



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 $S_{D1-SEEb}$ 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:

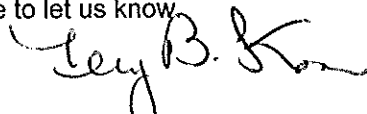
RBO Fishing Creek (46.031919B.01)

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: 45.169B.1	Latitude: 34.905
Route: S-103	County: York	Longitude: 81.1070
Project: RPO Fishing Creek		

Design EQ	PGA	S _{ps}	S _{xi}	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

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

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
0.09	0.10
0.10	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
0.47	0.10
0.51	0.10
0.55	0.10
0.59	0.10
0.63	0.07
0.67	0.06
0.71	0.05
0.75	0.04
0.79	0.03
0.83	0.03
0.87	0.03
0.91	0.02
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S-103 (Oak Park Road) - RBO Fishing Creek York County, South Carolina					LOG OF BORING No. B-2					
File No. 46.169B.1; Project No. BR-BR46 (012) Pin. No. 31919					Station: 58+93 Offset: 13 Feet Left of Proposed Centerline					
Date Drilled: 2/13/07		Supervisor: QORE (72720)			Notes: Coordinates: N34°54.312' W81°06.476' <i>Roadway</i>					
Casing Length: NA		Ground Elevation: 539.0								
Hammer Type: <input checked="" type="checkbox"/> Gravity <input type="checkbox"/> Automatic <input checked="" type="checkbox"/> Other: CME-45										
Water Level: 10.5 Ft. at TOB; 7 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	STD. PENETRATION TEST DATA (blows/ft)
	0.0	Top of Ground								5 10 20 40 70
	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						
	4.0	Fill - Firm Reddish Brown, Brown, and Gray Sandy Clay with Small Roots (CL)		4.0	SS-2	3	3	2	5	
534.0	6.0	Fill - Firm Reddish Brown, Brown, and Gray Sandy Clay with Small Roots (CL)		6.0	SS-3	2	3	3	6	
	8.0	Alluvium - Firm Brown, Gray, and Reddish Brown Silty Fine to Coarse Sand with Gravel (SM)		8.0	SS-4	10	10	9	19	
529.0		Residuum - Stiff Grayish Brown, Brown, and Dark Brown Sandy Lean Clay (CL)			SS-5	3	5	8	13	
	14.0			13.5						
524.0	15.0	Stiff Gray and Brown Sandy Clay (CL)			SS-6	4	5	7	12	
		Boring Terminated at 15 Feet								
519.0										
514.0										
509.0										
504.0										
499.0										
494.0										
LEGEND										
SAMPLER TYPE					DRILLING METHOD					
SS - Split Spoon					HSA - Hollow Stem Auger					
ST - Shelby Tube					CFA - Continuous Flight Augers					
AWG - Rock Core, 1-1/8"					DC - Driving Casing					
NQ - Rock Core, 1-7/8"					RW - Rotary Wash					
CU - Cuttings					RC - Rock Core					
CT - Continuous Tube										

SC DOT 72720.GPJ SC DOT.GDT 6/8/07



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 (72720)			Notes: Coordinates: N34°54.333' W81°06.449' IB									
Casing Length: 9		Ground Elevation: 540.0												
Hammer Type: <input checked="" type="checkbox"/> Gravity <input type="checkbox"/> Automatic <input checked="" type="checkbox"/> Other: CME-45														
Water Level: 9 Ft. at TOB; 9.5 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	STD. PENETRATION TEST DATA (blows/ft)				
	0.0	Top of Bridge Deck								5	10	20	40	70
	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	SS-1	3	3	3	6					
530.0				11.0	SS-2	2	3	4	7					
	13.0	Alluvium - Firm Brown and Gray Clayey Fine to Medium Sand with Small Roots (SC)		13.0	SS-3	3	5	7	12					
525.0				15.0	SS-4	3	3	4	7					
	17.0	Alluvium - Loose Gray Poorly Graded Fine to Medium Sand with Silt and Wood Pieces (SP-SM)		17.0	SS-5	15	17	20	37					
	20.0	Residuum - Dense Gray and Brown Fine to Coarse Sand with Silt and Gravel Fragments												
520.0		Partially Weathered Rock - Sampled as Very Dense Gray and Brown Fine to Coarse Sand with Gravel (PWR)		21.5	SS-6	50/2"			100+					
515.0														
	25.0	Auger Refusal Encountered at 25 Feet; Boring Terminated												
510.0														
505.0														
500.0														
495.0														

