BRIDGE GEOTECHNICAL PRELIMINARY REPORT – LRFD

PROJECT NAME: Replace Bridge over Fishing Creek
ROAD: S-103
PIN NO.: 31919
FILE NO.: 46.169B.1
COUNTY: York County
DATE: January 22, 2010

The Regional Production Group 3-Geotechnical Design Section (RPG3-GDS) has completed the LRFD Bridge Geotechnical Preliminary Report for the replacement of the bridge over Fishing Creek on S-103 in York County, South Carolina. This preliminary report presents anticipated foundation recommendations, preliminary point-of-fixity, and preliminary seismic design information. The recommendations provided herein are based on a review of five boring records (borings B-2 and B-6) that were performed for a bridge replacement over Fishing Creek on Secondary Road S-103.

Project Description: The GDS understands that the existing bridge over Fishing Creek is to be replaced. ~~with a Type IV girder bridge approximately 360 feet (90' 90' 90' 90') in length.~~ The clear roadway width will be 34 feet. The GDS understands that the proposed bridge will be replaced on a new horizontal and vertical alignment and that the vertical grade will be raised approximately 5 feet. The existing bridge will be closed and traffic detoured during the construction of the new bridge. The GDS understands that the design squad is considering the use of HP 14x73 steel H-piles for support of the end bents with 42-inch columns to 48-inch drilled shafts with 42-inch rock sockets at the interior bents

Soil Classification: Five (5) soil borings were conducted along the proposed alignment for the bridge over Fishing Creek. The soil borings were conducted at or near proposed bent locations. Based on the geographic location of this site and borings taken at the various locations (See Table 1), soils encountered at this site are considered typical of the Inner Piedmont Physiographic Province of South Carolina. The soils at the road and bridge consist primarily of fine to medium SANDS and sandy CLAY. These soils were underlain by very dense Partially Weathered Rock. Depths to top of the partially weathered rock ranged from Elevation 516 ft-msl - 523 ft-msl, to auger refusal. The soil test boring logs are preliminary boring logs and laboratory results are presented in the appendices of this report.

Table 1: Summary of Boring Locations – Fishing Creek

Boring	Location	Offset from Proposed CL
B-2	Road	13 ft L
B-3	Interior Bent	2 ft R
B-4	Interior Bent	15 ft L
B-5	Interior Bent	30 ft L
B-6	End Bent	9 ft L

Scour Study: The Hydraulic Engineering Section has not completed a scour analysis for the site. The GDS has forwarded the soil testing data to Hydraulic Engineering Section to be used for the scour analysis. For the end bents, we recommend the use of rip-rap to prevent scour.

Liquefaction Design: Based on our preliminary analysis, potential for liquefaction does not appear to be present at this site.

Seismic Design: A seismic site class evaluation was performed using the 2008 Seismic Design Specifications for Highway Bridges Manual and latest interim revisions. Based on the soil boring logs and Seismic Shear Wave Velocity Testing, the Seismic Soil Class for the soils encountered at the bridge over Fishing Creek has been determined to be "C". It is our understanding that the proposed bridge will have a Bridge Operational Classification (OC) of "II". The OC should be confirmed by the Structural Engineer. Based on Table 3.5 in the 2008 Seismic Design Specifications for Highway Bridges and the $S_{D1\text{-}SEEb}$ value of 0.10g, the Seismic Design Category (SDC) for the bridge is "A". The three-point method, Acceleration Design Response Spectrum (ADRS), used at this site includes the Safety Evaluation Earthquake (SEE) and the Functional Evaluation Earthquake (FEE). The SEE, which has a 3% probability of return in 75 years or an occurrence rate, is approximately 2,500 years. The Peak Ground Acceleration (PGA) is 0.12g for the SEE design event. The (FEE), which has a 15% probability of return in 75 years or an occurrence rate, is approximately 2,500 years. The Peak Ground Acceleration (PGA) is 0.06g for the FEE design event. The SEE and the FEE Acceleration Design Response Spectrum (ADRS) is attached in Appendix A.

Foundation Recommendations:

RBO Fishing Creek (46.031919B.01)

1. Locate the new foundations so that the existing bridge foundations at this site will not interfere with the proposed foundations of the new bridge.

2. For the end bents, the use of HP 14x73 Grade A36 steel (minimum yield strength 50 ksi) piling with reinforced pile tips designed to penetrate partially weathered rock is anticipated.

3. The preliminary point-of-fixity for the HP 14x73 steel piles at the end bent locations is estimated at Elevation 531 ft-msl.

4. For interior bents, based on shallow depth to rock, the use of 48-inch drilled shaft and a rock socket with a diameter of 42-inches is anticipated.

5. The preliminary point-of-fixity for the 48-inch drilled shaft with 42-inch diameter rock socket at soil test boring B-3 is estimated at Elevation 513 ft-msl, at B-4 is estimated at Elevation 505 ft-msl, and at B-5 is estimated at Elevation 508 ft-msl.

If you have any questions or comments, please feel free to let us know.

Melissa A. Jackson
Geotechnical Professional

Terry Koon, PE
RPG 3 Midlands Structural Design Engineer

MAJ/TK: maj
cc: RPG3 Geotechnical File

Appendix A

Acceleration Design Response Spectrum (ADRS)

Bridge Boring Logs

Laboratory Results

Buckling Point of Fixity

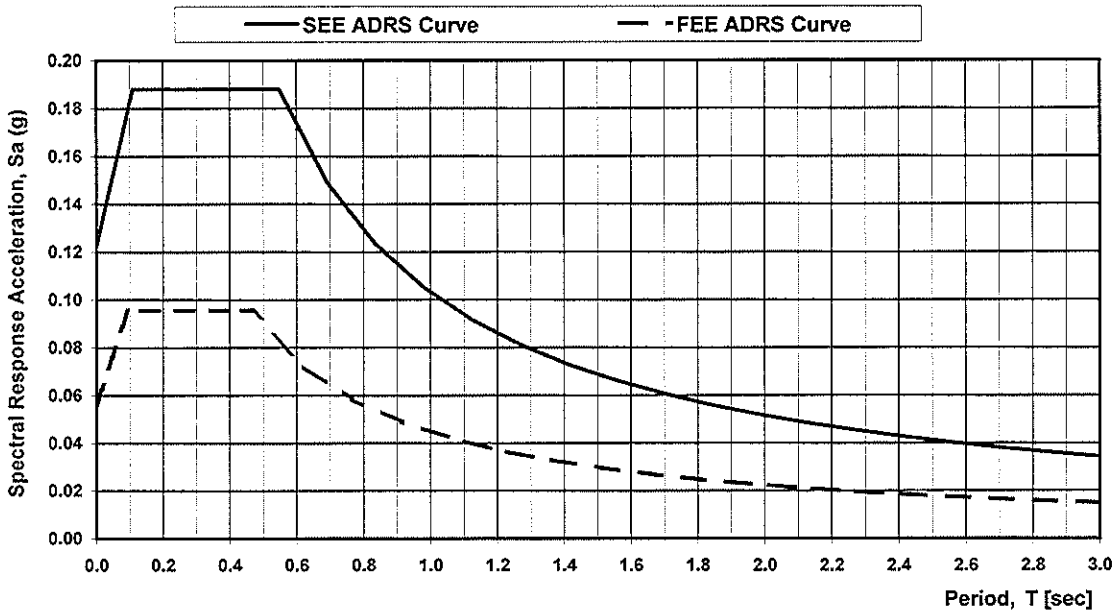
SC Seismic Hazard Map
Three-Point ADRS Curves

PIN No.	31919	File No:	46.169B.1	Latitude:	34.905
Route:	S-103	County:	York	Longitude:	81.1070
Project:	RPO Fishing Creek				

Designer:	M. Jackson - Midlands RPG
Date:	12/21/2009

Design EQ	PGA	S_{DS}	S_{D1}	M_W	R (km)	Geologic Condition	Site Class
FEE	0.06	0.10	0.04	7.345	181.35	Hard Rock Basement Outcrop	C
SEE	0.12	0.19	0.10	7.37	181.2	Hard Rock Basement Outcrop	C

SC Seismic Hazard Map Three-Point ADRS Curve



FEE ADRS Curve
Three-Point Method

	T	S_a
	0.00	0.06
	0.02	0.06
	0.03	0.07
	0.05	0.08
	0.06	0.08
	0.08	0.09
To	0.09	0.10
	0.12	0.10
	0.16	0.10
	0.19	0.10
	0.22	0.10
	0.25	0.10
	0.28	0.10
	0.31	0.10
	0.34	0.10
	0.37	0.10
	0.41	0.10
	0.44	0.10
Ts	0.47	0.10
	0.62	0.07
	0.77	0.06
	0.91	0.05
	1.06	0.04
	1.21	0.04
	1.36	0.03
	1.51	0.03
	1.66	0.03
	1.81	0.02
	1.96	0.02
	2.11	0.02
	2.26	0.02
	2.40	0.02
	2.55	0.02
	2.70	0.02
	2.85	0.02
	3.00	0.01

SEE ADRS Curve
Three-Point Method

	T	Sa
	0.00	0.12
	0.02	0.13
	0.04	0.14
	0.05	0.16
	0.07	0.17
	0.09	0.18
To	0.11	0.19
	0.15	0.19
	0.18	0.19
	0.22	0.19
	0.26	0.19
	0.29	0.19
	0.33	0.19
	0.37	0.19
	0.40	0.19
	0.44	0.19
	0.48	0.19
	0.51	0.19
Ts	0.55	0.19
	0.69	0.15
	0.84	0.12
	0.98	0.11
	1.13	0.09
	1.27	0.08
	1.41	0.07
	1.56	0.07
	1.70	0.06
	1.85	0.06
	1.99	0.05
	2.13	0.05
	2.28	0.05
	2.42	0.04
	2.57	0.04
	2.71	0.04
	2.86	0.04
	3.00	0.03

SCDOT

S-103 (Oak Park Road) - RBO Fishing Creek
York County, South Carolina
File No. 46.169B.1; Project No. BR-BR46 (012) Pin. No. 31919

LOG OF BORING No. B-2

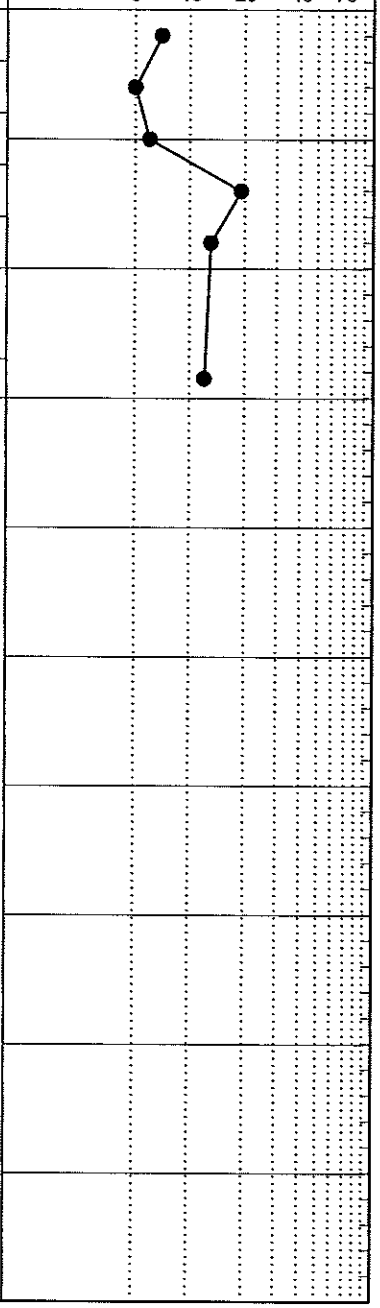
Station: 58+93
Offset: 13 Feet Left of Proposed Centerline

Date Drilled: 2/13/07
Supervisor: QORE (7272O)
Casing Length: NA
Ground Elevation: 539.0
Hammer Type: ☒ Gravity ☐ Automatic ☒ Other: CME-45
Water Level: 10.5 Ft. at TOB; 7 Ft. after 24 Hrs.
Drilling Method: HSA

Notes:
Coordinates: N34°54.312' W81°06.476'
Roadway

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0	Top of Ground						
	0.5	6 Inches Topsoil	0.0	SS-1	3	3	4	7
		Fill - Loose Brown, Gray, and Red Silty Fine to Medium Sand with Small Roots (SM)	2.0	SS-2	3	3	2	5
	4.0		4.0	SS-3	2	3	3	6
534.0	6.0	**Fill** - Firm Reddish Brown, Brown, and Gray Sandy Clay with Small Roots (CL)	6.0	SS-4	10	10	9	19
	8.0	**Alluvium** - Firm Brown, Gray, and Reddish Brown Silty Fine to Coarse Sand with Gravel (SM)	8.0	SS-5	3	5	8	13
529.0		**Residuum** - Stiff Grayish Brown, Brown, and Dark Brown Sandy Lean Clay (CL)	13.5	SS-6	4	5	7	12
	14.0							
524.0	15.0	Stiff Gray and Brown Sandy Clay (CL)						
		Boring Terminated at 15 Feet						

STD. PENETRATION TEST DATA (blows/ft)



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

S-103 (Oak Park Road) - RBO Fishing Creek
York County, South Carolina
File No. 46.169B.1; Project No. BR-BR46 (012) Pin. No. 31919

LOG OF BORING No. B-3

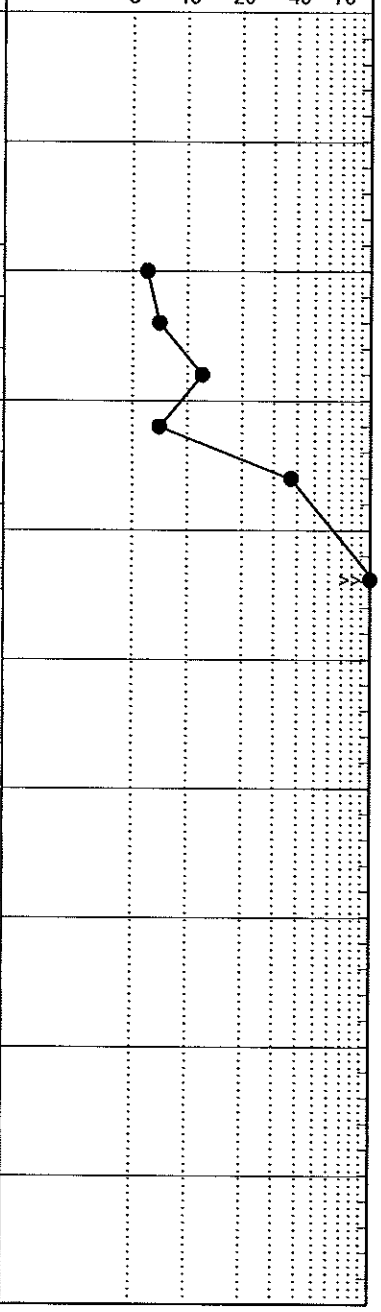
Station: 60+40
Offset: 2 Feet Right of Proposed Centerline

Date Drilled: 2/14/07
Supervisor: QORE (7272O)
Casing Length: 9
Ground Elevation: 540.0
Hammer Type: ☒ Gravity ☐ Automatic ☒ Other: CME-45
Water Level: 9 Ft. at TOB; 9.5 Ft. after 24 Hrs.
Drilling Method: HSA

