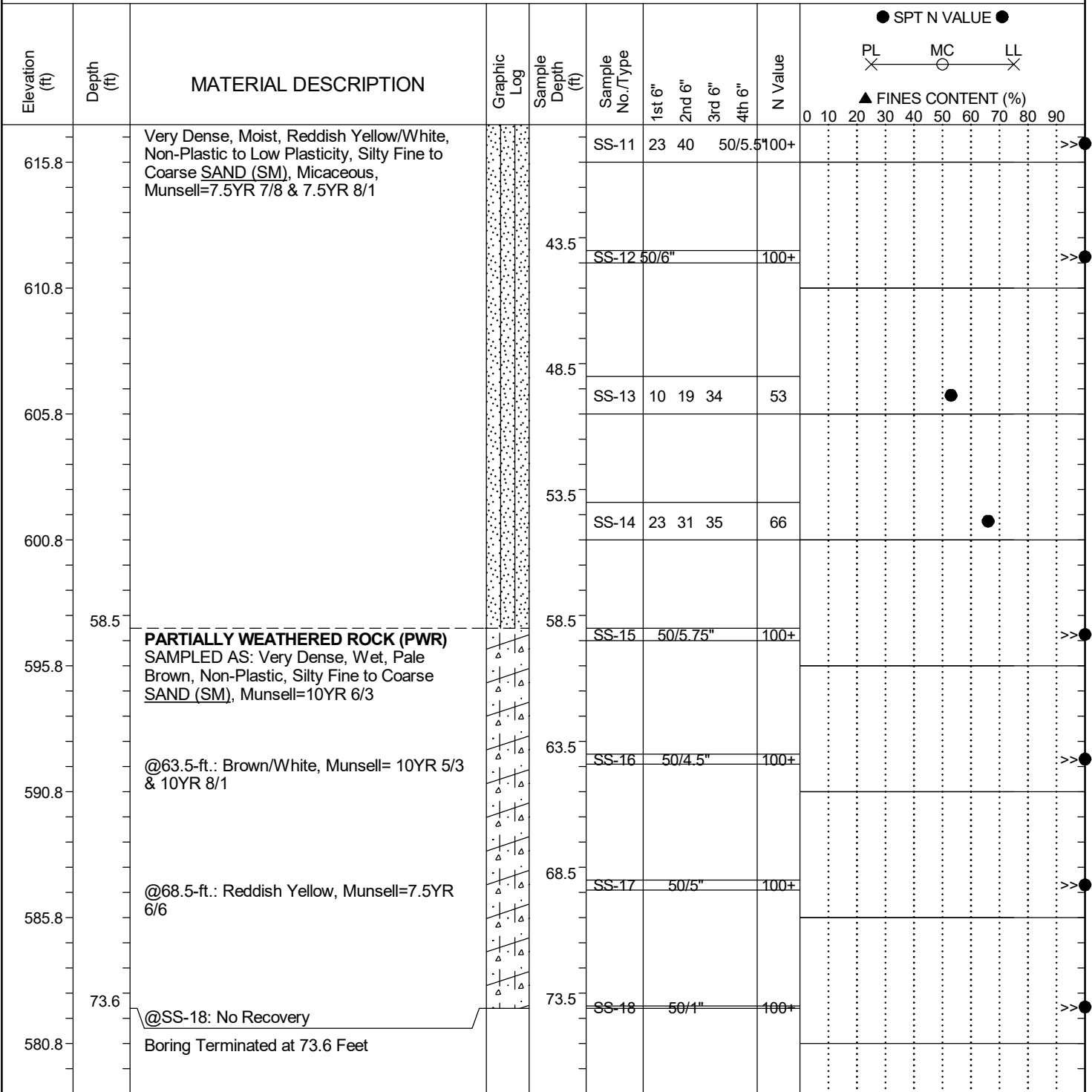
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SAMPLER TYPE	
SS - Split Spoon	NQ - Rock Core, 1-7/8"
UD - Undisturbed Sample	CU - Cuttings
AWG - Rock Core, 1-1/8"	CT - Continuous Tube

DRILLING METHOD	
HSA - Hollow Stem Auger	RW - Rotary Wash
CFA - Continuous Flight Augers	RC - Rock Core
DC - Driving Casing	

Project ID: P038302				County: Laurens		Boring No.: B-701	
Site Description: S-30-340 Replacement Bridge over Mountain Creek						Route: S-30-340	
Eng./Geo.: R.Wessinger		Boring Location: N/A		Offset: N/A		Alignment: Existing	
Elev.: 655.8 ft		Latitude: 34.589297		Longitude: -82.141812		Date Started: 6/5/2019	
Total Depth: 73.6 ft		Soil Depth: 73.6 ft		Core Depth: N/A ft		Date Completed: 6/5/2019	
Bore Hole Diameter (in): 4		Sampler Configuration		Liner Required: Y (N)		Liner Used: Y (N)	
Drill Machine: CME 45B		Drill Method: RW/RC		Hammer Type: Automatic		Energy Ratio: 92%	
Core Size: N/A		Driller: L. Guempel		Groundwater: TOB 15 ft		24HR Backfilled	



LEGEND

SAMPLER TYPE	
SS - Split Spoon	NQ - Rock Core, 1-7/8"
UD - Undisturbed Sample	CU - Cuttings
AWG - Rock Core, 1-1/8"	CT - Continuous Tube

DRILLING METHOD	
HSA - Hollow Stem Auger	RW - Rotary Wash
CFA - Continuous Flight Augers	RC - Rock Core
DC - Driving Casing	

SCDOT Soil Test Log

Project ID:	P038302	County:	Laurens	Boring No.:	B-701A
Site Description:	S-30-340 Replacement Bridge over Mountain Creek			Route:	S-30-340
Eng./Geo.:	C.Piercy	Boring Location:	N/A	Offset:	N/A
Elev.:	655.8 ft	Latitude:	34.589297	Longitude:	-82.141812
Date Started:	6/11/2019				
Total Depth:	98.6 ft	Soil Depth:	98.6 ft	Core Depth:	N/A ft
Date Completed:	6/13/2019				
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)	Drill Machine:	CME 45B	Drill Method:	RW
Hammer Type:	Automatic	Energy Ratio:	92%	Core Size:	N/A
Driller:	L. Guempel	Groundwater:	TOB 8.8 ft	24HR	11 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 ●
	0.0	ASPHALT ROADWAY									PL X MC X LL X
		AUGER PROBE TO 78.5-FT									▲ FINES CONTENT (%)
											0 10 20 30 40 50 60 70 80 90
650.8											
645.8											
640.8											
635.8											
630.8											
625.8											
620.8											
615.8											
610.8											
605.8											
600.8											
595.8											
590.8											
585.8											
580.8											
78.5											
575.8		PARTIALLY WEATHERED ROCK (PWR)			SS-1	50/1.5"	100+				>>●
		SAMPLED AS: Very Dense, Wet, Brown, Non-Plastic to Low Plasticity, Silty Fine to Coarse SAND (SM), Munsell=7.5YR 5/3			SS-2	50/1.5"	100+				>>●
570.8											
88.5		@83.5-ft.: Brown, Munsell= 10YR 4/3			SS-3	50/1.0"	100+				>>●
565.8		@SS-3: No Recovery									
560.8		@SS-4: No Recovery			SS-4	50/1.0"	100+				>>●
98.6		@SS-5: No Recovery			SS-5	50/1.0"	100+				>>●
555.8		Boring Terminated at 98.6 Feet									

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:	P038302	County:	Laurens	Boring No.:	B-702
Site Description:	S-30-340 Replacement Bridge over Mountain Creek			Route:	S-30-340
Eng./Geo.:	C.Piercy	Boring Location:	N/A	Offset:	N/A
Elev.:	655.4 ft	Latitude:	34.58925	Longitude:	-82.141648
Date Started:	6/10/2019				
Total Depth:	98.6 ft	Soil Depth:	98.6 ft	Core Depth:	N/A ft
Date Completed:	6/11/2019				
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)				
Drill Machine:	CME 45B	Drill Method:	RW	Hammer Type:	Automatic
Energy Ratio:	92%				
Core Size:	N/A	Driller:	L. Guempel	Groundwater:	TOB 8.6 ft
24HR	11 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 (%)
	0.0	ASPHALT ROADWAY											
	0.3	TOPSOIL (3.5-in.)		0.3	SS-1	3	2	2	2	4	●		
		FILL		2.0	SS-2	2	2	3	3	5	●		
		Very Loose to Loose, Moist, Very pale Brown/Reddish Yellow, Non-Plastic to Low Plasticity, Silty Fine to Coarse SAND (SM), Munsell=10YR 7/3 & 7.5YR 6/6		4.0	SS-3	2	2	2	3	4	●		
650.4	6.0	2.6-ft.: Light Yellowish Brown, Munsell=10YR 6/4		6.0	SS-4	1	1	1	2	2	●		▲
		14-ft.: Very Loose, Reddish Yellow, Munsell=7.5YR 6/6		8.0	SS-5	4	2	2	2	4	●		
645.4		ALLUVIUM											
		Very Loose, Moist, Yellowish Brown, Non-Plastic, Silty Fine to Medium SAND (SM/A-4(0)), Munsell=10YR 5/4											
	13.5	@SS-4: LL=NP, PL=NP, PI=NP, %200=47.9		13.5	SS-6	5	4	7		11	●	○	▲
640.4		@8.7-ft.: Gray, Munsell= 7.5YR 6/1											
		RESIDUUM											
		Medium Dense to Dense, Moist, Light Gray/White, Non-Plastic, Silty Fine to Medium SAND (SM/A-1-b), Munsell=2.5Y 7/2 & 2.5Y 8/1		18.5	SS-7	6	6	9		15	●	○	▲
635.4		@SS-6: NMC=19.4%, %200=21.8											
		@SS-7: LL=NP, PL=NP, PI=NP, NMC=20.3%, %200=20.6		23.5	SS-8	7	9	10		19	●		
630.4													
		28.5-ft.: Light Yellowish Brown/White, Munsell=10YR 6/4 & 10YR 8/1		28.5	SS-9	19	26	23		49	○	▲	●
625.4		@SS-9: NMC=15.6%, %200=20.4											
				33.5	SS-10	16	24	32		56			●
620.4													
				38.5									