Notes:
Coordinates: N34°54.333' W81°06.449'
IB

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0	Top of Bridge Deck						
	0.3	3 Inches Asphalt						
	1.0	8-1/2 Inches Concrete with Reinforcing Steel						
		Space Between Bottom of Bridge Deck and Ground Surface						
535.0								
	9.0	**Alluvium** - Firm Brown and Reddish Brown Sandy Lean Clay (CL)	9.0					
530.0			11.0	SS-1	3	3	3	6
	13.0	**Alluvium** - Firm Brown and Gray Clayey Fine to Medium Sand with Small Roots (SC)	13.0	SS-2	2	3	4	7
525.0	15.0	**Alluvium** - Loose Gray Poorly Graded Fine to Medium Sand with Silt and Wood Pieces (SP-SM)	15.0	SS-3	3	5	7	12
	17.0	**Residuum** - Dense Gray and Brown Fine to Coarse Sand with Silt and Gravel Fragments	17.0	SS-4	3	3	4	7
520.0	20.0	**Partially Weathered Rock** - Sampled as Very Dense Gray and Brown Fine to Coarse Sand with Gravel (PWR)		SS-5	15	17	20	37
			21.5	SS-6	50/2"			100+
515.0	25.0	Auger Refusal Encountered at 25 Feet; Boring Terminated						
513.0	27							
510.0								
505.0								
500.0								
495.0								

STD. PENETRATION TEST DATA (blows/ft)



LEGEND

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

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

SCDOT

S-103 (Oak Park Road) - RBO Fishing Creek
York County, South Carolina
File No. 46.169B.1; Project No. BR-BR46 (012) Pin. No. 31919

LOG OF BORING No. B-4

Station: 61+40
Offset: 15 Feet Left of Proposed Centerline

Date Drilled: 2/14/07
Supervisor: QORE (7272O)
Casing Length: 17
Ground Elevation: 540.0
Hammer Type: ☒ Gravity ☐ Automatic ☒ Other: CME-45
Water Level: 12 Ft. at TOB; 12 Ft. after 24 Hrs.
Drilling Method: HSA

Notes:
Coordinates: N34°54.335' W81°06.436'
IB

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0	Top of Bridge Deck							
	0.2	2-1/2 Inches Asphalt							
	1.0	9 Inches Concrete with Reinforcing Steel							
		Space Between Bottom of Bridge Deck and Creek Bed							
535.0									
530.0									
525.0									
	17.0			17.0					
	18.0	**Alluvium** - Firm Brownish Gray Fine to Coarse Sand with Silt (SP-SM)			SS-1	24	12	8	20
	19.0			19.0	SS-2	50/0"			100+
520.0	20	**Partially Weathered Rock** - Sampled as Very Dense Brown, Yellowish Brown, and Reddish Brown Silty Fine to Medium Sand (PWR)							
		Auger Refusal Encountered at 19 Feet; Boring Terminated							
515.0	25								
510.0	30								
505.0	35								
500.0									
495.0									

STD. PENETRATION TEST DATA (blows/ft)
5 10 20 40 70

LEGEND

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

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

SCDOT

S-103 (Oak Park Road) - RBO Fishing Creek
York County, South Carolina
File No. 46.169B.1; Project No. BR-BR46 (012) Pin. No. 31919

LOG OF BORING No. B-5

Station: 62+60
Offset: 30 Feet Left of Proposed Centerline

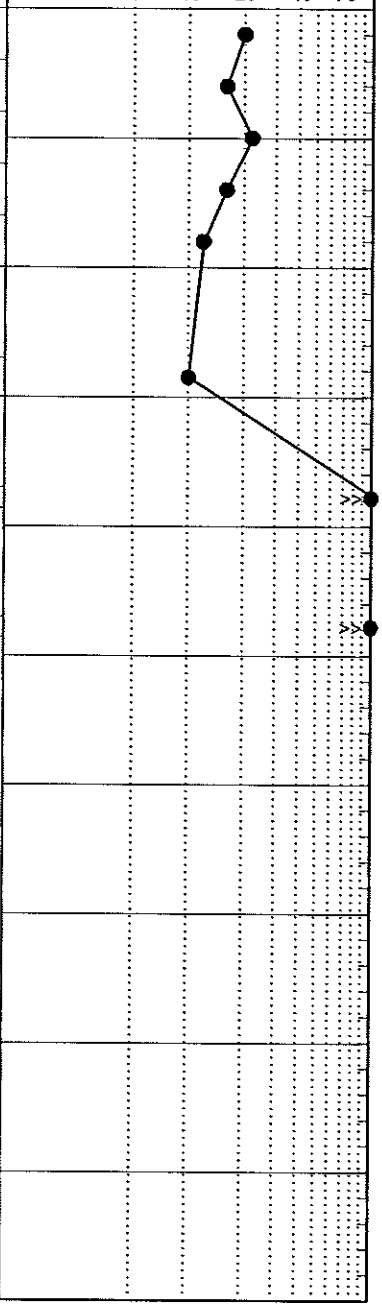
Date Drilled: 2/14/07
Supervisor: QORE (7272O)
Casing Length: NA
Ground Elevation: 540.0
Hammer Type: ☒ Gravity ☐ Automatic ☒ Other: CME-45
Water Level: 9 Feet at TOB
Drilling Method: HSA

Notes:
Coordinates: N34°54.340' W81°06.415'
Backfilled and patched with asphalt at time of boring completion.
IB

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION
	0.0	Top of Existing Roadway
	0.7	8 Inches Asphalt
	0.8	1 Inch Stone Base
	2.0	**Fill** - Firm Grayish Brown, Reddish Brown, and Brown Clayey Fine to Medium Sand (SC)
	4.0	**Fill** - Firm Grayish Brown Silty Fine to Medium Sand (SM)
535.0		
	8.0	**Fill** - Stiff Yellowish Brown and Reddish Brown Sandy Lean Clay (CL)
		Alluvium - Firm to Loose Reddish Brown, Light Brown, and Gray Silty Clayey Fine Sand (SC-SM)
530.0		
	14.0	**Residuum** - Loose Brown, Reddish Brown, and Gray Micaceous Silty Fine to Medium Sand (SM)
525.0		
523	17.0	**Partially Weathered Rock** - Sampled as Very Dense Gray, Brown, and White Micaceous Silty Fine to Coarse Sand (PWR)
520.0		
	23.0	**Partially Weathered Rock** - Sampled as Very Dense Grayish Brown, Brown, and Dark Brown Slightly Micaceous Silty Fine to Coarse Sand (PWR)
515.0	25.5	Auger Refusal Encountered at 25-1/2 Feet; Boring Terminated
510.0	30	
509		
508	32	
505.0		
500.0		
495.0		

Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
0.0	SS-1	10	9	11	20
2.0	SS-2	8	7	9	16
4.0	SS-3	6	10	12	22
6.0	SS-4	6	8	8	16
8.0	SS-5	4	5	7	12
13.5	SS-6	7	4	6	10
18.5	SS-7	50/5"			100+
23.5	SS-8	50/5"			100+

STD. PENETRATION TEST DATA (blows/ft)



LEGEND

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

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

SC_DOT 7272O.GPJ SC_DOT.GDT 6/8/07

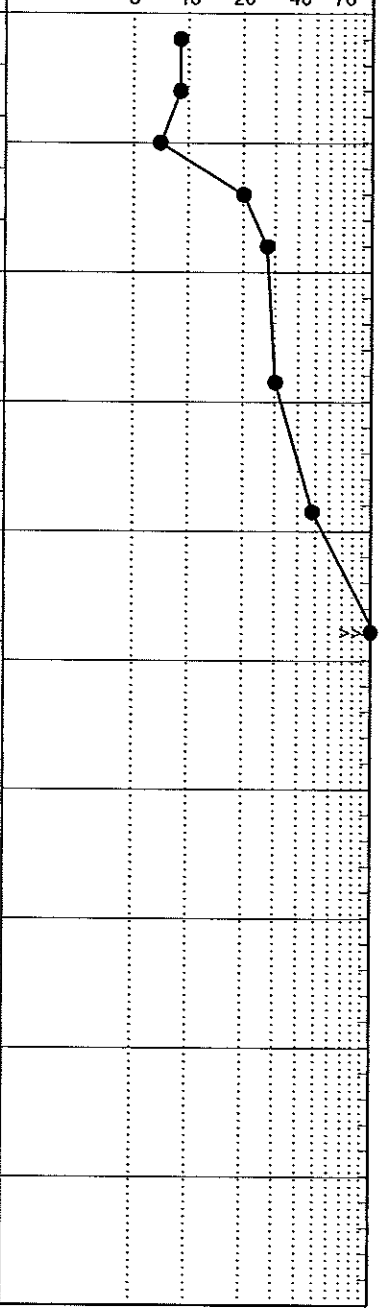
SCDOT

S-103 (Oak Park Road) - RBO Fishing Creek York County, South Carolina File No. 46.169B.1; Project No. BR-BR46 (012) Pin. No. 31919	LOG OF BORING No. B-6 Station: 63+52 Offset: 9 Feet Left of Proposed Centerline

Date Drilled: 2/14/07	Supervisor: QORE (7272O)	Notes: Coordinates: N34°54.344' W81°06.399' E B
Casing Length: NA	Ground Elevation: 538.0	
Hammer Type: ☒ Gravity ☐ Automatic ☒ Other: CME-45		
Water Level: 9.5 Ft. at TOB; 8 Ft. after 24 Hrs.	Drilling Method: HSA	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0	Top of Ground							
	0.5	6 Inches Topsoil		0.0	SS-1	3	4	5	9
		Fill - Stiff Brownish Red and Brown Sandy Lean Clay (CL)		2.0	SS-2	2	4	5	9
	4.0			4.0					
533.0		**Alluvium** - Firm Gray, Brown, and Dark Brown Sandy Silt (ML)			SS-3	3	3	4	7
532	6.0			6.0					
531		**Residuum** - Very Stiff Grayish Brown, Brown, and Dark Brown Sandy Silt (ML)			SS-4	6	9	11	20
530	8.0			8.0					
529		Very Firm Grayish Brown, Yellowish Brown, and Brown Silty Fine Sand (SM)			SS-5	6	15	12	27
528.0									
	12.0								
		Very Firm Reddish Brown, Yellowish Brown, and Brown Micaceous Silty Fine to Coarse Sand (SM)		13.5	SS-6	15	15	15	30
523.0									
	18.0								
		Dense Gray, Light Brown, and White Slightly Micaceous Fine to Coarse Sand with Silt and Gravel (SP-SM)		18.5	SS-7	12	28	20	48
518.0									
514	22.0	**Partially Weathered Rock** (No Sample Recovery for SS-8; Classified as PWR Based on SPT Values)		23.5	SS-8	50/0			100+
513.0	25.5								
		Auger Refusal Encountered at 25-1/2 Feet; Boring Terminated							
508.0									
503.0									
498.0									
493.0									

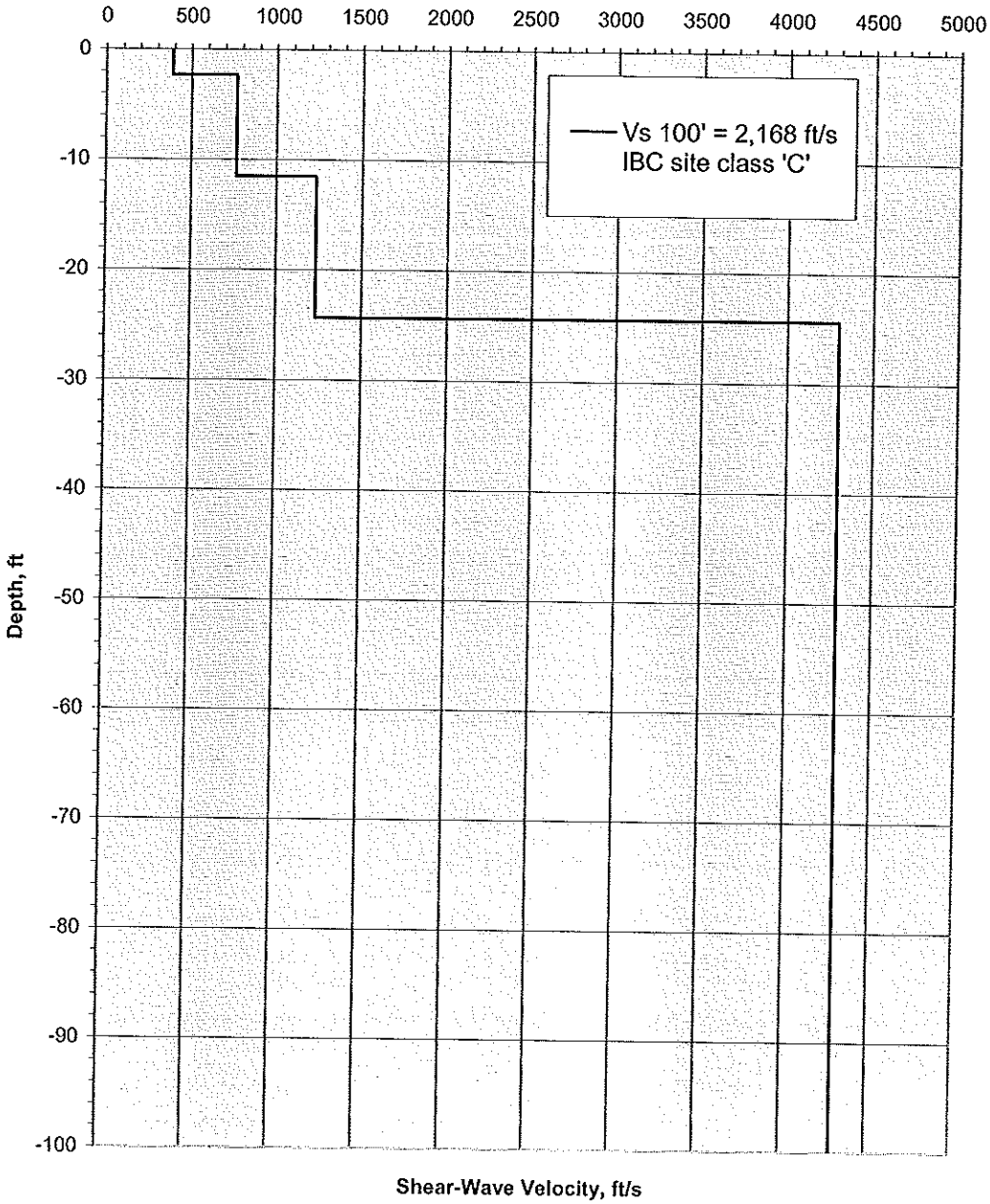
STD. PENETRATION TEST DATA (blows/ft)



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	

Job No. 7272O: S-103 (Oak Park Road) RBO Fishing Creek
File No. 46.169B.1; Project No. BR-BR46 (012) PIN No. 31919
Station: 63+77
Offset: 6 Feet Left of Proposed Centerline
Boring No. SA-1 Vs Model



SUMMARY OF LABORATORY INDEX TEST RESULTS
S-103 (Oak Park Road)-Replace Bridge Over Fishing Creek
York County, South Carolina
SCDOT Project No. BR-BR46(012); PIN No. 31919
QORE Job No. 7272O, Report No. 115235

Boring No.	Sample Depth (ft)	Sample No.	Soil Classification		% Fines (% Passing #200 Sieve)	Atterberg Limits		Moisture Content (%)
			AASHTO	USCS		Liquid Limit (%)	Plasticity Index (%)	
B-1	2-4	SS-2	[A-5]	[SM]	40.3	N/A	N/A	13.3
B-2	2-4	SS-2	[A-2-4]	[SM]	27.6	N/A	N/A	12.7
B-2	8-10	SS-5	A-4(2)	CL	60.2	24	8	18.1
B-3	9-11	SS-1	A-4(4)	CL	65.6	29	10	24.6
B-3	15-17	SS-4	[A-2-4]	[SP-SM]	10.4	N/A	N/A	36.1
B-5	6-8	SS-4	A-6(7)	CL	70.5	34	12	23.2
B-5	8-10	SS-5	A-2-4	SC-SM	29.7	22	5	18.7
B-5	13.5-15	SS-6	A-2-4	SM	26.9	31	6	24.7
B-6	2-4	SS-2	A-6(5)	CL	52.0	35	15	19.7
B-6	8-10	SS-5	A-4	SM	42.6	22	NP	16.9
B-7	4-6	SS-3	A-6(4)	CL	20.3	26	11	20.3
B-7	6-8	SS-4	A-6(16)	CL	72.9	39	25	19.0
B-8	2-4	SS-2	A-6(4)	CL	54.5	29	13	17.3
B-8	4-6	SS-3	A-6(6)	CL	51.4	30	19	17.6
Sta. 64+00	0-5	Bulk	A-4(1)	SC	44.9	26	9	16.9

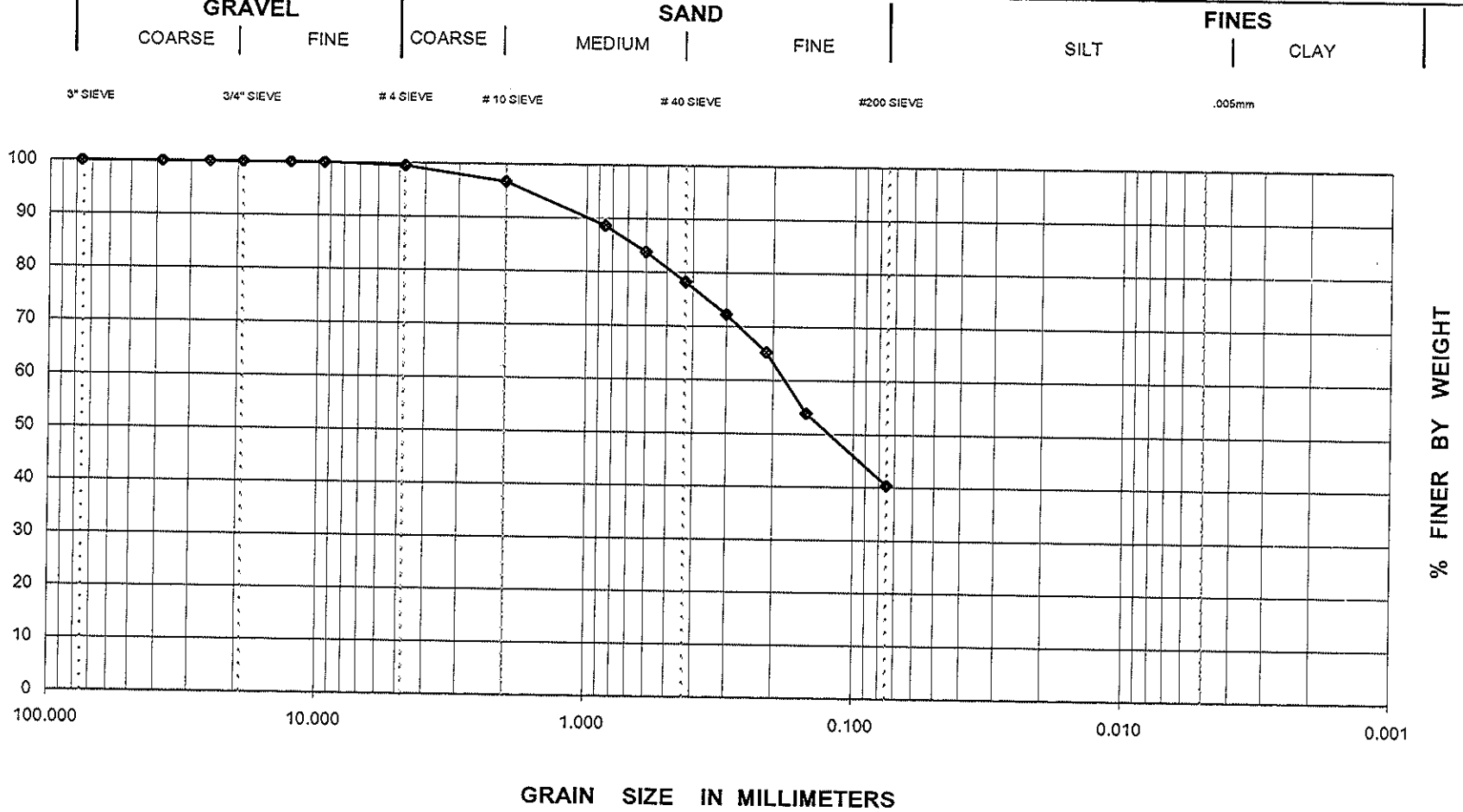
Notes: NP = Non-plastic; N/A = Test Not Performed

QORE™
PROPERTY SCIENCES

GRAIN SIZE DISTRIBUTION TEST REPORT
(ASTM D422)

AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	**REPORT NO. :**	115235	**DATE :**	5/30/2007	**REVIEWED BY :**	
BORING / PIT NO. :	B - 1	**DEPTH / ELEV. :**	2' - 4'	**SAMPLE NO. :**	SS-2	**SAMPLE TYPE :**	SS
SAMPLE LOCATION :	-						
SOIL DESCRIPTION :	Brown and Gray Silty Fine to Medium Sand					**SP. GRAVITY, Gs :**	-
LIQUID LIMIT, % :	N/A	**PLASTICITY INDEX , % :**	N/A	**MOISTURE , % :**	13.3	**FINES , % :**	40.3
D10 , MM :	-	**D30 , MM :**	-	**D60 , MM :**	0.18	**COEFF. OF CURVATURE , C_C :**	-
CLASSIFICATION		**UNIFIED :**	[SM]	**AASHTO :**	[A-5]	**COEFF. OF UNIFORMITY , C_U :**	-



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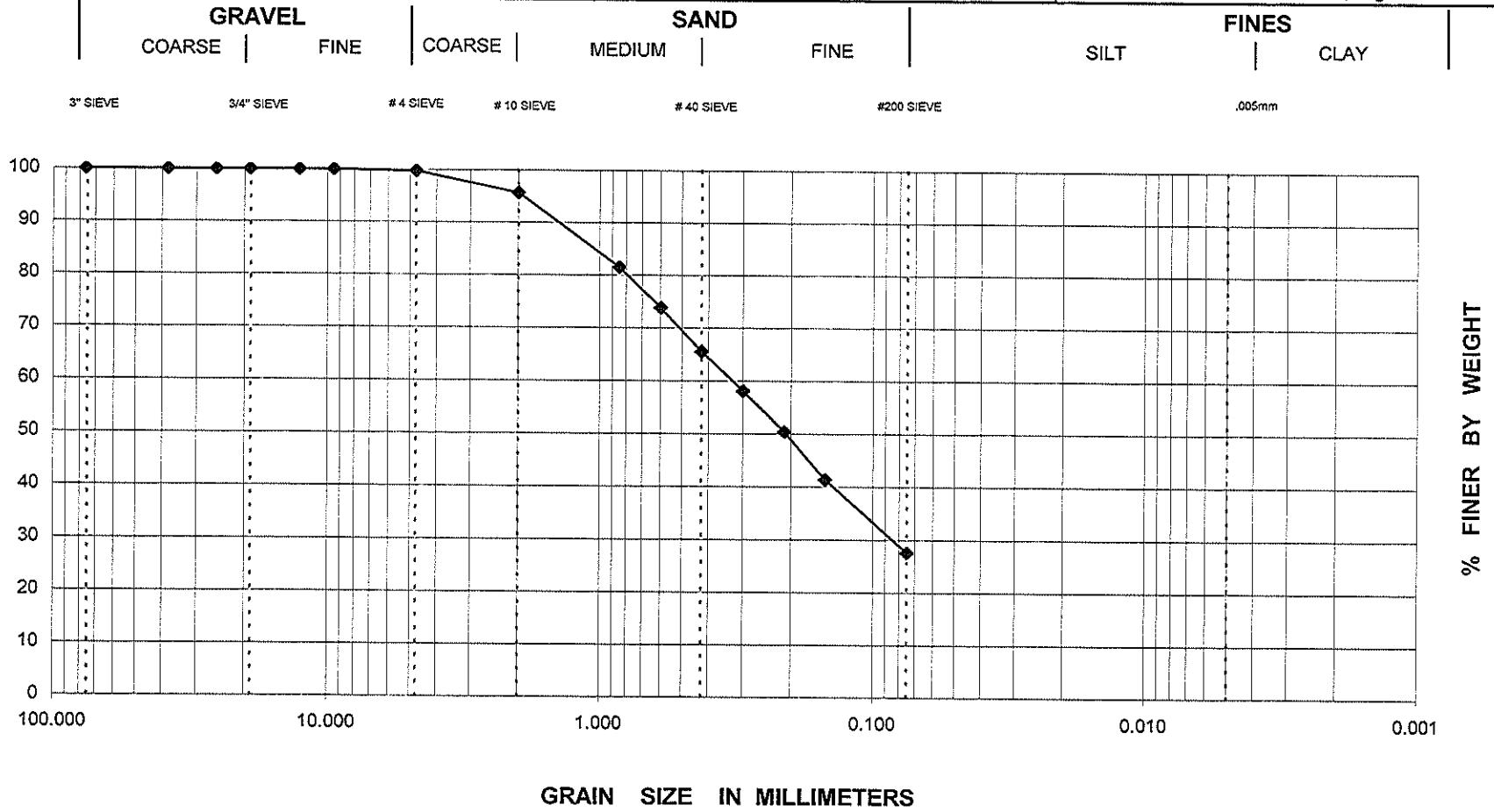
GRAIN SIZE DISTRIBUTION TEST REPORT
(ASTM D422)

AAP SM
AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	**REPORT NO. :**	115235	**DATE :**	5/30/2007	**REVIEWED BY :**	[illegible]
BORING / PIT NO. :	B - 2	**DEPTH / ELEV. :**	2' - 4'	**SAMPLE NO. :**	SS-2	**SAMPLE TYPE :**	SS
SAMPLE LOCATION :		-					
SOIL DESCRIPTION :	Brown, Gray, and Red Silty Fine to Medium Sand					**SP. GRAVITY, Gs :**	-
LIQUID LIMIT, % :	N/A	**PLASTICITY INDEX , % :**	N/A	**MOISTURE , % :**	12.7	**FINES , % :**	27.6
D10 , MM :	-	**D30 , MM :**	0.085	**D60 , MM :**	0.33	**COEFF. OF CURVATURE , C_C :**	-
CLASSIFICATION		**UNIFIED :**	[SM]	**AASHTO :**	[A-2-4]	**COEFF. OF UNIFORMITY , C_U :**	-



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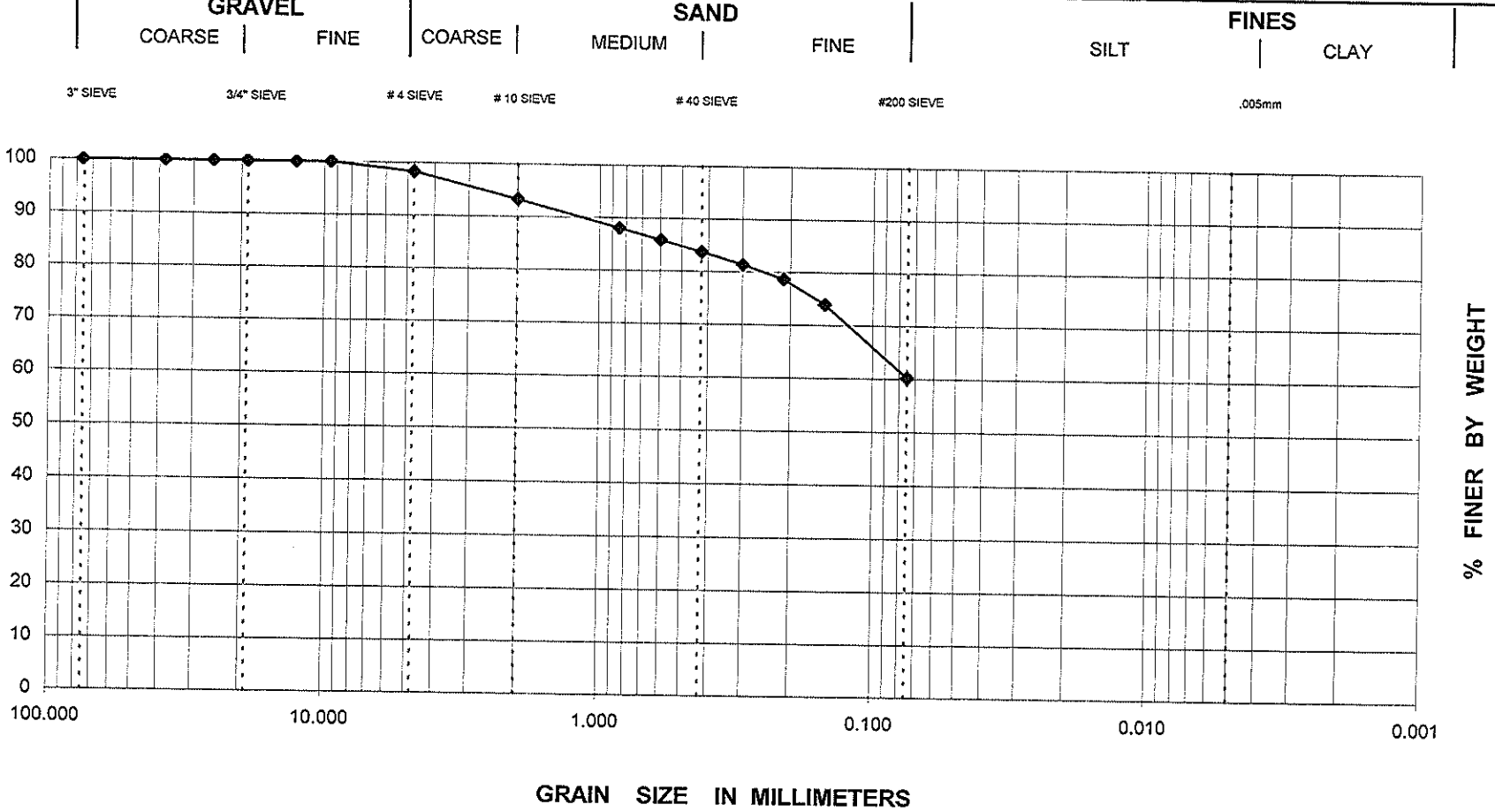
GRAIN SIZE DISTRIBUTION TEST REPORT
(ASTM D422)

AAP SM
AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	5/30/2007	REVIEWED BY :	KW
BORING / PIT NO. :	B - 2	DEPTH / ELEV. :	8' - 10'	SAMPLE NO. :	SS-5	SAMPLE TYPE :	SS
SAMPLE LOCATION :		-					
SOIL DESCRIPTION :	Grayish Brown, Brown, and Dark Brown Sandy Lean Clay					SP. GRAVITY, Gs :	-
LIQUID LIMIT, % :	24	PLASTICITY INDEX , % :	8	MOISTURE , % :	18.1	FINES , % :	60.2
D10 , MM :	-	D30 , MM :	-	D60 , MM :	0.074	COEFF. OF CURVATURE , C_C :	-
CLASSIFICATION		UNIFIED :	CL	AASHTO :	A-4(2)	COEFF. OF UNIFORMITY , C_U :	-