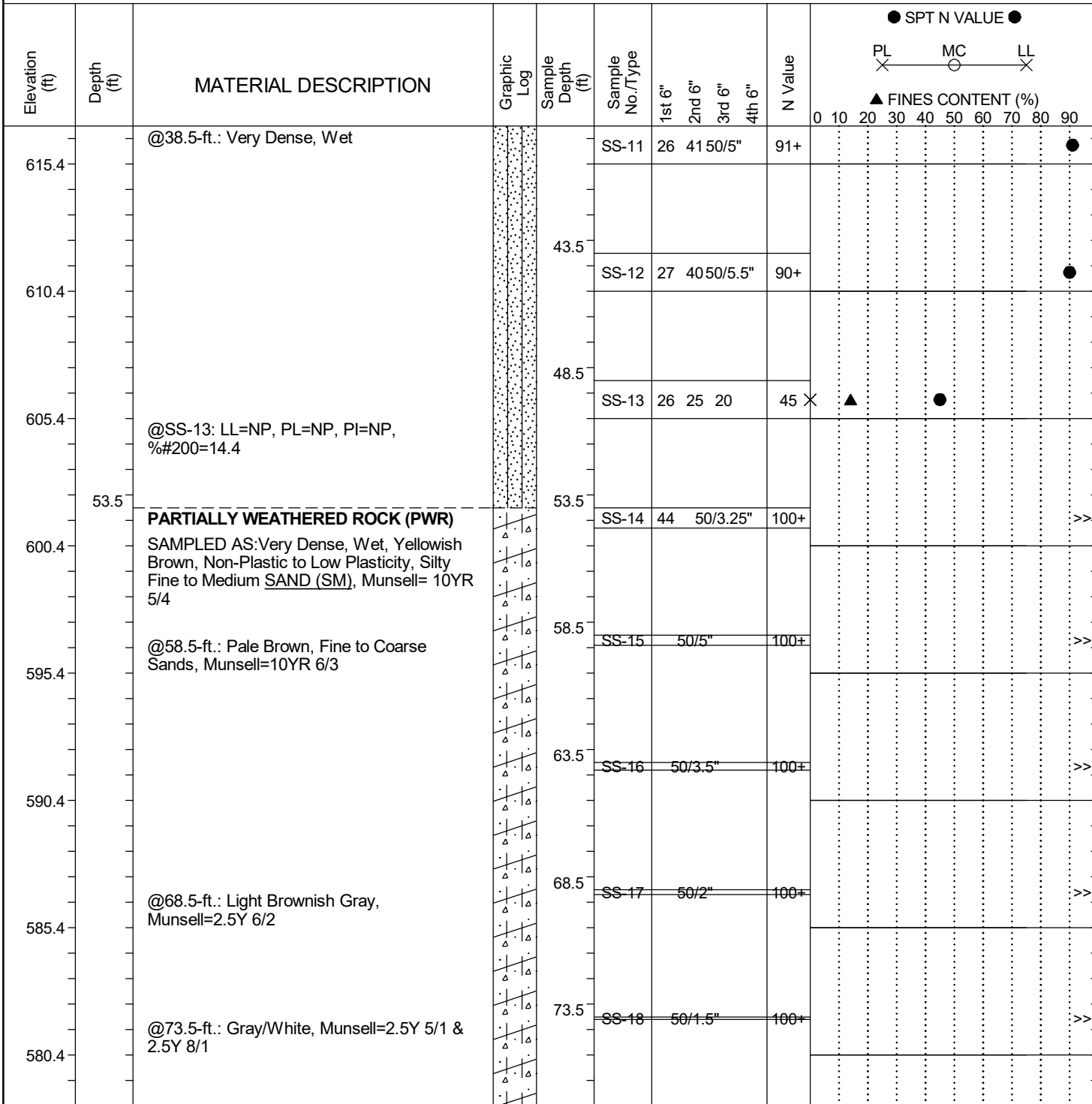
LEGEND

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:	P038302	County:	Laurens	Boring No.:	B-702
Site Description:	S-30-340 Replacement Bridge over Mountain Creek			Route:	S-30-340
Eng./Geo.:	C.Piercy	Boring Location:	N/A	Offset:	N/A
Elev.:	655.4 ft	Latitude:	34.58925	Longitude:	-82.141648
Date Started:	6/10/2019				
Total Depth:	98.6 ft	Soil Depth:	98.6 ft	Core Depth:	N/A ft
Date Completed:	6/11/2019				
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)	Drill Machine:	CME 45B	Drill Method:	RW
Hammer Type:	Automatic	Energy Ratio:	92%	Core Size:	N/A
Driller:	L. Guempel	Groundwater:	TOB	8.6 ft	24HR
					11 ft



LEGEND

Continued Next Page

SAMPLER TYPE	
SS - Split Spoon	NQ - Rock Core, 1-7/8"
UD - Undisturbed Sample	CU - Cuttings
AWG - Rock Core, 1-1/8"	CT - Continuous Tube

DRILLING METHOD	
HSA - Hollow Stem Auger	RW - Rotary Wash
CFA - Continuous Flight Augers	RC - Rock Core
DC - Driving Casing	

SCDOT Soil Test Log

Project ID:	P038302	County:	Laurens	Boring No.:	B-702
Site Description:	S-30-340 Replacement Bridge over Mountain Creek			Route:	S-30-340
Eng./Geo.:	C.Piercy	Boring Location:	N/A	Offset:	N/A
Elev.:	655.4 ft	Latitude:	34.58925	Longitude:	-82.141648
Date Started:	6/10/2019				
Total Depth:	98.6 ft	Soil Depth:	98.6 ft	Core Depth:	N/A ft
Date Completed:	6/11/2019				
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)
Liner Used:	Y (N)	Drill Machine:	CME 45B	Drill Method:	RW
Hammer Type:	Automatic	Energy Ratio:	92%	Core Size:	N/A
Driller:	L. Guempel	Groundwater:	TOB	8.6 ft	24HR
					11 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 X MC X LL X
											▲ FINES CONTENT (%)
											0 10 20 30 40 50 60 70 80 90
575.4	78.6	@NQ-1: No Recovery		78.5	SS-19	50/1"				100+	>>●
				78.6	NQ-1						%REC=0, %RCD=0
		@NQ-2: No Recovery		81.0	NQ-2						%REC=0, %RCD=0
570.4				86.0	SS-20	50/1.5"				100+	>>●
		@SS-20: No Recovery		88.5	SS-21	4350/1.5"				100+	>>●
565.4	88.5	PARTIALLY WEATHERED ROCK (PWR) SAMPLED AS: Very Dense, Wet, Gray/White, Non-Plastic, Silty Fine to Coarse SAND (SM), Micaceous, Munsell= 10YR 5/1 & 10YR 8/1		93.5	SS-22	50/2"				100+	>>●
		@SS-22: No Recovery		98.5	SS-23	50/1.25"				100+	>>●
560.4		@SS-23: No Recovery									
555.4	98.6	Boring Terminated at 98.6 Feet									
550.4											
545.4											
540.4											

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	

S-30-340 Replacement Bridge over Mountain Creek

Geotechnical Base Line Report

APPENDIX

SECTION 5 GENERALIZED SUBSURFACE PROFILE

KEY TO SYMBOLS

















PROJECT NAME

Closed and Load-Restricted Bridge Package 2020-1
(S-30-340 Bridge Replacement over Mountain Creek)

PROJECT COUNTY

Laurens



LITHOLOGIC SYMBOLS
(Unified Soil Classification System)