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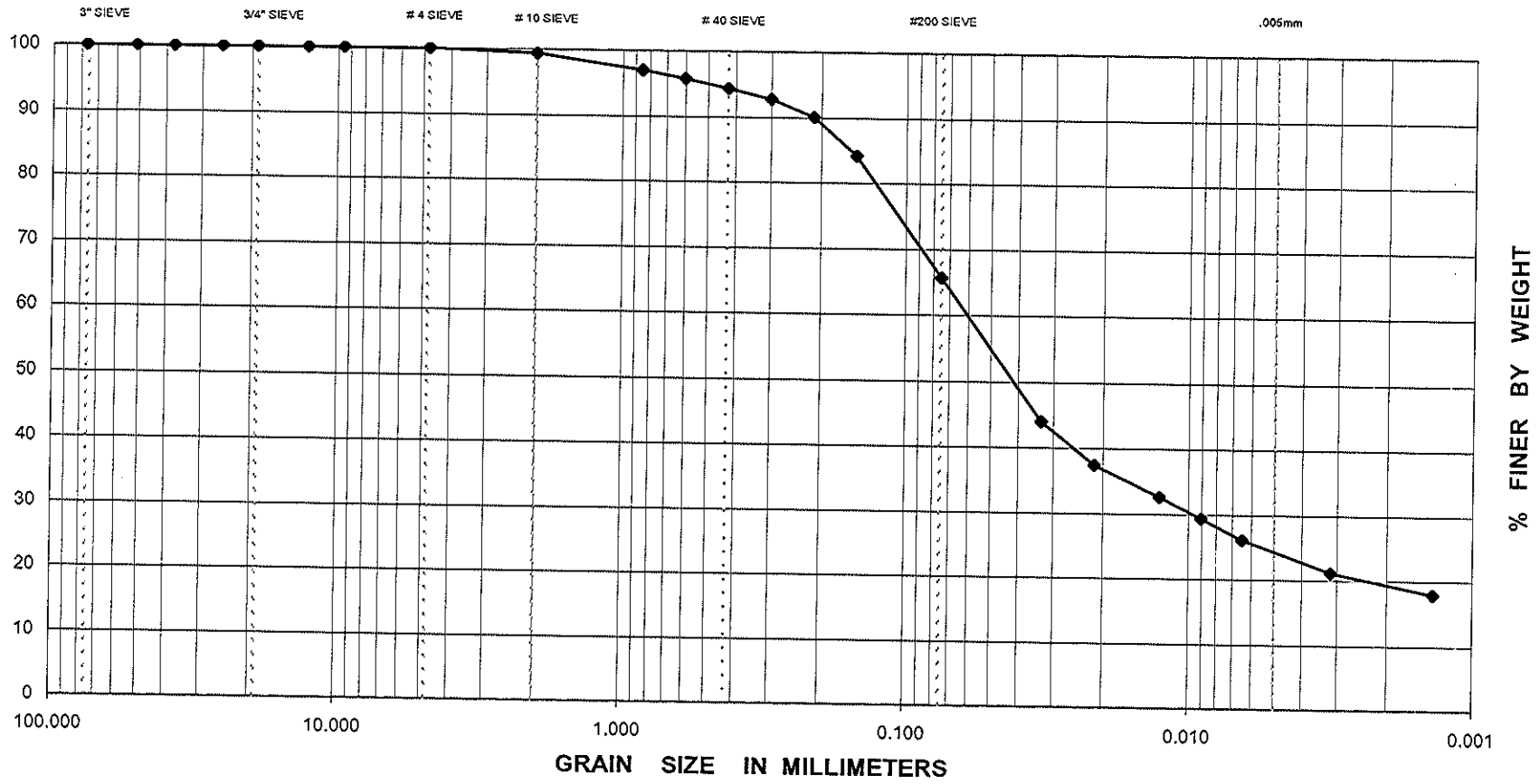
PARTICLE- SIZE DISTRIBUTION TEST REPORT

SIEVE AND HYDROMETER ASTM D422

REV1,9/17/03

AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	5/30/07	REVIEWED BY :	KWM
BORING / PIT NO. :	B - 3	DEPTH / ELEV. :	9' - 11'	SAMPLE NO. :	SS-1	SAMPLE TYPE :	SS
SAMPLE LOCATION :							
SOIL DESCRIPTION :	Brown and Reddish Brown Sandy Lean Clay					SP. GRAVITY, Gs :	2.68
LIQUID LIMIT, % :	29	PLASTICITY INDEX , % :	10	MOISTURE , % :	24.6	FINES , % :	65.6
D10 , MM :	-	D30 , MM :	0.0098	D60 , MM :	0.061	COEFF. OF CURVATURE , C_C :	-
CLASSIFICATION		UNIFIED :	CL	AASHTO :	A-4(4)	COEFF. OF UNIFORMITY , C_U :	-



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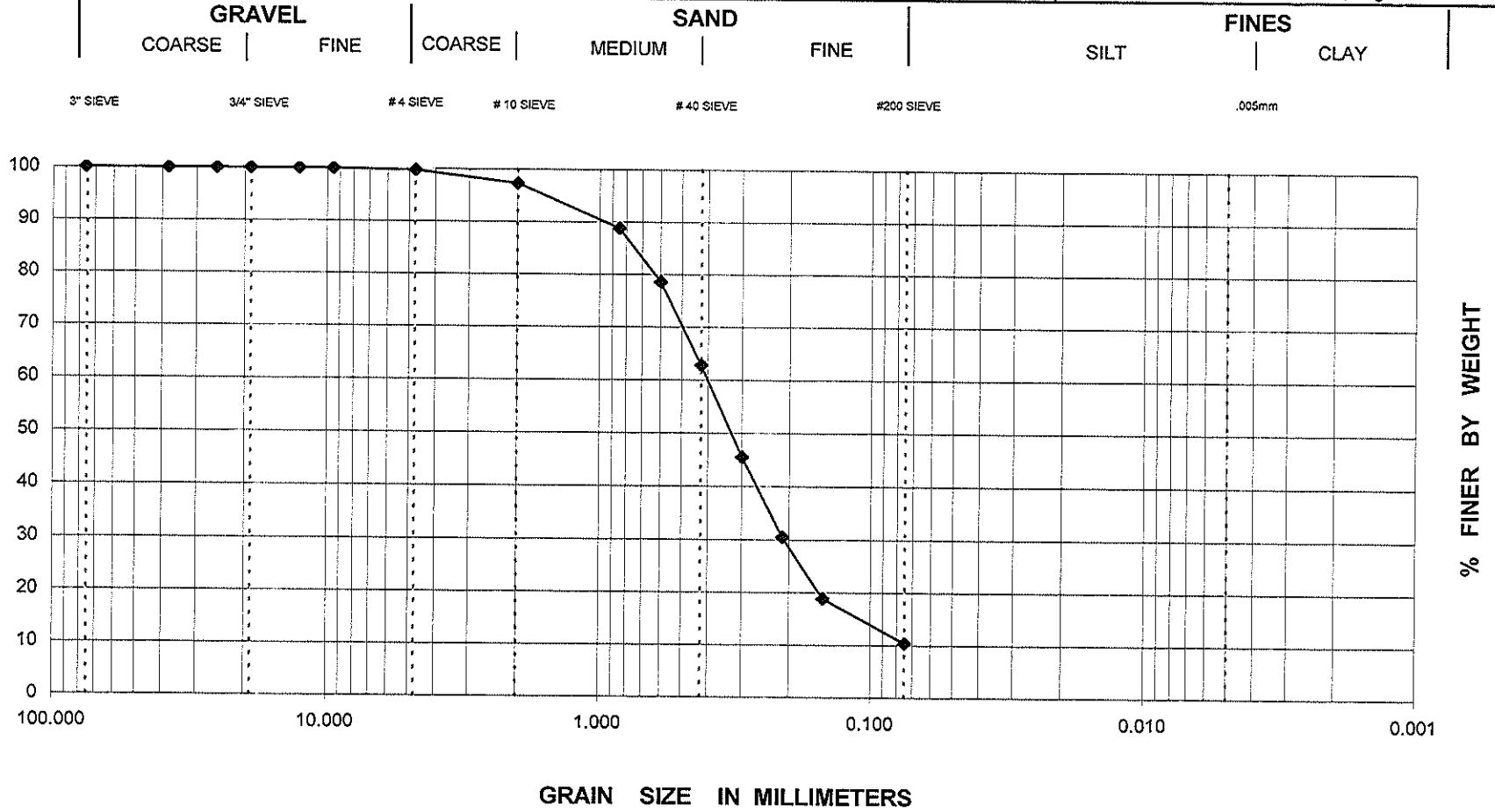
PROPERTY SCIENCES

GRAIN SIZE DISTRIBUTION TEST REPORT
(ASTM D422)

AAP℠ AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	**REPORT NO. :**	115235	**DATE :**	5/30/2007	**REVIEWED BY :**	
BORING / PIT NO. :	B - 3	**DEPTH / ELEV. :**	15' - 17'	**SAMPLE NO. :**	SS-4	**SAMPLE TYPE :**	SS
SAMPLE LOCATION :		-					
SOIL DESCRIPTION :	Gray Poorly Graded Fine to Medium Sand with Silt and Wood Pieces					**SP. GRAVITY, Gs :**	-
LIQUID LIMIT, % :	N/A	**PLASTICITY INDEX , % :**	N/A	**MOISTURE , % :**	36.1	**FINES , % :**	10.4
D10 , MM :	0.073	**D30 , MM :**	0.22	**D60 , MM :**	0.400	**COEFF. OF CURVATURE , C_C :**	1.7
CLASSIFICATION		**UNIFIED :**	[SP-SM]	**AASHTO :**	[A-2-4]	**COEFF. OF UNIFORMITY , C_U :**	5.5



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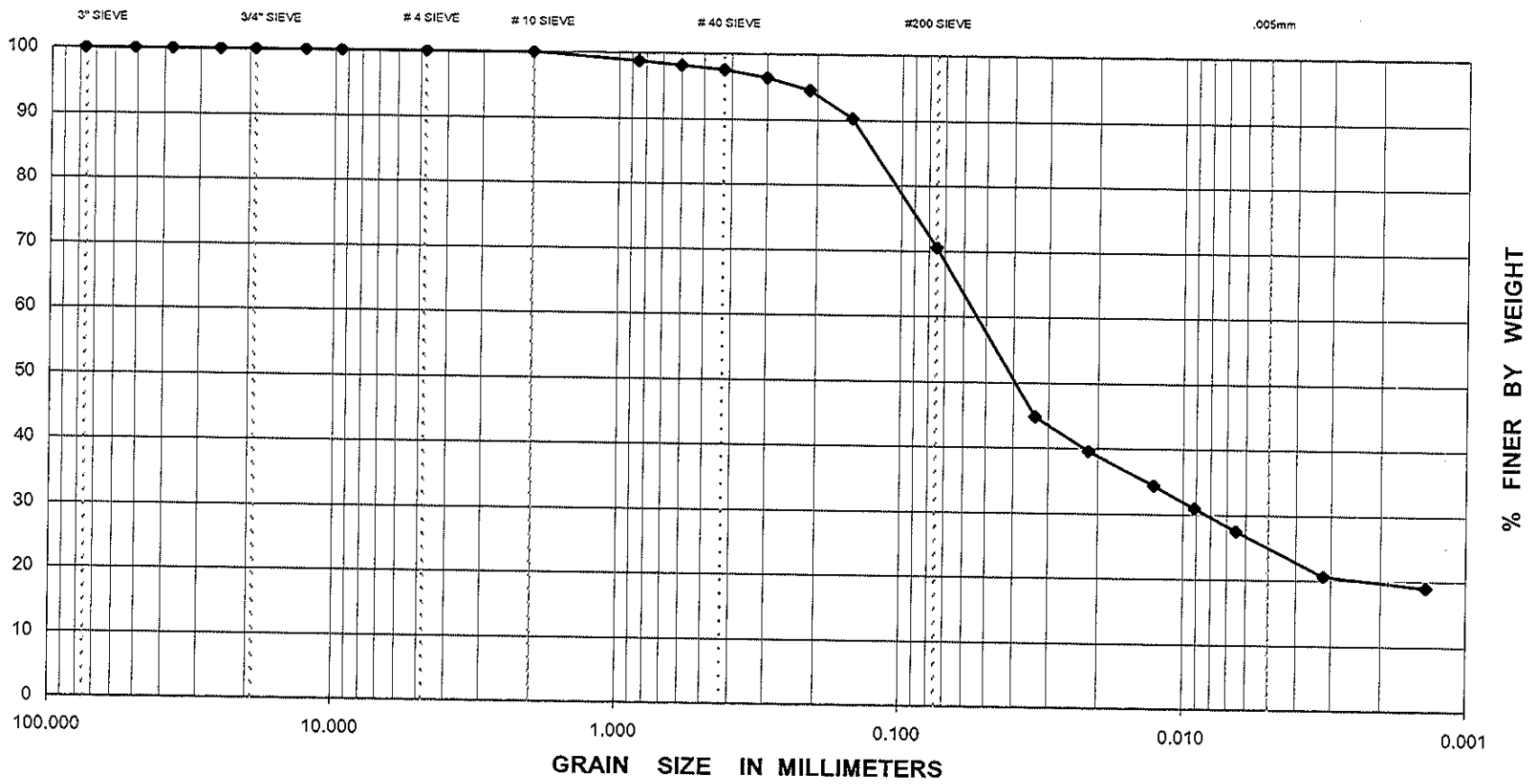
PARTICLE- SIZE DISTRIBUTION TEST REPORT

SIEVE AND HYDROMETER ASTM D422

REV1,9/17/03

AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	5/30/07	REVIEWED BY :	KW
BORING / PIT NO. :	B - 5	DEPTH / ELEV. :	6' - 8'	SAMPLE NO. :	SS-4	SAMPLE TYPE :	SS
SAMPLE LOCATION :							
SOIL DESCRIPTION :	Yellowish Brown and Reddish Brown Sandy Lean Clay					SP. GRAVITY, Gs :	2.66
LIQUID LIMIT, % :	34	PLASTICITY INDEX , % :	12	MOISTURE , % :	23.2	FINES , % :	70.5
D10 , MM :	-	D30 , MM :	0.0083	D60 , MM :	0.054	COEFF. OF CURVATURE , C_C :	-
CLASSIFICATION		UNIFIED :	CL	AASHTO :	A-6(7)	COEFF. OF UNIFORMITY , C_U :	-