-  ASPHALT
-  GABC (Graded Aggregate Base Course)
-  PWR: Partially Weathered Rock
-  BEDROCK: Bedrock
-  CH: USCS High Plasticity Clay
-  CL: USCS Low Plasticity Clay
-  CL-ML: USCS Low Plasticity Silty Clay
-  MH: USCS Elastic Silt
-  ML: USCS Silt
-  SP: USCS Poorly Graded Sand
-  SM: USCS Silty Sand
-  SC: USCS Clayey Sand
-  SP-SM: USCS Poorly Graded Sand w/ Silt
-  SC-SM: USCS Silty, Clayey Sand
-  SP-SC: USCS Poorly Graded Sand w/ Clay
-  No Recovery

SOIL TEST ID'S

B-# SOIL TEST BORING

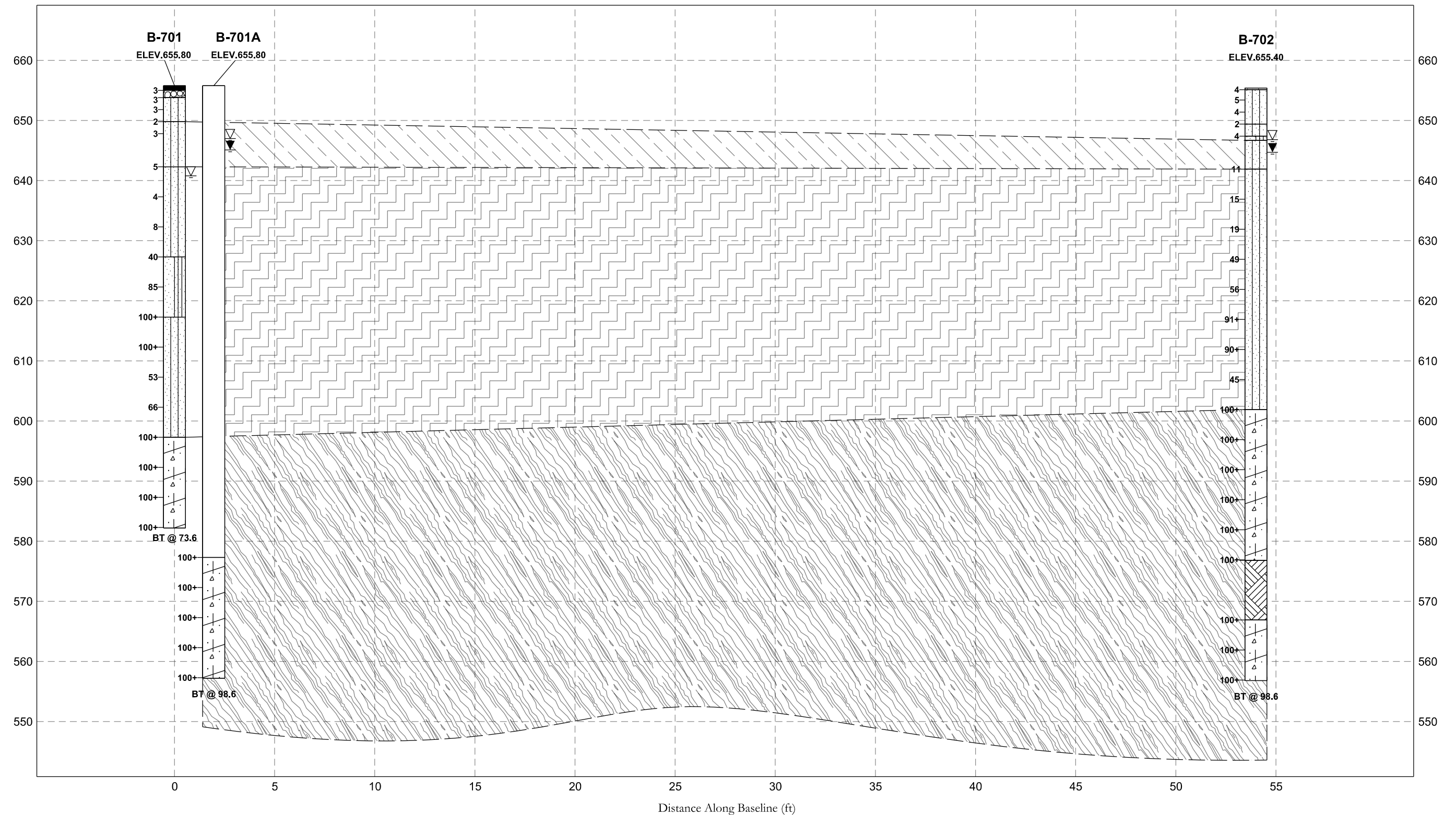
ABBREVIATIONS

- LL - LIQUID LIMIT (%)
- PL - PLASTIC LIMIT (%)
- PI - PLASTIC INDEX (%)
- NMC - MOISTURE CONTENT (%)
- NP - NON PLASTIC
- %#200 - PERCENT PASSING NO. 200 SIEVE
-  Water Level at Time
Drilling, or as Shown
-  Water Level at End of
Drilling, or as Shown

NOTES

1. THE GENERALIZED SUBSURFACE PROFILES ARE PROVIDED ONLY FOR ILLUSTRATIVE PURPOSES. THE INTENT OF THESE DRAWINGS IS TO PROVIDE THE READER WITH VERY GENERAL INFORMATION ON SUBSURFACE CONDITIONS AT THE TIME OF THE INVESTIGATION. VARIATIONS IN THE INDICATED SUBSURFACE CONDITIONS WILL BECOME EVIDENT ONCE ADDITIONAL BORINGS ARE PERFORMED. THE INDICATED STRATIGRAPHY BETWEEN TESTING LOCATIONS WAS GENERATED USING STRAIGHT-LINE LINEAR INTERPOLATION, AND DOES NOT REPRESENT THE TRUE STRATIGRAPHY.

Elevation (ft-MSL)



ALLUVIUM



RESIDUUM



PWR

The generalized subsurface profile is provided for illustrative purposes. The intent of this drawing is to provide the reader with very general information on soil stratigraphy at the bridge site. Variations in the indicated subsurface conditions will become evident once additional borings are performed.

4			
3			
2			
1			
REV. NO.	BY	DATE	DESCRIPTION OF REVISION
TOPO.	JFH	DATE	8.27.19
DWG.	JFH	DATE	8.27.19
R/W		DATE	



**S-30-340 BRIDGE REPLACEMENT
OVER MOUNTAIN CREEK**

GENERALIZED SUBSURFACE PROFILE

HRZ SCALE = NTS

VRT SCALE = NTS

S-30-340 Replacement Bridge over Mountain Creek

Geotechnical Base Line Report

APPENDIX

SECTION 6 LABORATORY TEST RESULTS



SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 1

PROJECT ID P038302

PROJECT NAME S-30-340 Replacement Bridge over Mountain Creek

PROJECT COUNTY Laurens

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-701	10.0				4.76	47					
B-701	15.0	NP	NP	NP	4.76	24	SM	37.3			
B-701	25.0				9.51	28		31.7			
B-702	8.0	NP	NP	NP	4.76	48	SM				
B-702	15.0				4.76	22		19.4			
B-702	20.0	NP	NP	NP	4.76	21	SM	20.3			
B-702	30.0				19	20		15.6			
B-702	50.0	NP	NP	NP	9.51	14	SM				

F&ME CONSULTANTS
3112 Devine Street
Columbia, South Carolina 29205

MOISTURE CONTENT DETERMINATION
(AASHTO T265)

PROJECT:	<u>S-30-340 Replacement Bridge over Mountain Creek</u>	PROJECT NO.:	<u>P038302</u>
SAMPLE NUMBER:	<u>19-1603</u>	DATE SAMPLE RECEIVED:	<u>6/18/2019</u>
DESCRIPTION OF SOIL:	<u>VARIOUS</u>		
TESTED BY:	<u>AMC</u>	DATE OF TESTING:	<u>8/7/2019</u>
WEIGHED BY:	<u>AMC</u>	DATE OF WEIGHING:	<u>8/8/2019</u>

BORING NO.	B-701	B-701	B-701		
SAMPLE NO.	SS-6	SS-8	SS-10		
SAMPLE DEPTH	13.5-15'	23.5-25'	33.5-35'		
WATER CONTENT, W%	37.3	31.7	14.3		

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

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

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

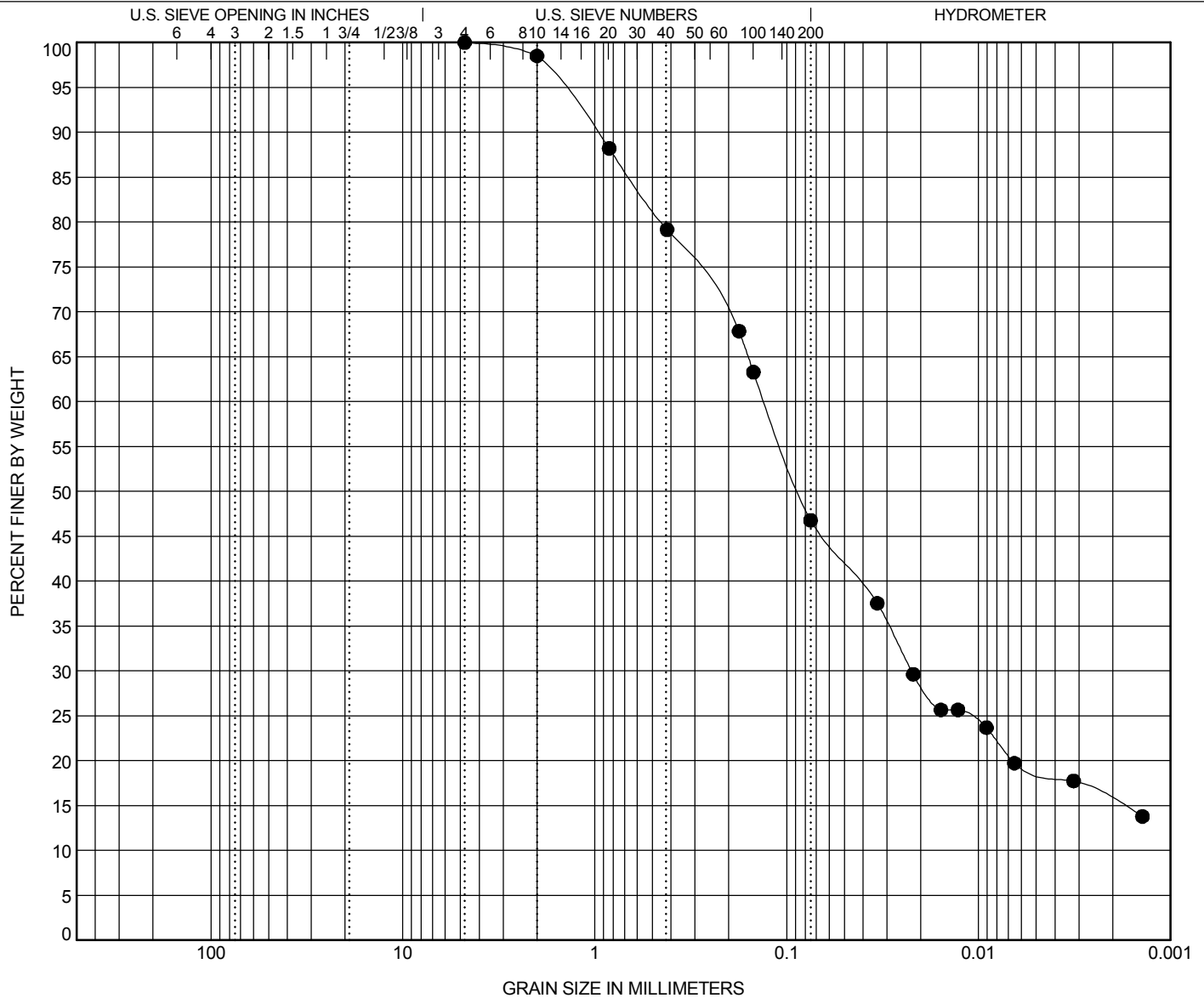


GRAIN SIZE DISTRIBUTION

PROJECT ID P038302

PROJECT NAME S-30-340 Replacement Bridge over Mountain Creek

PROJECT COUNTY Laurens



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-701	10.0	Silty SAND (SM)									
BOREHOLE	DEPTH	D100	D95	D50	D10	%Gravel	%Sand	%Silt	%Clay		
● B-701	10.0	4.76	1.488	0.086		0.0	53.2	27.8	19.0		