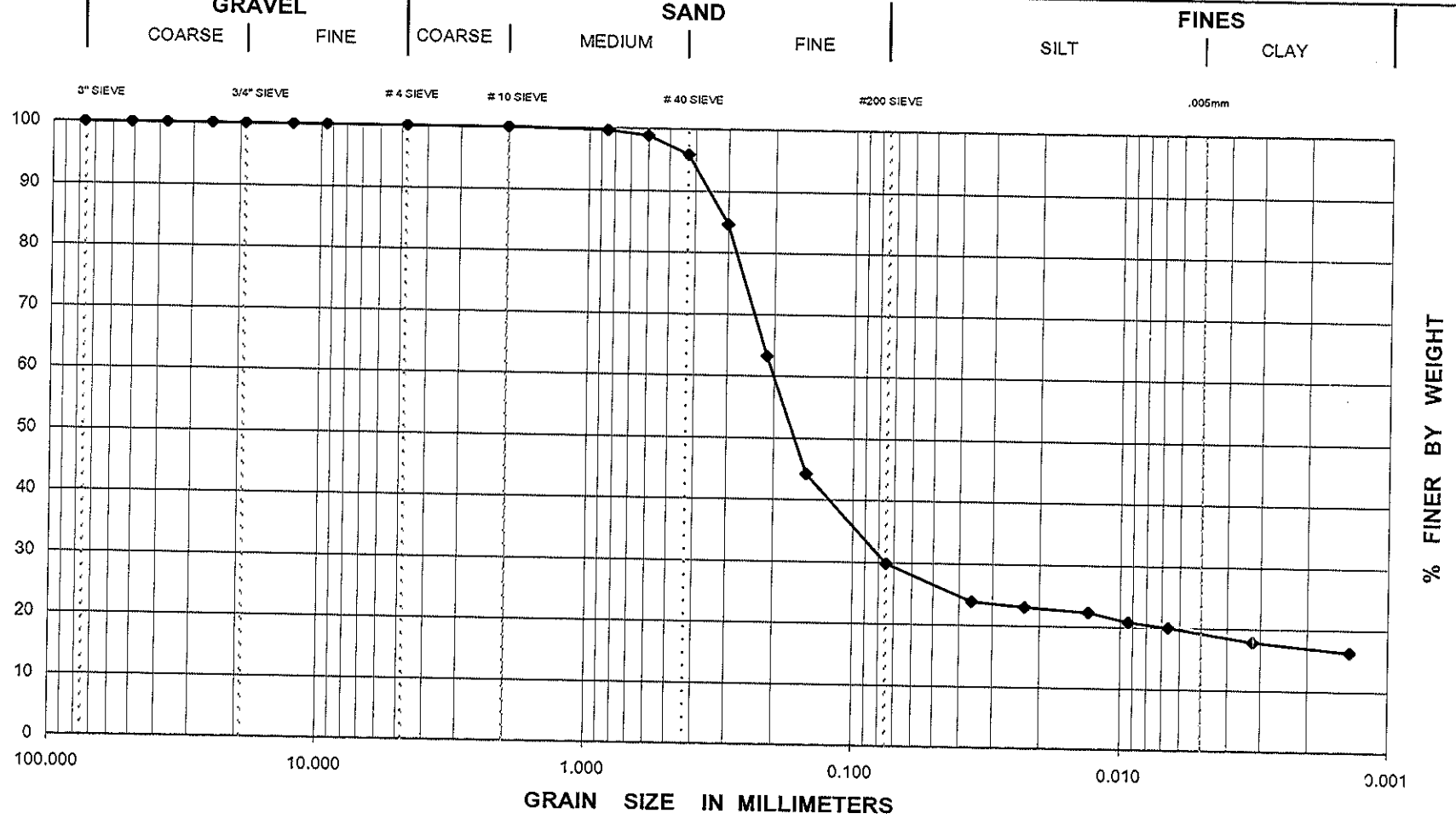
PARTICLE- SIZE DISTRIBUTION TEST REPORT

SIEVE AND HYDROMETER ASTM D422

REV1,9/17/03

AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	5/30/07	REVIEWED BY :	K [illegible]
BORING / PIT NO. :	B - 5	DEPTH / ELEV. :	8' - 10'	SAMPLE NO. :	SS-5	SAMPLE TYPE :	SS
SAMPLE LOCATION :							
SOIL DESCRIPTION :	Reddish Brown, Light Brown, and Gray Silty, Clayey Fine Sand					SP. GRAVITY, Gs :	2.65
LIQUID LIMIT, % :	22	PLASTICITY INDEX , % :	5	MOISTURE , % :	18.7	FINES , % :	29.7
D10 , MM :	-	D30 , MM :	0.075	D60 , MM :	0.200	COEFF. OF CURVATURE , C_C :	-
CLASSIFICATION		UNIFIED :	SC-SM	AASHTO :	A-2-4	COEFF. OF UNIFORMITY , C_U :	-



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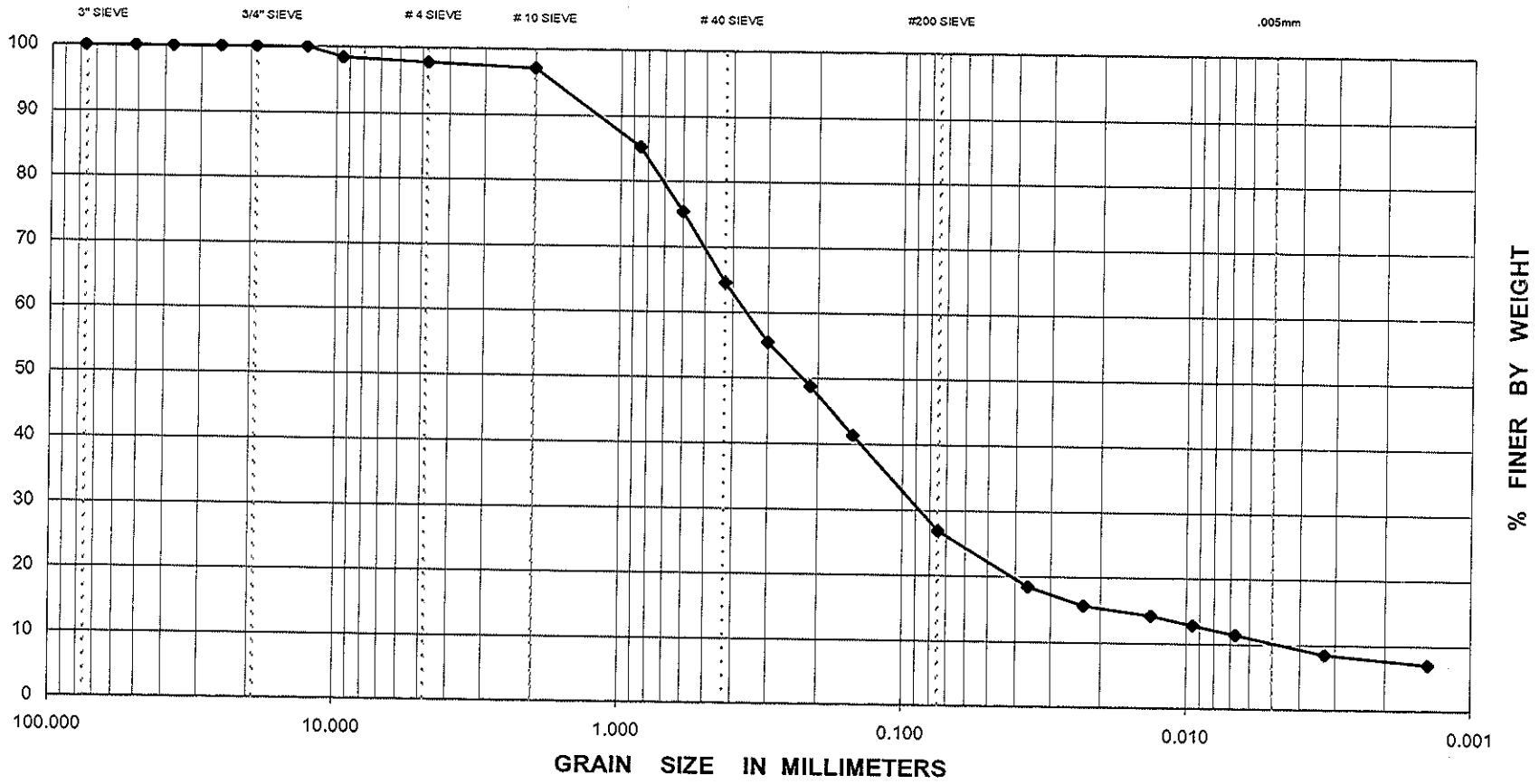
PARTICLE- SIZE DISTRIBUTION TEST REPORT

SIEVE AND HYDROMETER ASTM D422

REV1,9/17/03

AAP AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	5/30/07	REVIEWED BY :	K W
BORING / PIT NO. :	B - 5	DEPTH / ELEV. :	13.5' - 15'	SAMPLE NO. :	SS-6	SAMPLE TYPE :	SS
SAMPLE LOCATION :							
SOIL DESCRIPTION :	Brown, Reddish Brown, and Gray Micaceous Silty Fine to Medium Sand					SP. GRAVITY, Gs :	2.69
LIQUID LIMIT, % :	31	PLASTICITY INDEX , % :	6	MOISTURE , % :	24.7	FINES , % :	26.9
D10 , MM :	0.0050	D30 , MM :	0.088	D60 , MM :	0.36	COEFF. OF CURVATURE , C_C :	4.3
CLASSIFICATION		UNIFIED :	SM	AASHTO :	A-2-4	COEFF. OF UNIFORMITY , C_U :	72.0



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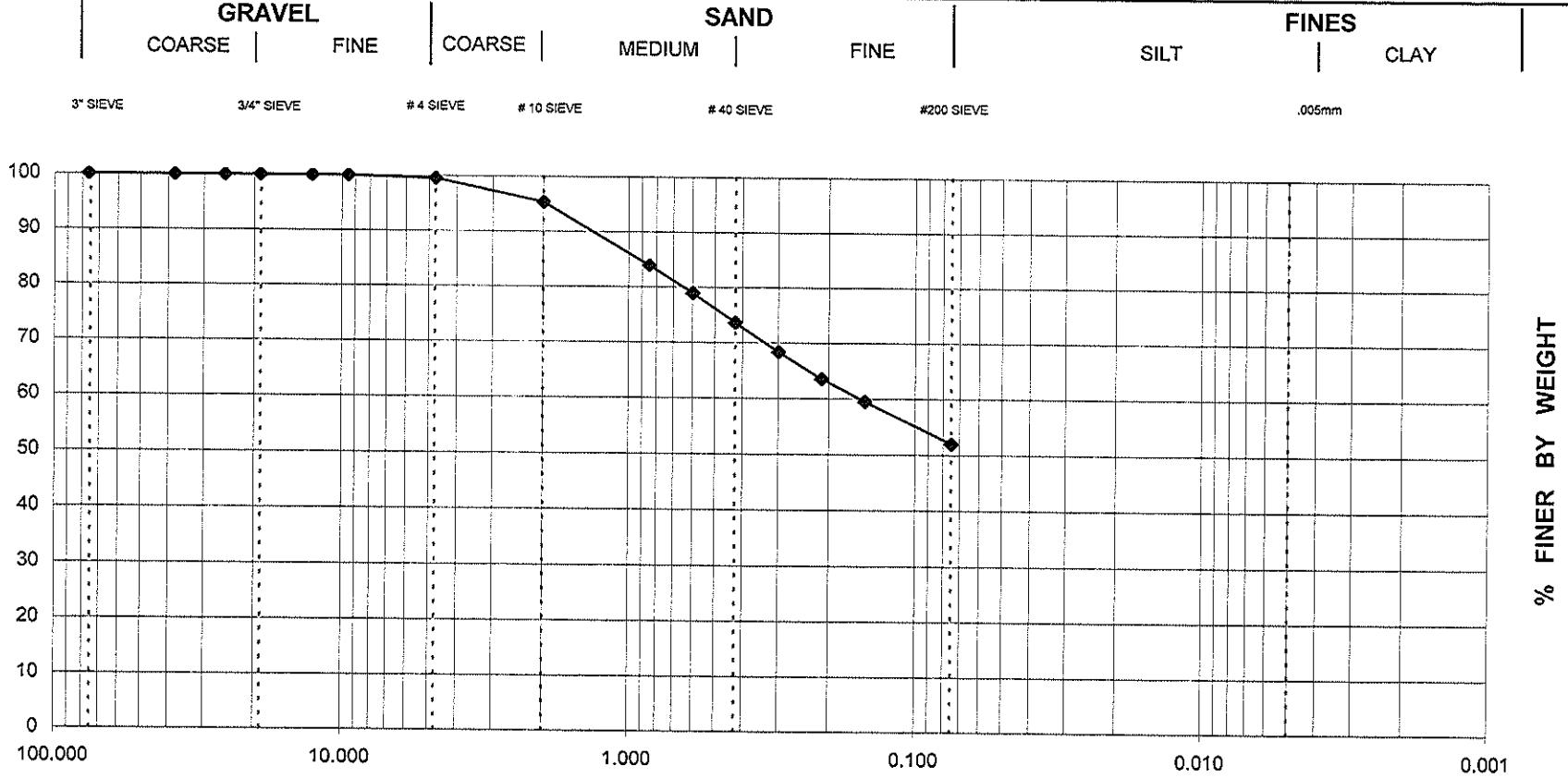
GRAIN SIZE DISTRIBUTION TEST REPORT
(ASTM D422)

AAP℠ AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	5/30/2007	REVIEWED BY :	
BORING / PIT NO. :	B - 6	DEPTH / ELEV. :	2' - 4'	SAMPLE NO. :	SS-2	SAMPLE TYPE :	SS
SAMPLE LOCATION :	-						
SOIL DESCRIPTION :	Brownish Red and Brown Sandy Lean Clay					SP. GRAVITY, Gs :	-
LIQUID LIMIT, % :	35	PLASTICITY INDEX , % :	15	MOISTURE , % :	19.7	FINES , % :	52.0
D10 , MM :	-	D30 , MM :	-	D60 , MM :	0.16	COEFF. OF CURVATURE , C_C :	-
CLASSIFICATION		UNIFIED :	CL	AASHTO :	A-6(5)	COEFF. OF UNIFORMITY , C_U :	-