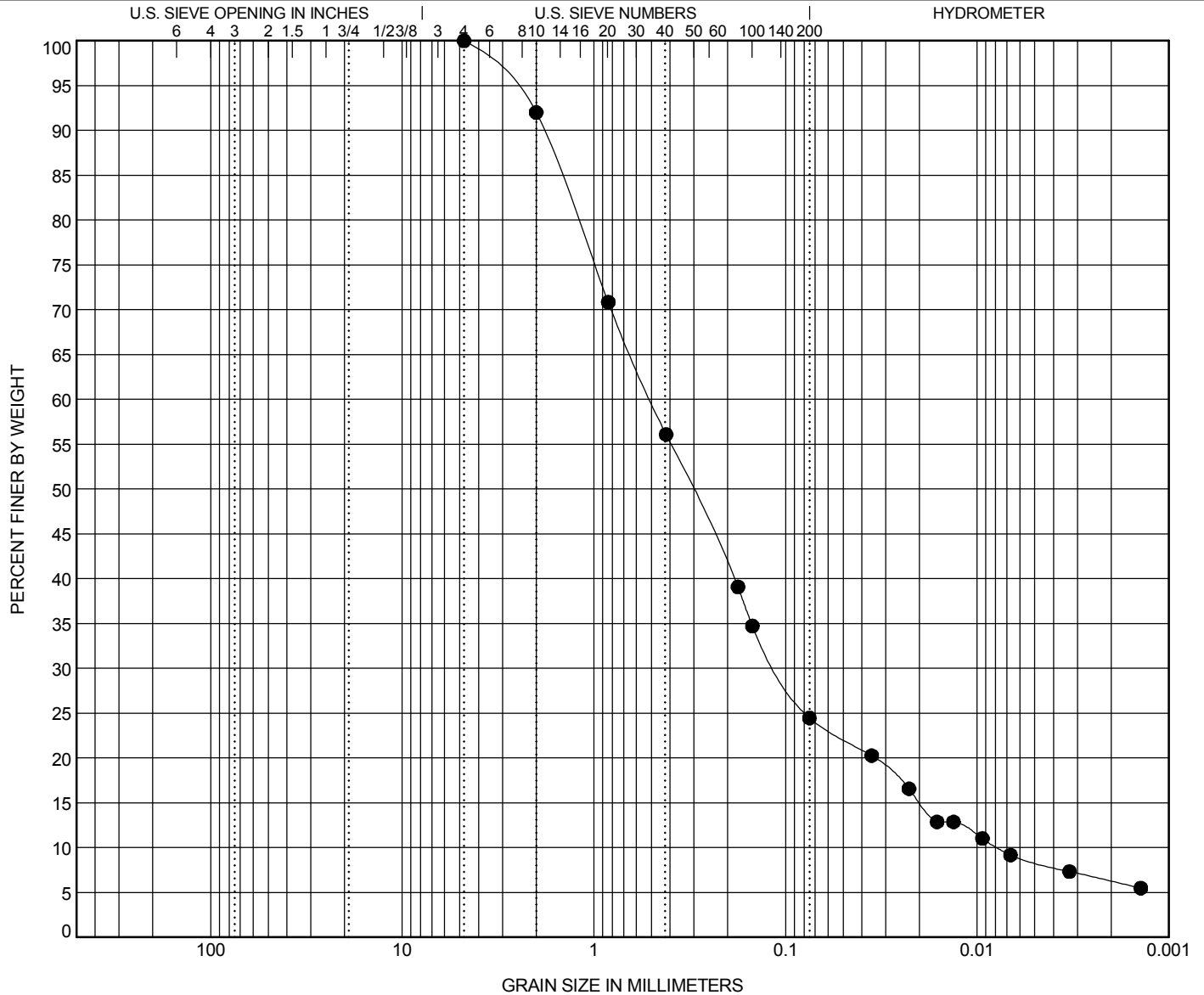


GRAIN SIZE DISTRIBUTION

PROJECT ID P038302

PROJECT NAME S-30-340 Replacement Bridge over Mountain Creek

PROJECT COUNTY Laurens



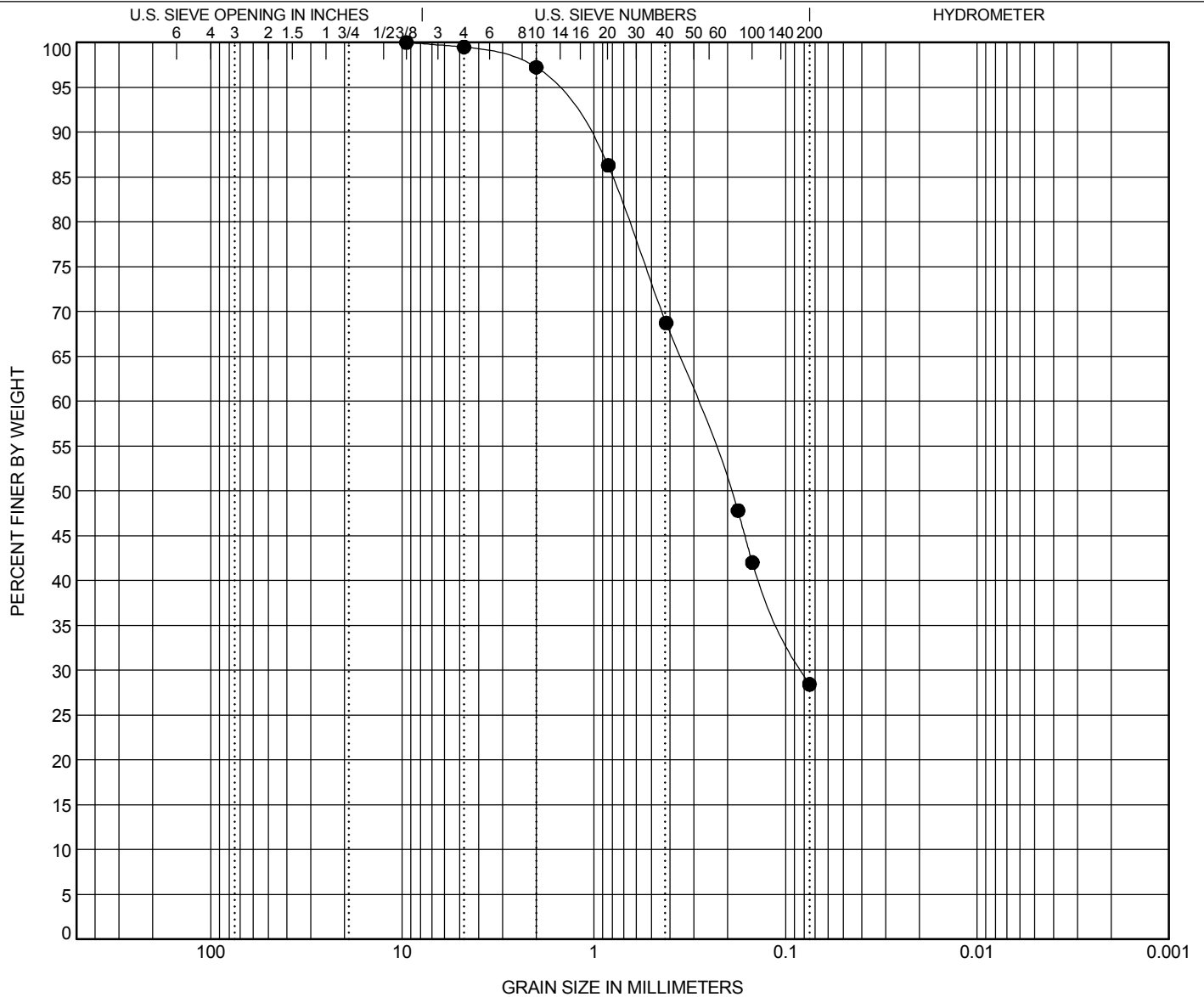


GRAIN SIZE DISTRIBUTION

PROJECT ID P038302

PROJECT NAME S-30-340 Replacement Bridge over Mountain Creek

PROJECT COUNTY Laurens



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

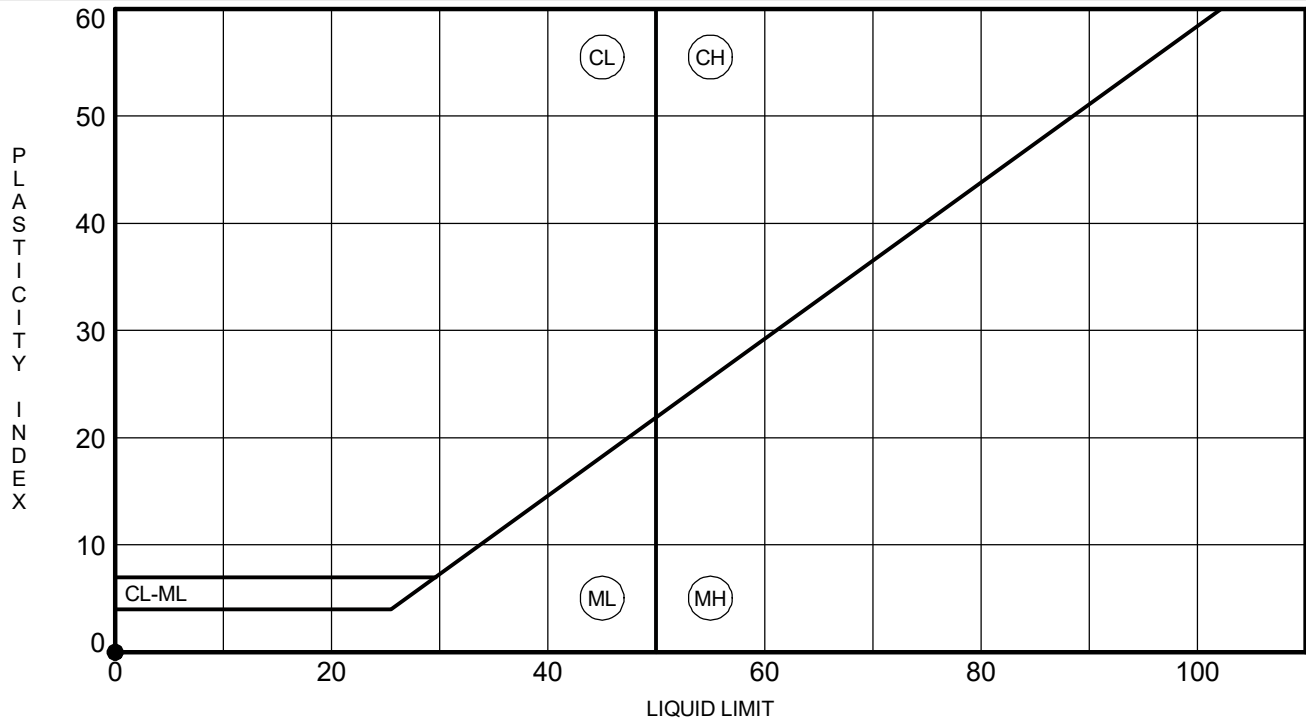
BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-701	25.0	Silty SAND (SM)									
BOREHOLE	DEPTH	D100	D95	D50	D10	%Gravel	%Sand	%Silt		%Clay	
● B-701	25.0	9.51	1.674	0.194		0.5	71.1	28.4			

ATTERBERG LIMITS' RESULTS

PROJECT ID P038302

PROJECT NAME S-30-340 Replacement Bridge over Mountain Creek

PROJECT COUNTY Laurens

[illegible]

F&ME CONSULTANTS
3112 Devine Street
Columbia, South Carolina 29205

MOISTURE CONTENT DETERMINATION
(AASHTO T265)

PROJECT:	<u>S-30-340 Replacement Bridge over Mountain Creek</u>	PROJECT NO.:	<u>P038302</u>
SAMPLE NUMBER:	<u>19-1647</u>	DATE SAMPLE RECEIVED:	<u>6/18/2019</u>
DESCRIPTION OF SOIL:	<u>VARIOUS</u>		
TESTED BY:	<u>AMC</u>	DATE OF TESTING:	<u>8/7/2019</u>
WEIGHED BY:	<u>AMC</u>	DATE OF WEIGHING:	<u>8/8/2019</u>

BORING NO.	B-702	B-702	B-702		
SAMPLE NO.	SS-6	SS-7	SS-9		
SAMPLE DEPTH	13.5-15'	18.5-20'	28.5-30'		
WATER CONTENT, W%	19.4	20.3	15.6		

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

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

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

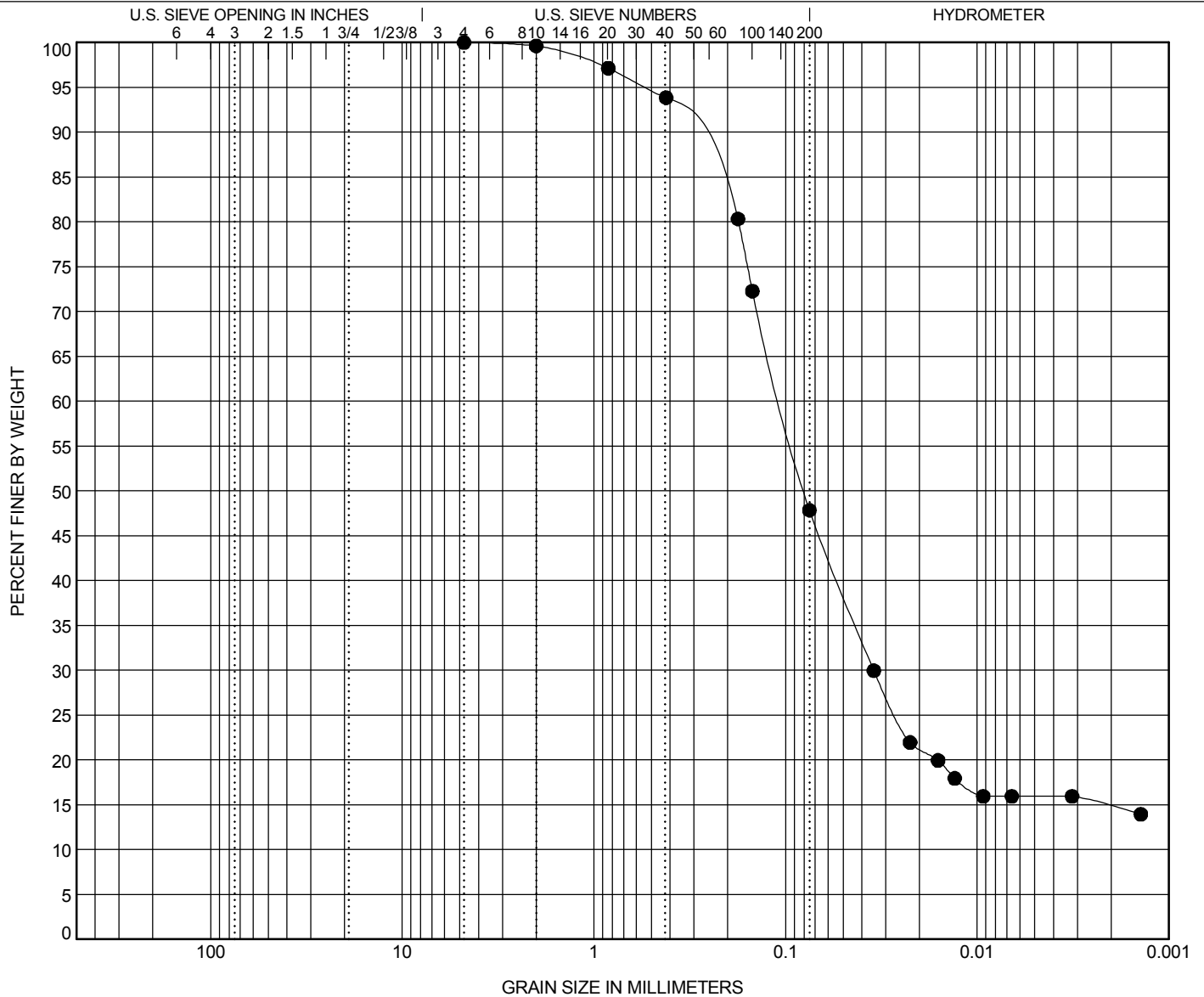


GRAIN SIZE DISTRIBUTION

PROJECT ID P038302

PROJECT NAME S-30-340 Replacement Bridge over Mountain Creek

PROJECT COUNTY Laurens



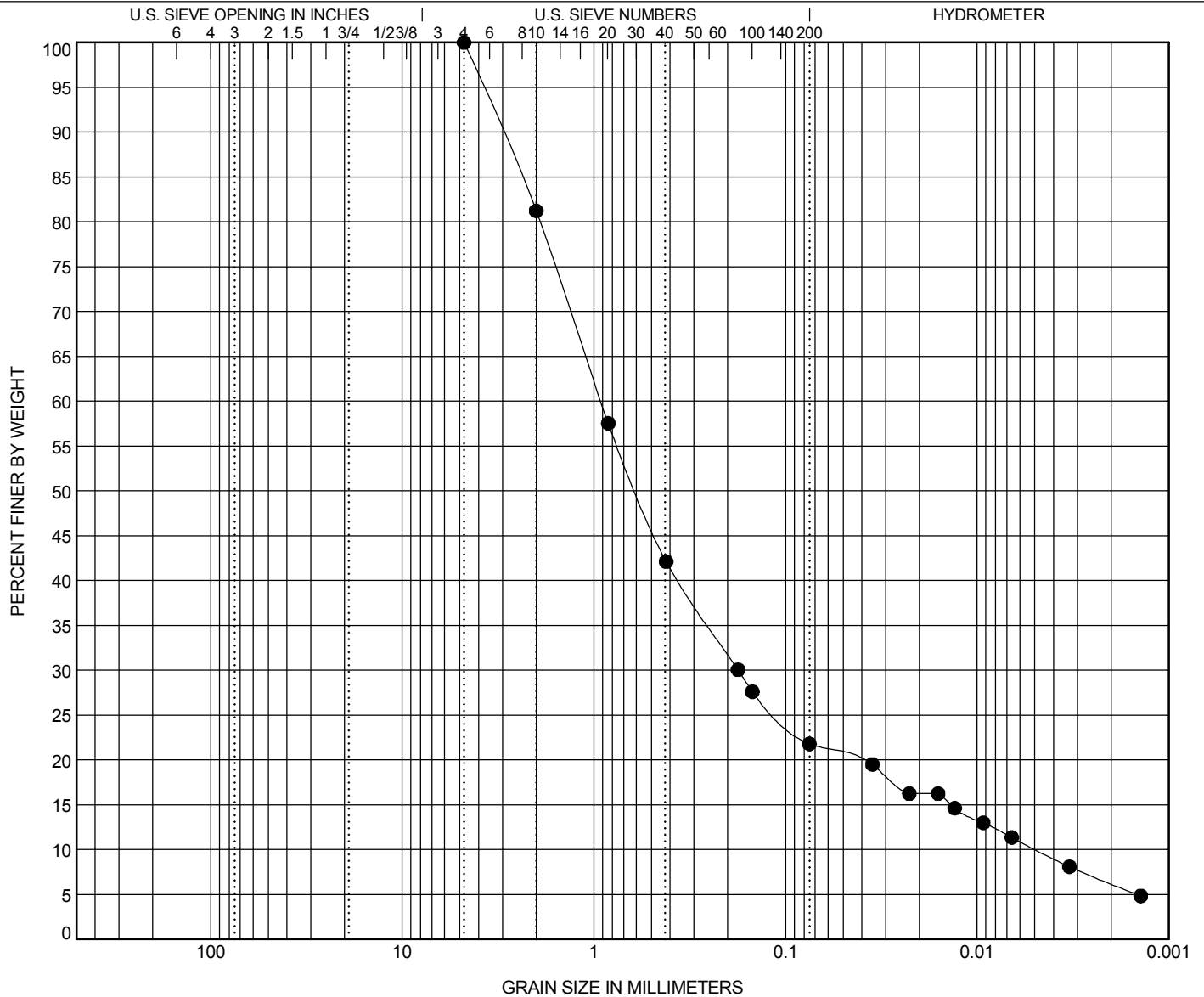


GRAIN SIZE DISTRIBUTION

PROJECT ID P038302

PROJECT NAME S-30-340 Replacement Bridge over Mountain Creek

PROJECT COUNTY Laurens



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-702	15.0	Silty SAND (SM)								6.84	186.26
BOREHOLE	DEPTH	D100	D95	D50	D10	%Gravel	%Sand	%Silt	%Clay		
● B-702	15.0	4.76	3.778	0.599	0.005	0.0	78.2	11.7	10.1		