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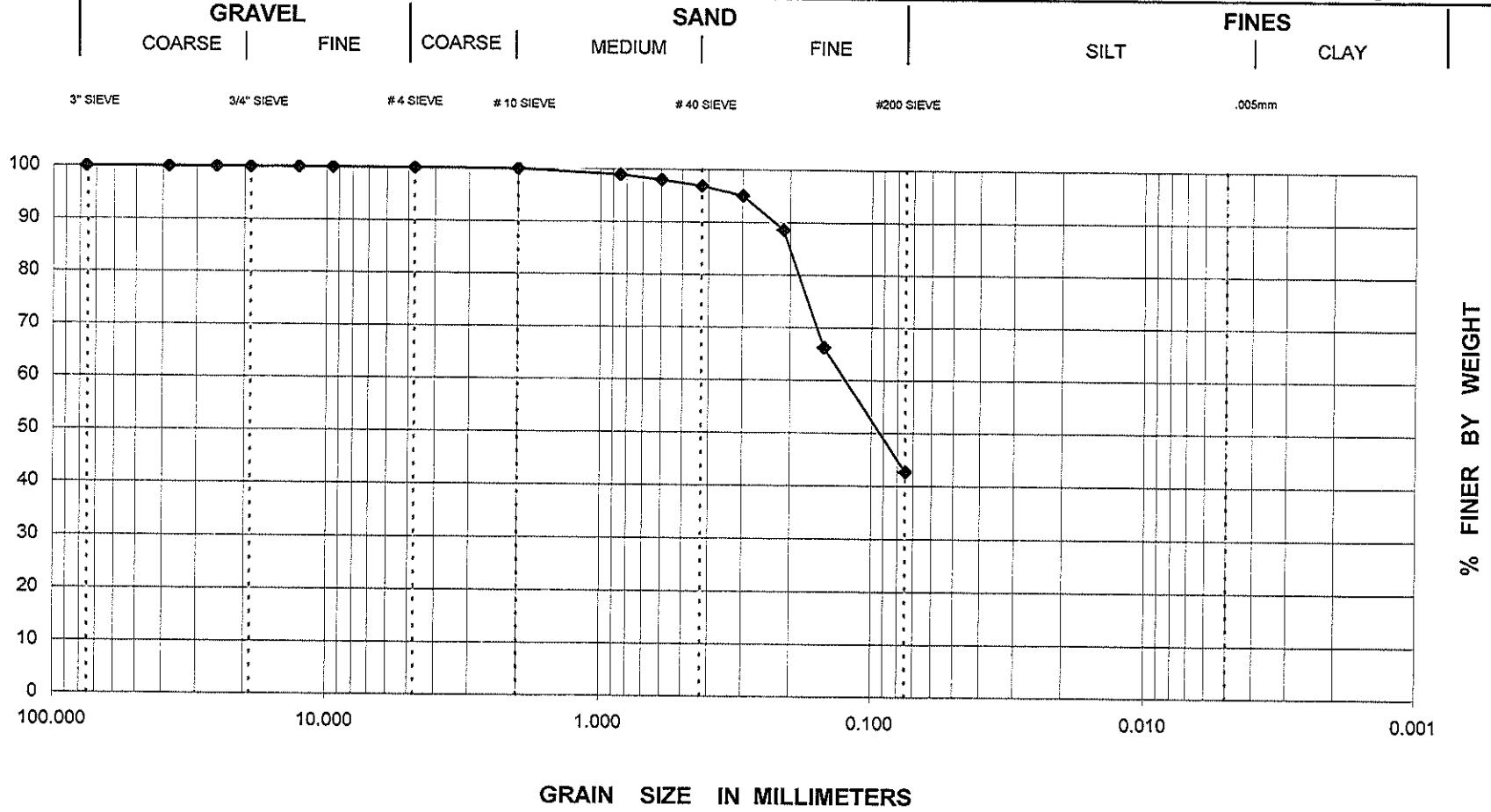
GRAIN SIZE DISTRIBUTION TEST REPORT
(ASTM D422)

AAP SM
AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	5/30/2007	REVIEWED BY :	KWW
BORING / PIT NO. :	B - 6	DEPTH / ELEV. :	8' - 10'	SAMPLE NO. :	SS-5	SAMPLE TYPE :	SS
SAMPLE LOCATION :		-					
SOIL DESCRIPTION :	Grayish Brown, Yellowish Brown, and Brown Silty Fine Sand					SP. GRAVITY, Gs :	-
LIQUID LIMIT, % :	22	PLASTICITY INDEX , % :	NP	MOISTURE , % :	16.9	FINES , % :	42.6
D10 , MM :	-	D30 , MM :	-	D60 , MM :	0.13	COEFF. OF CURVATURE , C_C :	-
CLASSIFICATION		UNIFIED :	SM	AASHTO :	A-4	COEFF. OF UNIFORMITY , C_U :	-



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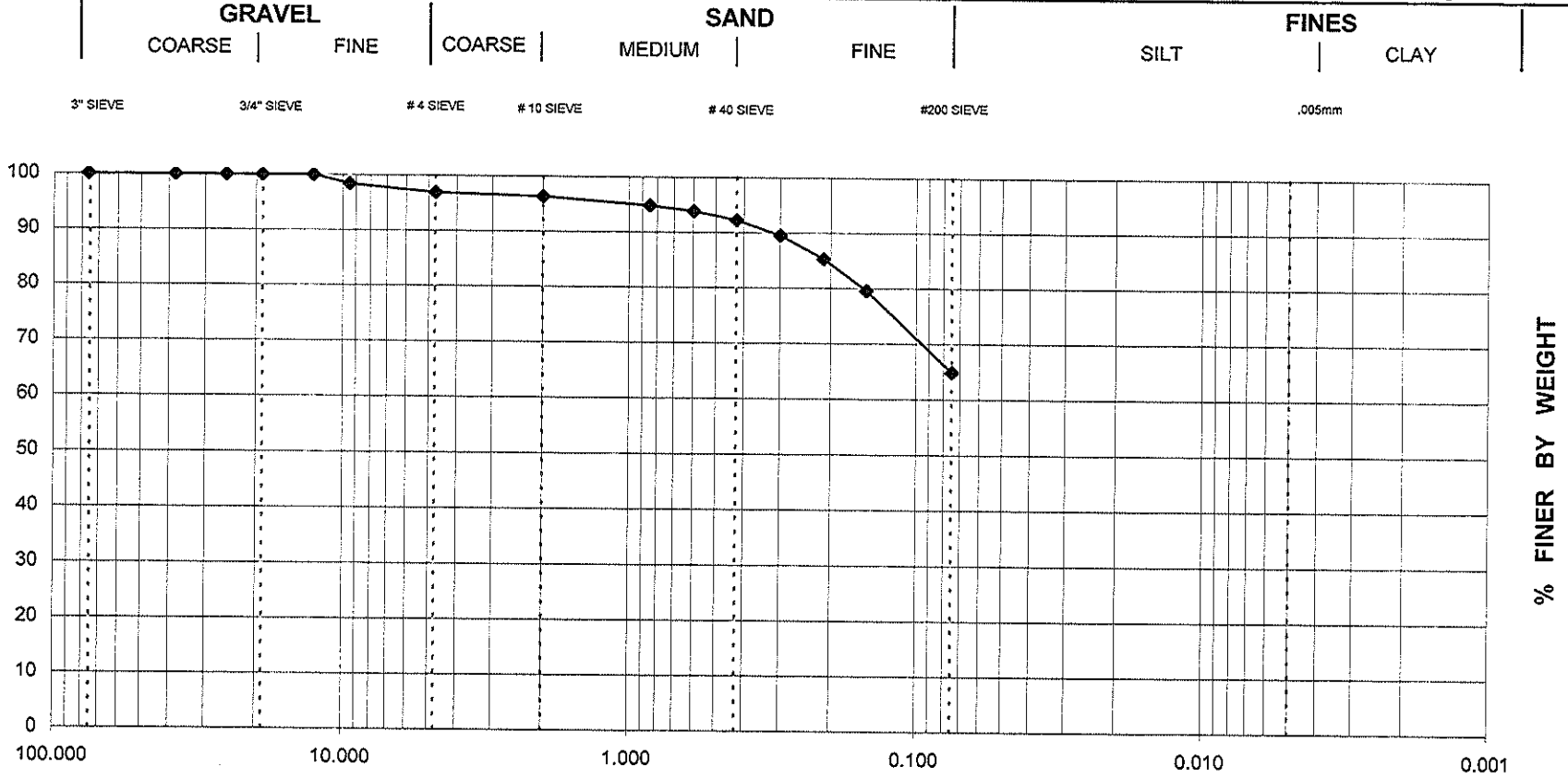
GRAIN SIZE DISTRIBUTION TEST REPORT
(ASTM D422)

AAP SM AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	5/30/2007	REVIEWED BY :	KWW
BORING / PIT NO. :	B - 7	DEPTH / ELEV. :	4' - 6'	SAMPLE NO. :	SS-3	SAMPLE TYPE :	SS
SAMPLE LOCATION :	-						
SOIL DESCRIPTION :	Brown, Gray, and Dark Brown Sandy Lean Clay					SP. GRAVITY, Gs :	-
LIQUID LIMIT, % :	26	PLASTICITY INDEX , % :	11	MOISTURE , % :	20.3	FINES , % :	64.9
D10 , MM :	-	D30 , MM :	-	D60 , MM :	-	COEFF. OF CURVATURE , C_C :	-
CLASSIFICATION		UNIFIED :	CL	AASHTO :	A-6(4)	COEFF. OF UNIFORMITY , C_U :	-



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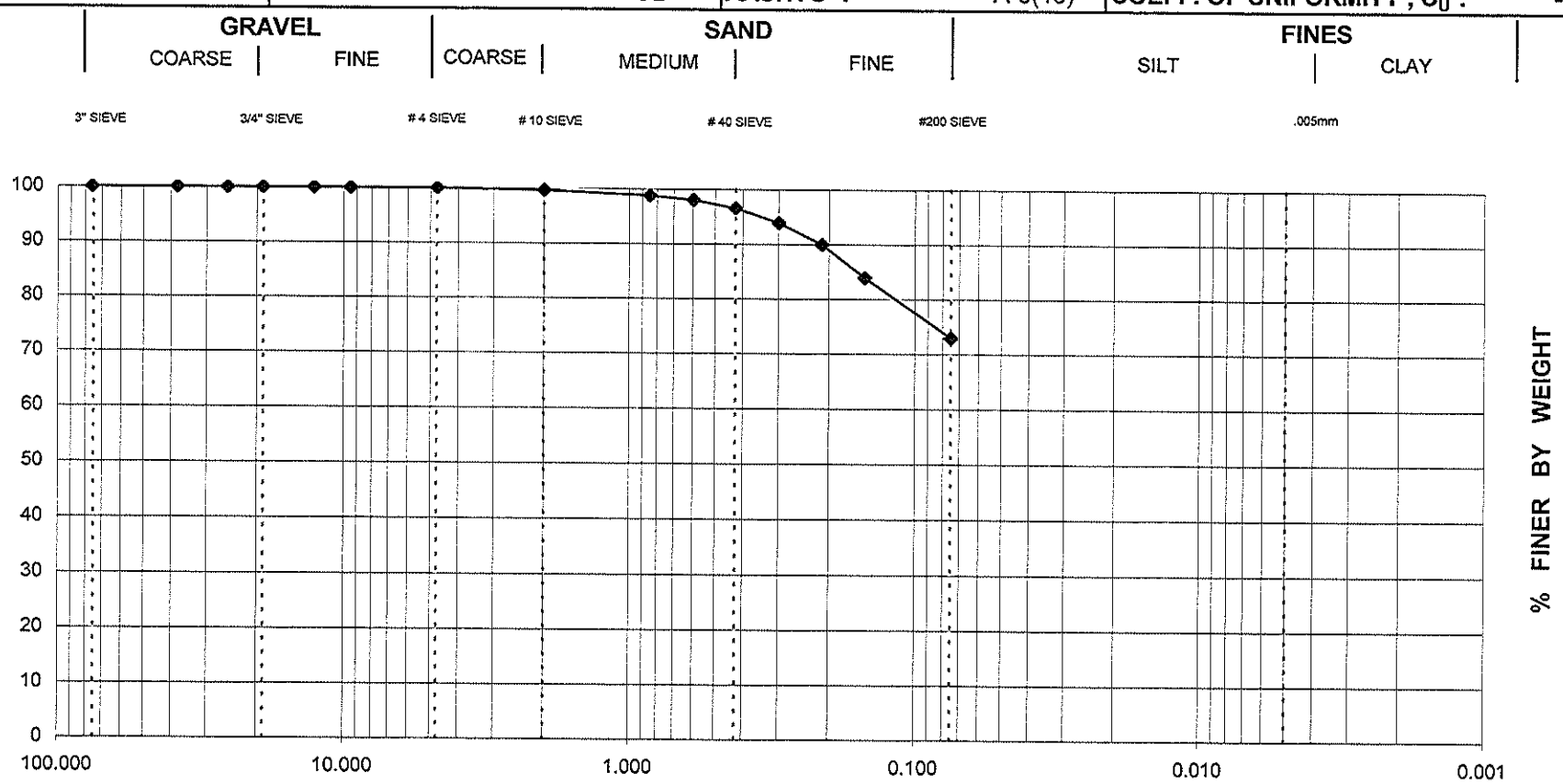
GRAIN SIZE DISTRIBUTION TEST REPORT
(ASTM D422)

AAP℠ AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	5/30/2007	REVIEWED BY :	
BORING / PIT NO. :	B - 7	DEPTH / ELEV. :	6' - 8'	SAMPLE NO. :	SS-4	SAMPLE TYPE :	SS
SAMPLE LOCATION :		-					
SOIL DESCRIPTION :	Gray, Brown, and Light Brown Lean Clay with Sand					SP. GRAVITY, Gs :	-
LIQUID LIMIT, % :	39	PLASTICITY INDEX , % :	25	MOISTURE , % :	19.0	FINES , % :	72.9
D10 , MM :	-	D30 , MM :	-	D60 , MM :	-	COEFF. OF CURVATURE , C_C :	-
CLASSIFICATION		UNIFIED :	CL	AASHTO :	A-6(16)	COEFF. OF UNIFORMITY , C_U :	-



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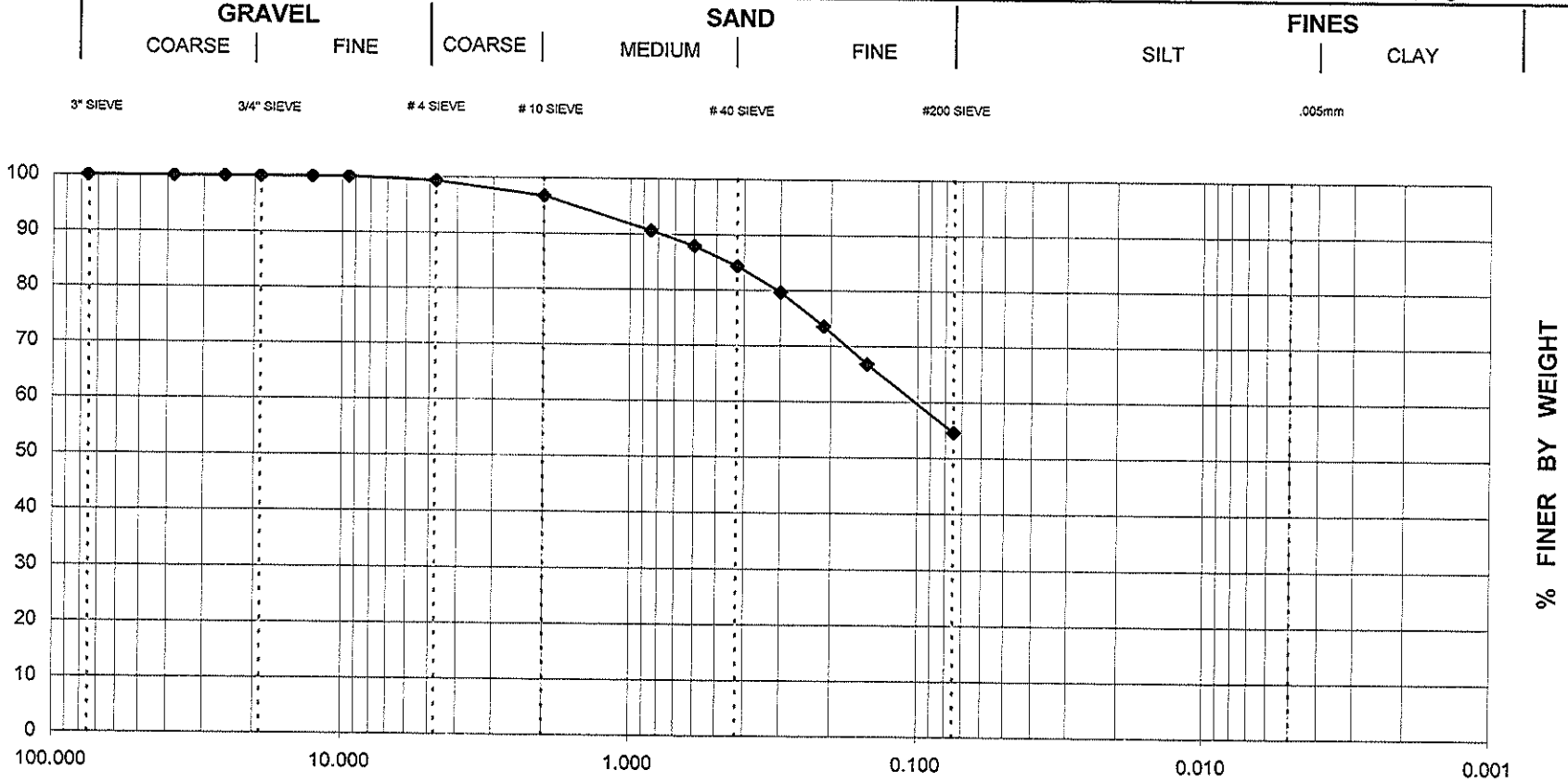
GRAIN SIZE DISTRIBUTION TEST REPORT
(ASTM D422)