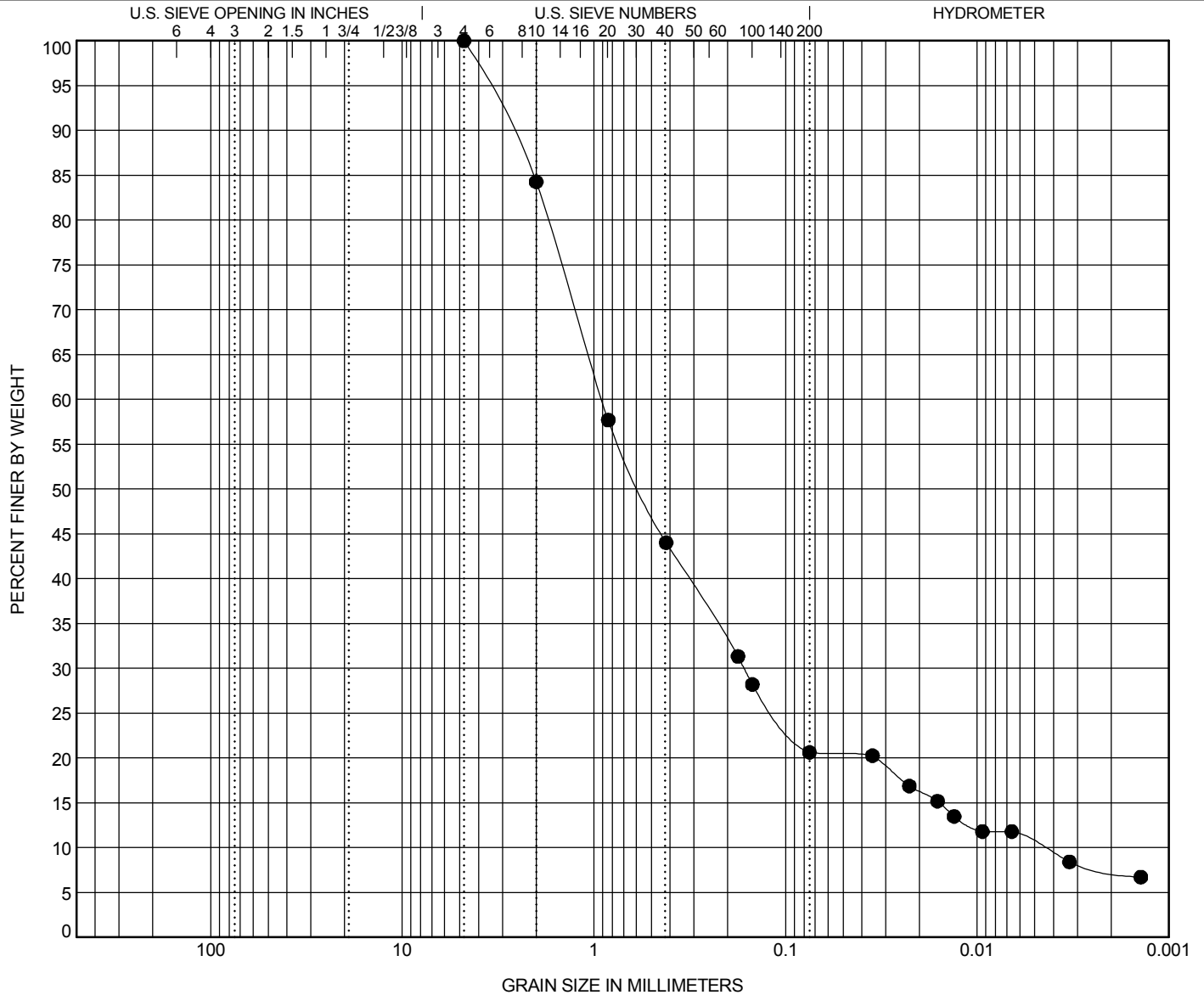


GRAIN SIZE DISTRIBUTION

PROJECT ID P038302

PROJECT NAME S-30-340 Replacement Bridge over Mountain Creek

PROJECT COUNTY Laurens



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-702	20.0	Silty SAND (SM/A-1-b)					NP	NP	NP	6.54	198.64
BOREHOLE	DEPTH	D100	D95	D50	D10	%Gravel	%Sand	%Silt	%Clay		
● B-702	20.0	4.76	3.613	0.569	0.005	0.0	79.3	10.2	10.4		

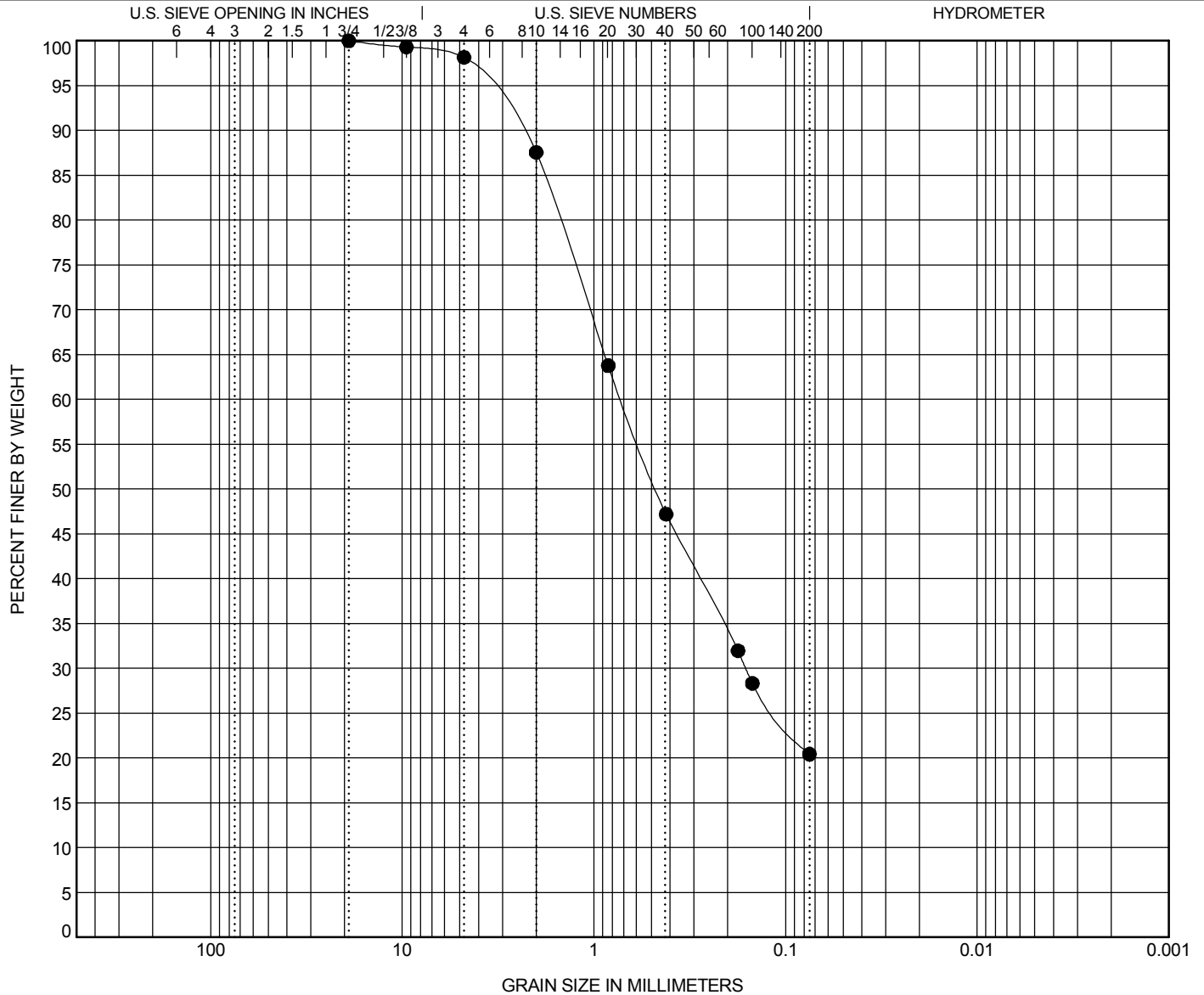


GRAIN SIZE DISTRIBUTION

PROJECT ID P038302

PROJECT NAME S-30-340 Replacement Bridge over Mountain Creek

PROJECT COUNTY Laurens



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-702	30.0	Silty SAND (SM)									
BOREHOLE	DEPTH	D100	D95	D50	D10	%Gravel	%Sand	%Silt		%Clay	
● B-702	30.0	19	3.675	0.472		1.9	77.7	20.4			

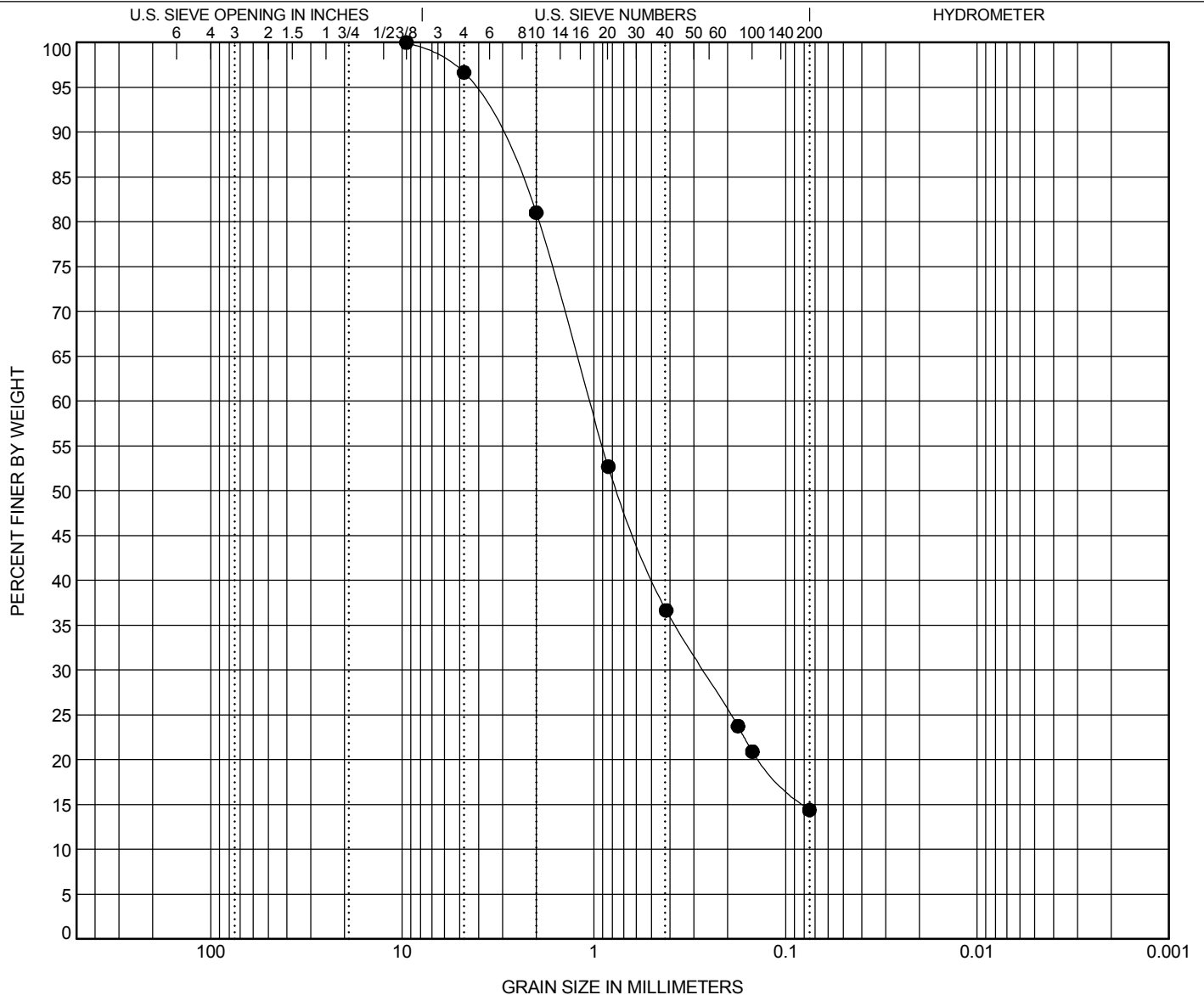


GRAIN SIZE DISTRIBUTION

PROJECT ID P038302

PROJECT NAME S-30-340 Replacement Bridge over Mountain Creek

PROJECT COUNTY Laurens



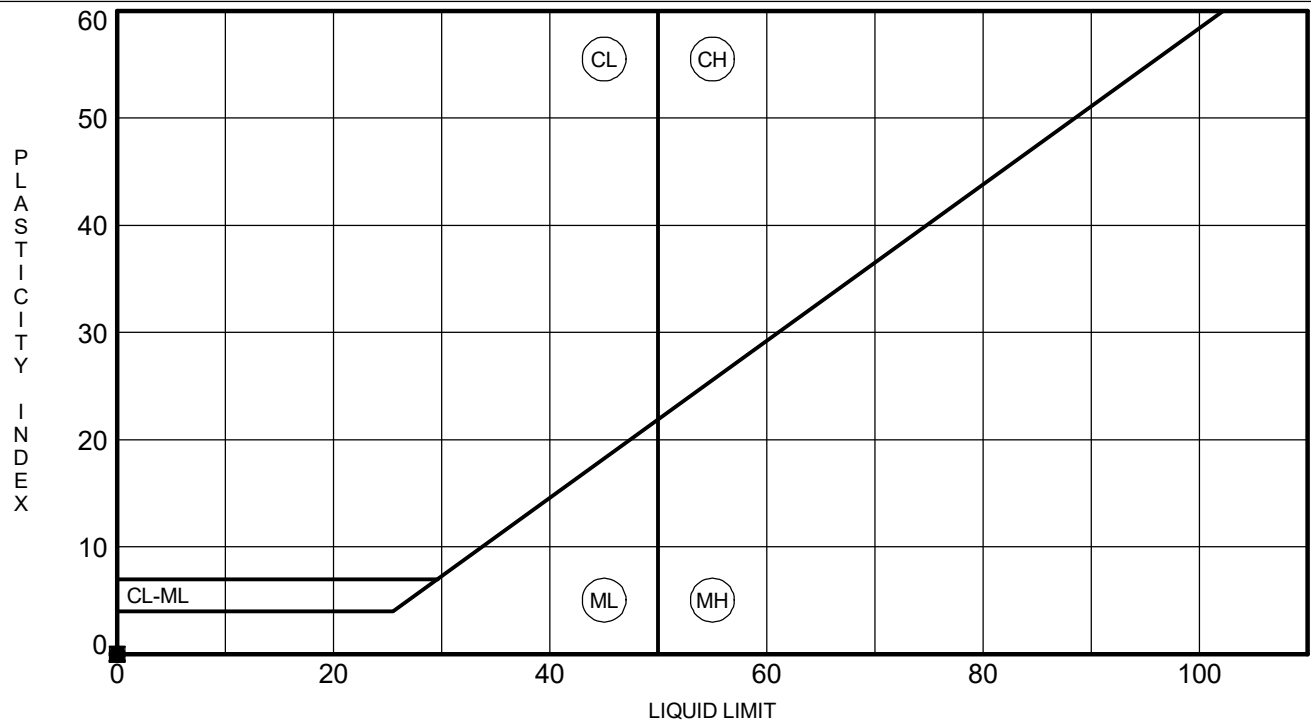
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-702	50.0	Silty SAND (SM/A-1-b)					NP	NP	NP		
BOREHOLE	DEPTH	D100	D95	D50	D10	%Gravel	%Sand	%Silt		%Clay	
● B-702	50.0	9.51	4.34	0.748		3.4	82.2	14.4			



PROJECT ID P038302

PROJECT NAME S-30-340 Replacement Bridge over Mountain Creek

PROJECT COUNTY Laurens[illegible]

Corrosivity Testing

Client F&ME Consultants
 Client Project G6100.050 Load Restricted Bridge Package 2020-1
 Project No. 42301

Lab Sample ID	Boring	Depth	Sample	Matrix	pH AASHTO T289			Chloride AASHTO T291 (Method B)			Sulfate AASHTO T290 (Method B)			Min. Soil Resistivity AASHTO T288		
					Result	Date Tested	Tested By	Result mg/kg (ppm)	Date Tested	Tested By	Result mg/kg (ppm)	Date Tested	Tested By	Result, Ohm-cm	Date Tested	Tested By
42301013	G6100.050.00001	B-901	0.0' - 10.0'	Soil	5.3	8/27/2019	AMP	75	8/29/2019	AMP	<30	8/28/2019	AMP	16,500	8/27/2019	AMP
42301014	G6100.050.00002	B-802	0.0' - 10.0'	Soil	5.4	8/27/2019	AMP	47	8/29/2019	AMP	<30	8/28/2019	AMP	9,850	8/27/2019	AMP
42301015	G6100.050.00003	B-1001	0.0' - 10.0'	Soil	5.7	8/27/2019	AMP	<10	8/29/2019	AMP	<30	8/28/2019	AMP	16,500	8/27/2019	AMP
42301016	G6100.050.00004	B-602	0.0' - 10.0'	Soil	5.6	8/27/2019	AMP	<10	8/29/2019	AMP	<30	8/28/2019	AMP	15,500	8/27/2019	AMP
42301017	G6100.050.00005	B-501	0.0' - 10.0'	Soil	6.0	8/27/2019	AMP	75	8/29/2019	AMP	<30	8/28/2019	AMP	4,900	8/27/2019	AMP
42301018	G6100.050.00006	B-701	0.0' - 10.0'	Soil	5.2	8/27/2019	AMP	<10	8/29/2019	AMP	<30	8/28/2019	AMP	18,000	8/27/2019	AMP
42301019	G6100.050.00007	B-1202	0.0' - 10.0'	Soil	5.5	8/27/2019	AMP	38	8/29/2019	AMP	88	8/28/2019	AMP	1,700	8/27/2019	AMP
42301020	G6100.050.00008	B-1602	0.0' - 10.0'	Soil	6.1	8/27/2019	AMP	136	8/29/2019	AMP	<30	8/28/2019	AMP	3,500	8/27/2019	AMP
42301021	G6100.050.00009	B-402	0.0' - 10.0'	Soil	5.9	8/27/2019	AMP	<10	8/29/2019	AMP	<30	8/28/2019	AMP	10,500	8/29/2019	AMP
42301022	G6100.050.00010	B-301	0.0' - 10.0'	Soil	7.5	8/27/2019	AMP	40	8/29/2019	AMP	28	8/28/2019	AMP	2,200	8/29/2019	AMP
42301023	G6100.050.00011	B-202	0.0' - 10.0'	Soil	5.9	8/27/2019	AMP	<10	8/29/2019	AMP	36	8/28/2019	AMP	7,200	8/29/2019	AMP
42301024	G6100.050.00012	B-101	0.0' - 10.0'	Soil	6.2	8/27/2019	AMP	<10	8/29/2019	AMP	<30	8/28/2019	AMP	6,000	8/29/2019	AMP
42301025	G6100.050.00013	B-1302	0.0' - 10.0'	Soil	4.9	8/27/2019	AMP	40	8/29/2019	AMP	<30	8/28/2019	AMP	8,500	8/28/2019	AMP
42301026	G6100.050.000014	B-1402	0.0' - 10.0'	Soil	5.2	8/27/2019	AMP	<10	8/29/2019	AMP	<30	8/28/2019	AMP	11,000	8/28/2019	AMP
42301027	G6100.050.00015	B-1501	0.0' - 10.0'	Soil	5.8	8/27/2019	AMP	<10	8/29/2019	AMP	<30	8/28/2019	AMP	11,000	8/28/2019	AMP
42301028	G6100.050.00016	B-1102	0.0' - 10.0'	Soil	5.7	8/27/2019	AMP	78	8/29/2019	AMP	<30	8/28/2019	AMP	5,200	8/28/2019	AMP

Input Validation: AMP

Reviewed By: ALO