AAR SM
AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	5/30/2007	REVIEWED BY :	
BORING / PIT NO. :	B - 8	DEPTH / ELEV. :	2' - 4'	SAMPLE NO. :	SS-2	SAMPLE TYPE :	SS
SAMPLE LOCATION :		-					
SOIL DESCRIPTION :	Brown Sandy Lean Clay with Small Roots and Gravel					SP. GRAVITY, Gs :	-
LIQUID LIMIT, % :	29	PLASTICITY INDEX , % :	13	MOISTURE , % :	17.3	FINES , % :	54.5
D10 , MM :	-	D30 , MM :	-	D60 , MM :	0.11	COEFF. OF CURVATURE , C_C :	-
CLASSIFICATION		UNIFIED :	CL	AASHTO :	A-6(4)	COEFF. OF UNIFORMITY , C_U :	-



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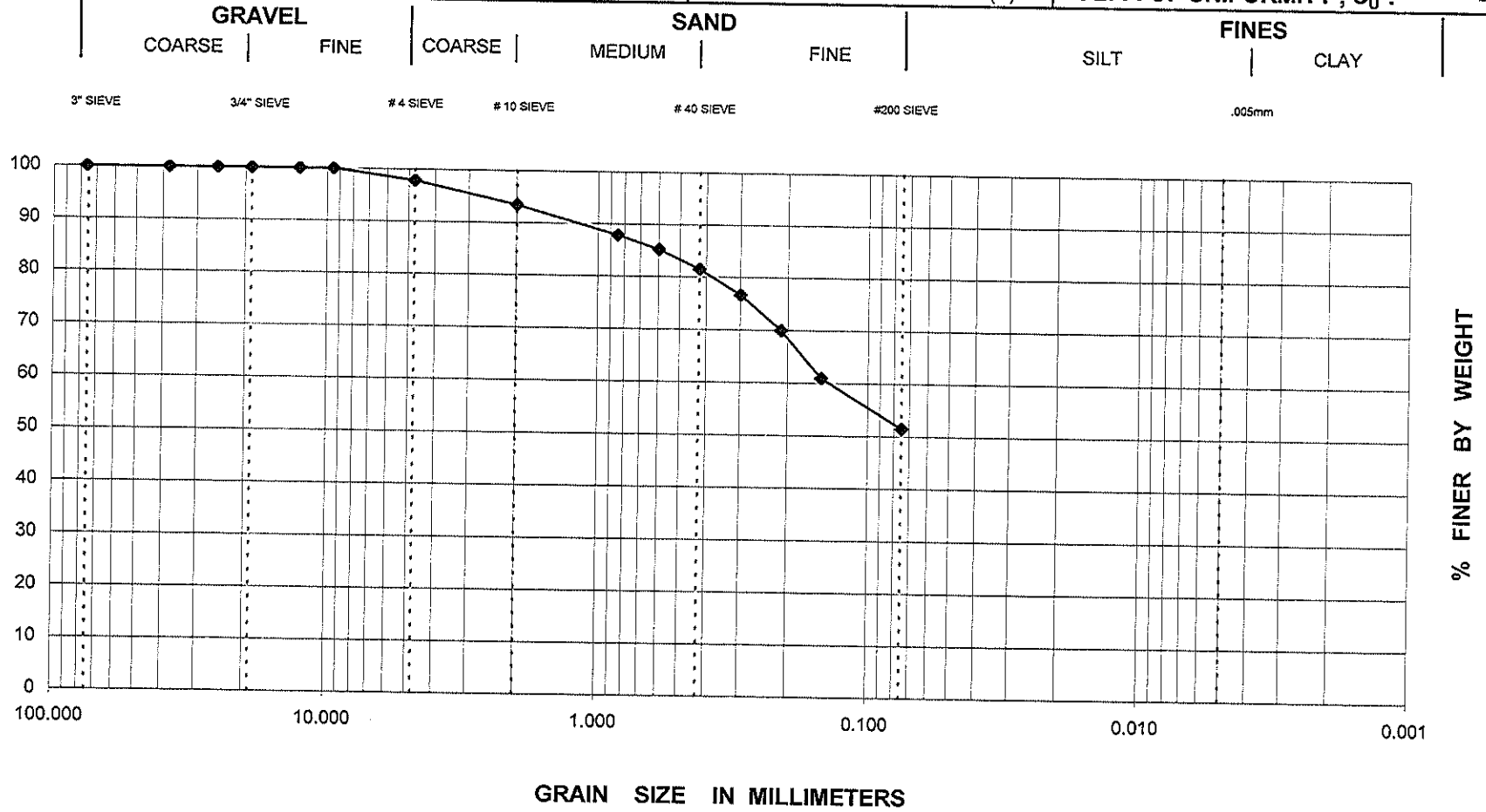
GRAIN SIZE DISTRIBUTION TEST REPORT
(ASTM D422)

AAP SM
AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	5/30/2007	REVIEWED BY :	
BORING / PIT NO. :	B - 8	DEPTH / ELEV. :	4' - 6'	SAMPLE NO. :	SS-3	SAMPLE TYPE :	SS
SAMPLE LOCATION :		-					
SOIL DESCRIPTION :	Gray and Brown Sandy Lean Clay					SP. GRAVITY, Gs :	-
LIQUID LIMIT, % :	30	PLASTICITY INDEX , % :	19	MOISTURE , % :	17.6	FINES , % :	51.4
D10 , MM :	-	D30 , MM :	-	D60 , MM :	0.15	COEFF. OF CURVATURE , C_C :	-
CLASSIFICATION		UNIFIED :	CL	AASHTO :	A-6(6)	COEFF. OF UNIFORMITY , C_U :	-



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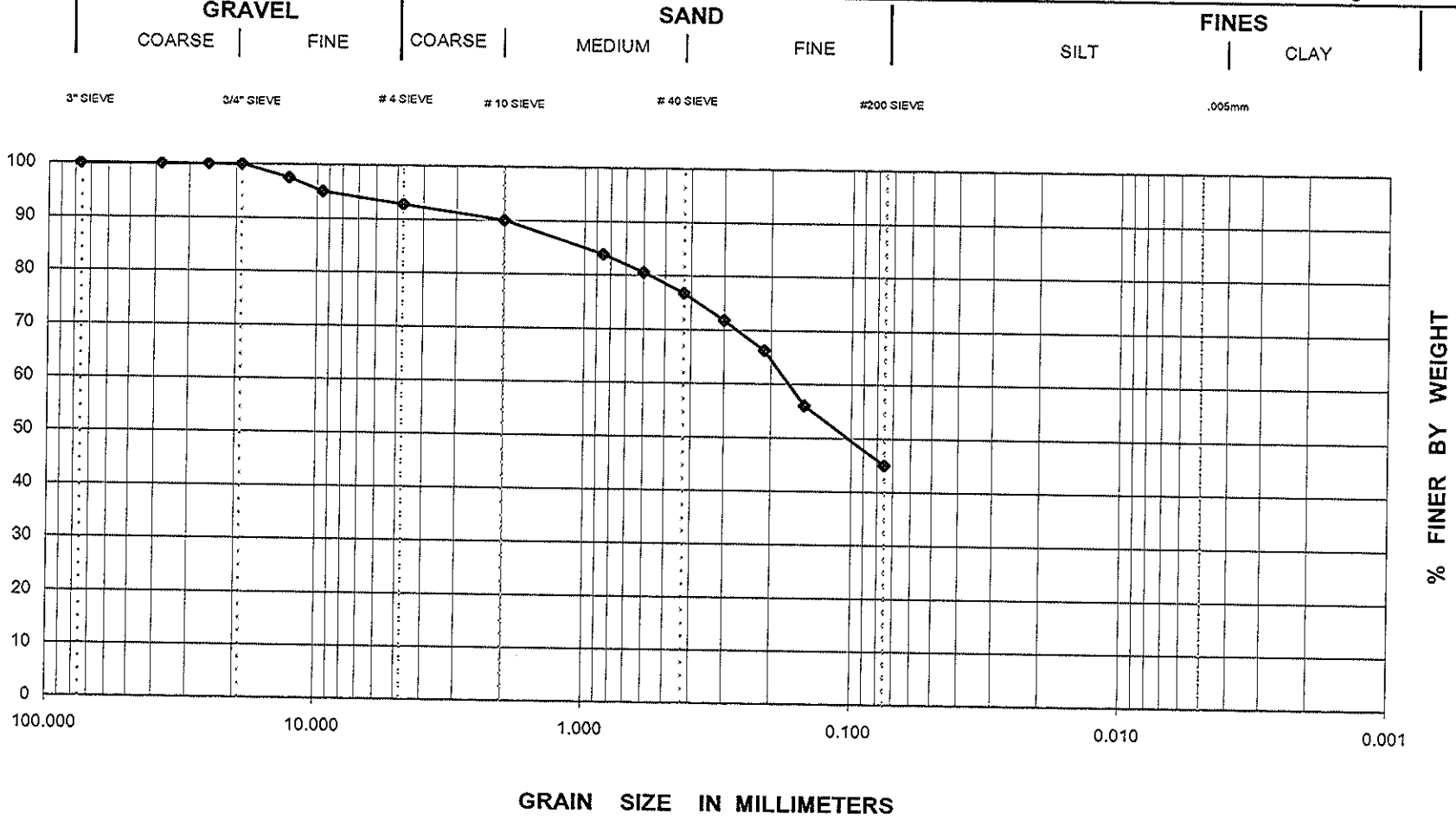
GRAIN SIZE DISTRIBUTION TEST REPORT
(ASTM D422)

AAP AASHTO R18

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; File No. 46.169B.1; Project No. BR-BR46 (012); PIN No. 31919						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	2/26/2007	REVIEWED BY :	KBF
BORING / PIT NO. :	-	DEPTH / ELEV. :	0 - 5'	SAMPLE NO. :	BS-1	SAMPLE TYPE :	Bulk
SAMPLE LOCATION :	Station: 64+00; 3 Feet Left of Proposed Centerline						
SOIL DESCRIPTION :	Dark Brown Clayey Fine to Medium Sand					SP. GRAVITY, Gs :	2.70
LIQUID LIMIT, % :	26	PLASTICITY INDEX , % :	9	MOISTURE , % :	16.9	FINES , % :	44.9
D10 , MM :	-	D30 , MM :	-	D60 , MM :	0.18	COEFF. OF CURVATURE , C_C :	-
CLASSIFICATION		UNIFIED :	SC	AASHTO :	A-4(1)	COEFF. OF UNIFORMITY , C_U :	-



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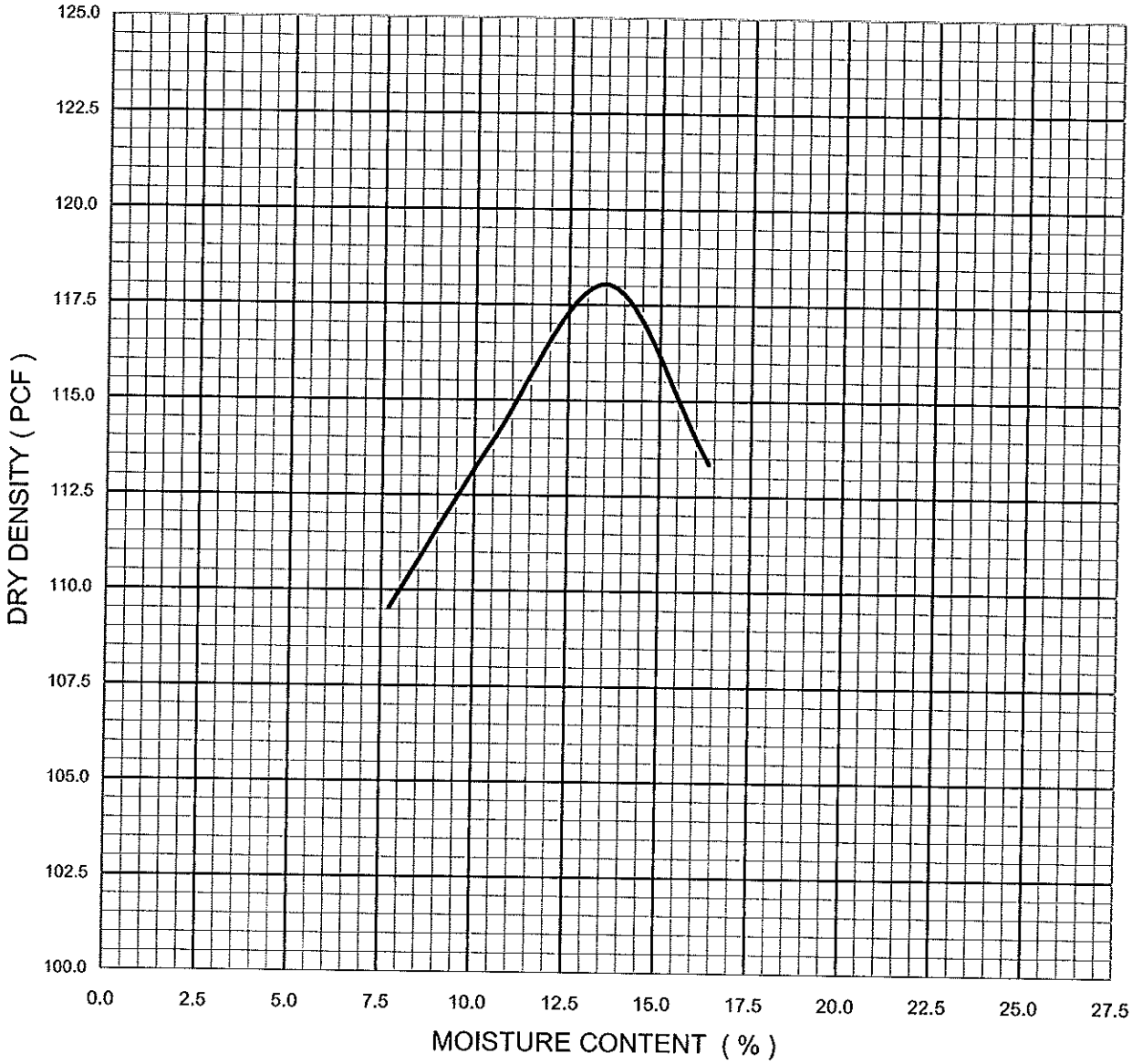
PROPERTY SCIENCES

MOISTURE / DENSITY RELATIONSHIPS OF SOIL
(AASHTO T-99)

JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; File No. 46.169B.1; Project No. BR-BR46 (012); PIN No. 31919						
CLIENT :	SCDOT Research & Materials Laboratory						
JOB NO. :	7272O	REPORT NO. :	115235	DATE :	02/21/07	REVIEWED BY :	KBF
BORING / PIT NO. :	-	DEPTH / ELEV. :	0 - 5'	SAMPLE NO. :	BS-1		
SAMPLE LOCATION :	Station: 64+00; 3 Feet Left of Proposed Centerline						
SOIL DESCRIPTION :	Dark Brown Clayey Fine to Medium Sand						
LIQUID LIMIT , % :	26	PLASTICITY INDEX , % :	9			FINES , % :	44.9
CLASSIFICATION :		USCS :	SC	AASHTO :	A-4(1)		
PROCTOR TYPE :	STANDARD	PROCEDURE :	A	OVERSIZE , % :	-	IN-SITU M.C. :	16.9
UNCORRECTED MAXIMUM DRY DENSITY , PCF :			118.1	CORRECTED MAXIMUM DRY DENSITY , PCF :			-
UNCORRECTED OPTIMUM MOISTURE CONTENT ,% :			13.4	CORRECTED OPTIMUM MOISTURE CONTENT ,% :			-



DISTRIBUTION :

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TRIAXIAL SHEAR TEST REPORT

(ASTM D 4767)

AAP AASHTO R18

REV4.1/13/04

JOB NAME:	S-103 (Oak Park Road) - RBO Fishing Creek; File No. 46.169B.1; Project No. BR-BR46 (012); PIN No. 31919						
JOB NO.:	7272O	REPORT NO. :	115235	REVIEWED BY :	KBF	DATE:	2/26/07
BORING / PIT NO. :	-	DEPTH / ELEV. :	0 - 5'	SAMPLE NO . :	BS-1	TYPE:	Bulk
SAMPLE LOCATION :	Station: 64+00; 3 Feet Left of Proposed Centerline						
SOIL DESCRIPTION :	Dark Brown Clayey Fine to Medium Sand						
LL, % :	26	PI , % :	9	FINES, % :	44.9	G_s :	2.70

SPECIMEN PROPERTIES								
		INITIAL			AFTER CONSOLIDATION			
SPECIMEN NO.		1	2	3		1	2	3
DIAMETER , INCHES	D_o	2.82	2.82	2.82	D_c	2.81	2.80	2.79
HEIGHT , INCHES	H_o	6.03	6.03	6.03	H_c	6.01	5.99	5.98
WATER CONTENT, %	W_o	13.4	13.4	13.4	W_c	18.1	17.3	17.0
DRY DENSITY, PCF	γ_{dryo}	112.5	112.5	112.5	γ_{dryc}	113.2	114.8	115.5
SATURATION ,%	S_o	72.7	72.8	72.8	S_c	95.1	93.6	92.2
VOID RATIO	e_o	0.498	0.497	0.497	e_c	0.489	0.468	0.459

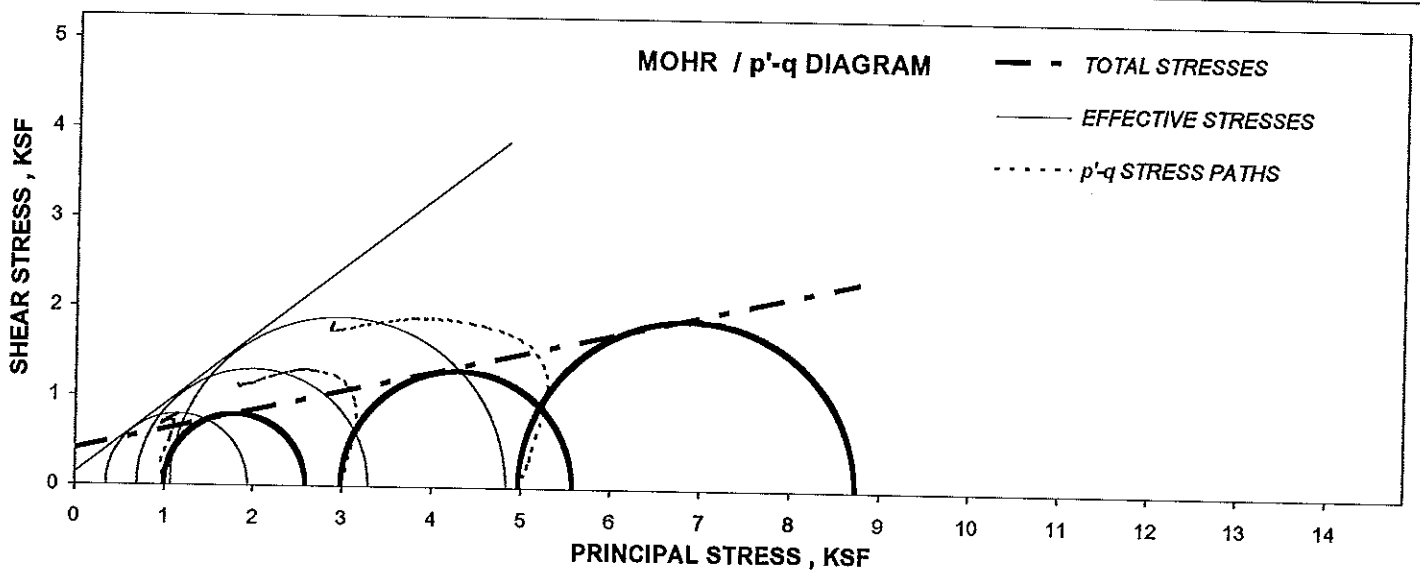
TEST PARAMETERS , TEST TYPE : CU/PP				
SPECIMEN NO.		1	2	3
B Value		0.95	0.95	0.95
BACK PRESSURE, ksf	U_o	8.6	8.6	8.6
CONFINING PRESSURE , ksf	σ_3'	1.0	3.0	5.0
MAX. DEVIATOR STRESS ,ksf	$\sigma_1-\sigma_3$	1.6	2.6	3.8
ULT. DEVIATOR STRESS , ksf	$\sigma_1-\sigma_3$	1.6	2.3	3.7
Specimen Shape @ Failure		Bulged		

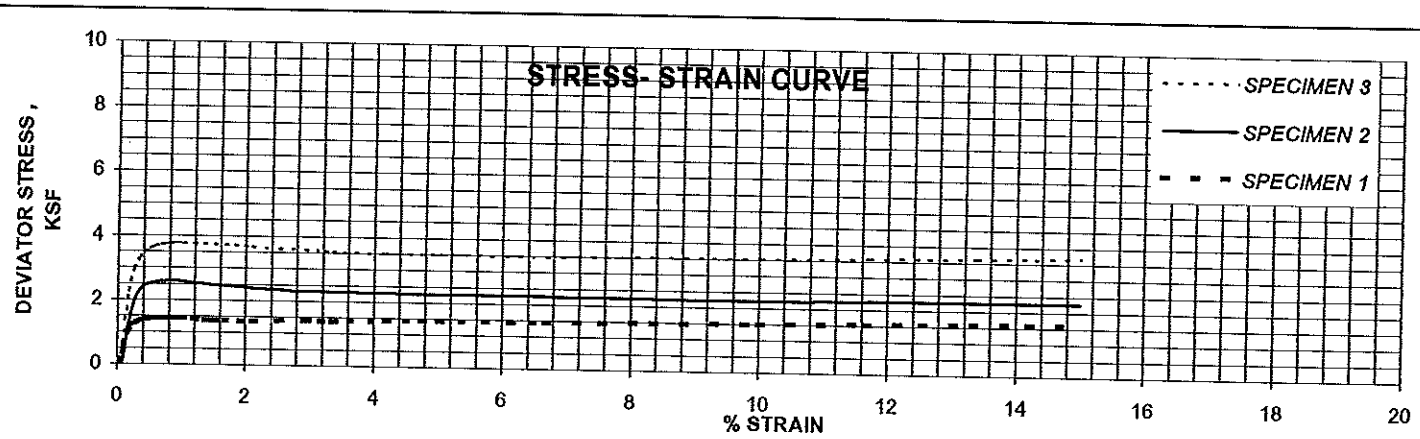
CONTROLLED : Strain @ 0.37 % per minute T50, Minutes = 1.07

PROCTOR TYPE : *Standard*, MAXIMUM DRY DENSITY, PCF : *118.1* ,OPTIMUM MOISTURE CONTENT , % : *13.4*

REMOLDED : *Specimens were remolded to 95 % of maximum dry density at about 0.0 % wet of o.m.c.*

SHEAR STRENGTH PARAMETERS	TOTAL		EFFECTIVE	
	COHESION , C (ksf) :	0.4	APPARENT COHESION , (ksf) :	0.1
	ANGLE OF INTER. FRICTION, Φ(DEGREES)	12	ANGLE OF INTER. FRICTION, Φ' (DEGREES) :	38





Buckling Point of Fixity Determination

2004 LRFD AASHTO 10.7.4.2

1/13/2010
4:36 PM

File No. 46.169B.1

Project Description: S-103 Bridge Over Fishing Creek IB, B-3

Pile Information:

Pile Type/Size:	DS48		Pile Type and Size
F.G. Elevation =	540	ft.	Bridge Finished Grade Elevation
Ds =	9	ft.	Depth from Finished Grade to Ground Surface
D_{neg} =	0	ft.	Depth Below Ground of Surface Soils Neglected
Ep =	259,559.7	tsf	Ep, Modulus of Elasticity of Pile
Ip =	12.5664	ft^4	Ip, Moment of Inertia of Pile

CLAY Subgrade:

Su =	0	psf	Undrained Shear Strength of Clays
Es =	0	tsf	Es, Soil Modulus for Clays
Lpent =	#DIV/0!	ft.	Lpent, Dept to point of fixity below ground due to buckling
L_{fg}=	#DIV/0!	ft.	L_{fg}, Distance from F.G. to point of fixity due to buckling
Elev. Point of Fixity =	#DIV/0!	ft.	Elevation of point of fixity due to buckling

SAND Subgrade:

Consistency =	Medium		Consistency, sand density (i.e. Loose, Medium, Dense)
Submerged =	Yes		Submerged, Below the Water Table
n_h =	40	tsf/ft	n_h, Rate of Increase of Soil Modulus with Depth for Sand
Lpent =	17.28	ft.	Lpent, Dept to point of fixity below ground due to buckling
L_{fg}=	26.3	ft.	L_{fg}, Distance from F.G. to point of fixity due to buckling
P.O.F. Elevation =	513.7	ft.	Elevation of point of fixity due to buckling

Buckling Point of Fixity Determination

2004 LRFD AASHTO 10.7.4.2

1/13/2010
4:35 PM

File No.	46.169B.1
Project Description:	S-103 Bridge Over Fishing Creek IB, B-4

Pile Information:

Pile Type/Size:	DS48		Pile Type and Size
F.G. Elevation =	540	ft.	Bridge Finished Grade Elevation
Ds =	17	ft.	Depth from Finished Grade to Ground Surface
D_{neg} =	0	ft.	Depth Below Ground of Surface Soils Neglected
Ep =	259,559.7	tsf	Ep, Modulus of Elasticity of Pile
Ip =	12.5664	ft^4	Ip, Moment of Inertia of Pile

CLAY Subgrade:

Su =	0	psf	Undrained Shear Strength of Clays
Es =	0	tsf	Es, Soil Modulus for Clays
Lpent =	#DIV/0!	ft.	Lpent, Dept to point of fixity below ground due to buckling
L_{fg}=	#DIV/0!	ft.	L_{fg}, Distance from F.G. to point of fixity due to buckling
Elev. Point of Fixity =	#DIV/0!	ft.	Elevation of point of fixity due to buckling

SAND Subgrade:

Consistency =	Medium		Consistency, sand density (i.e. Loose, Medium, Dense)
Submerged =	Yes		Submerged, Below the Water Table
n_h =	40	tsf/ft	n_h, Rate of Increase of Soil Modulus with Depth for Sand
Lpent =	17.28	ft.	Lpent, Dept to point of fixity below ground due to buckling
L_{fg}=	34.3	ft.	L_{fg}, Distance from F.G. to point of fixity due to buckling
P.O.F. Elevation =	505.7	ft.	Elevation of point of fixity due to buckling

Buckling Point of Fixity Determination

2004 LRFD AASHTO 10.7.4.2

1/13/2010
4:35 PM

File No.	46.169B.1	
Project Description:	S-103 Bridge Over Fishing Creek IB, B-5	

Pile Information:

Pile Type/Size:	DS48		Pile Type and Size
F.G. Elevation =	540	ft.	Bridge Finished Grade Elevation
Ds =	14	ft.	Depth from Finished Grade to Ground Surface
D_{neg} =	0	ft.	Depth Below Ground of Surface Soils Neglected
Ep =	259,559.7	tsf	Ep, Modulus of Elasticity of Pile
Ip =	12.5664	ft^4	Ip, Moment of Inertia of Pile

CLAY Subgrade:

Su =	0	psf	Undrained Shear Strength of Clays
Es =	0	tsf	Es, Soil Modulus for Clays
Lpent =	#DIV/0!	ft.	Lpent, Dept to point of fixity below ground due to buckling
L_{fg}=	#DIV/0!	ft.	L_{fg}, Distance from F.G. to point of fixity due to buckling
Elev. Point of Fixity =	#DIV/0!	ft.	Elevation of point of fixity due to buckling

SAND Subgrade:

Consistency =	Medium		Consistency, sand density (i.e. Loose, Medium, Dense)
Submerged =	Yes		Submerged, Below the Water Table
n_h =	40	tsf/ft	n_h, Rate of Increase of Soil Modulus with Depth for Sand
Lpent =	17.28	ft.	Lpent, Dept to point of fixity below ground due to buckling
L_{fg}=	31.3	ft.	L_{fg}, Distance from F.G. to point of fixity due to buckling
P.O.F. Elevation =	508.7	ft.	Elevation of point of fixity due to buckling

Buckling Point of Fixity Determination

2004 LRFD AASHTO 10.7.4.2

1/13/2010
4:43 PM

File No.	46.169B.1
Project Description:	S-103 Bridge Over Fishing Creek EB-5, B-6

Pile Information:

Pile Type/Size:	HP14x73 x-x		Pile Type and Size
F.G. Elevation =	538	ft.	Bridge Finished Grade Elevation
Ds =	0	ft.	Depth from Finished Grade to Ground Surface
D_{neg} =	0	ft.	Depth Below Ground of Surface Soils Neglected
Ep =	2,088,000.0	tsf	Ep, Modulus of Elasticity of Pile
Ip =	0.0352	ft^4	Ip, Moment of Inertia of Pile

CLAY Subgrade:

Su =	0	psf	Undrained Shear Strength of Clays
Es =	0	tsf	Es, Soil Modulus for Clays
Lpent =	#DIV/0!	ft.	Lpent, Dept to point of fixity below ground due to buckling
L_{fg}=	#DIV/0!	ft.	L_{fg}, Distance from F.G. to point of fixity due to buckling
Elev. Point of Fixity =	#DIV/0!	ft.	Elevation of point of fixity due to buckling

SAND Subgrade:

Consistency =	Dense		Consistency, sand density (i.e. Loose, Medium, Dense)
Submerged =	Yes		Submerged, Below the Water Table
n_h =	100	tsf/ft	n_h, Rate of Increase of Soil Modulus with Depth for Sand
Lpent =	6.74	ft.	Lpent, Dept to point of fixity below ground due to buckling
L_{fg}=	6.7	ft.	L_{fg}, Distance from F.G. to point of fixity due to buckling
P.O.F. Elevation =	531.3	ft.	Elevation of point of fixity due to buckling