SC DOT 72720.GPJ SC DOT.GDT 6/8/07

LEGEND

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



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 (72720)		Notes: Coordinates: N34°54.335' W81°06.436' IB										
Casing Length: 17		Ground Elevation: 540.0												
Hammer Type: <input checked="" type="checkbox"/> Gravity <input type="checkbox"/> Automatic <input checked="" type="checkbox"/> Other: CME-45														
Water Level: 12 Ft. at TOB; 12 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	STD. PENETRATION TEST DATA (blows/ft)				
	0.0	Top of Bridge Deck								5	10	20	40	70
	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	Alluvium - Firm Brownish Gray Fine to Coarse Sand with Silt (SP-SM)		17.0										
	18.0													
	19.0	Partially Weathered Rock - Sampled as Very Dense Brown, Yellowish Brown, and Reddish Brown Silty Fine to Medium Sand (PWR)		19.0	SS-1	24	12	8	20					
520.0	20.0	Auger Refusal Encountered at 19 Feet; Boring Terminated			SS-2	50/0"			100+					
515.0	25.0													
510.0	30.0													
505.0	35.0													
500.0														
495.0														

LEGEND

SAMPLER TYPE

SS - Split Spoon NQ - Rock Core, 1-7/8"
ST - Shelby Tube 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

SC DOT 72720.GPJ SC DOT.GDT 6/8/07



S-103 (Oak Park Road) - RBO Fishing Creek York County, South Carolina					LOG OF BORING No. B-5									
File No. 46.169B.1; Project No. BR-BR46 (012) Pin. No. 31919					Station: 62+60 Offset: 30 Feet Left of Proposed Centerline									
Date Drilled: 2/14/07			Supervisor: QORE (72720)			Notes: Coordinates: N34°54.340' W81°06.415' Backfilled and patched with asphalt at time of boring completion. IB								
Casing Length: NA			Ground Elevation: 540.0											
Hammer Type: <input checked="" type="checkbox"/> Gravity <input type="checkbox"/> Automatic <input checked="" type="checkbox"/> Other: CME-45			Drilling Method: HSA											
Water Level: 9 Feet at TOB														
Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	STD. PENETRATION TEST DATA (blows/ft)				
	0.0	Top of Existing Roadway								5	10	20	40	70
	0.7	8 Inches Asphalt		0.0	SS-1	10	9	11	20					
	0.8	1 Inch Stone Base		2.0										
	2.0	Fill - Firm Grayish Brown, Reddish Brown, and Brown Clayey Fine to Medium Sand (SC)		4.0	SS-2	8	7	9	16					
535.0	4.0	Fill - Firm Grayish Brown Silty Fine to Medium Sand (SM)		6.0	SS-3	6	10	12	22					
	8.0	Fill - Stiff Yellowish Brown and Reddish Brown Sandy Lean Clay (CL)		8.0	SS-4	6	8	8	16					
530.0		Alluvium - Firm to Loose Reddish Brown, Light Brown, and Gray Silty Clayey Fine Sand (SC-SM)			SS-5	4	5	7	12					
	14.0	Residuum - Loose Brown, Reddish Brown, and Gray Micaceous Silty Fine to Medium Sand (SM)		13.5	SS-6	7	4	6	10					
525.0	17.0	Partially Weathered Rock - Sampled as Very Dense Gray, Brown, and White Micaceous Silty Fine to Coarse Sand (PWR)		18.5	SS-7	50/5*			100+					
520.0		Partially Weathered Rock - Sampled as Very Dense Grayish Brown, Brown, and Dark Brown Slightly Micaceous Silty Fine to Coarse Sand (PWR)		23.5	SS-8	50/5*			100+					
515.0	25.5	Auger Refusal Encountered at 25-1/2 Feet; Boring Terminated												
510.0	30													
509	31													
508	32													
505.0														
500.0														
495.0														

LEGEND

SAMPLER TYPE

SS - Split Spoon NQ - Rock Core, 1-7/8"
ST - Shelby Tube 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

SC DOT 72720.GPJ SC DOT.GDT 6/8/07



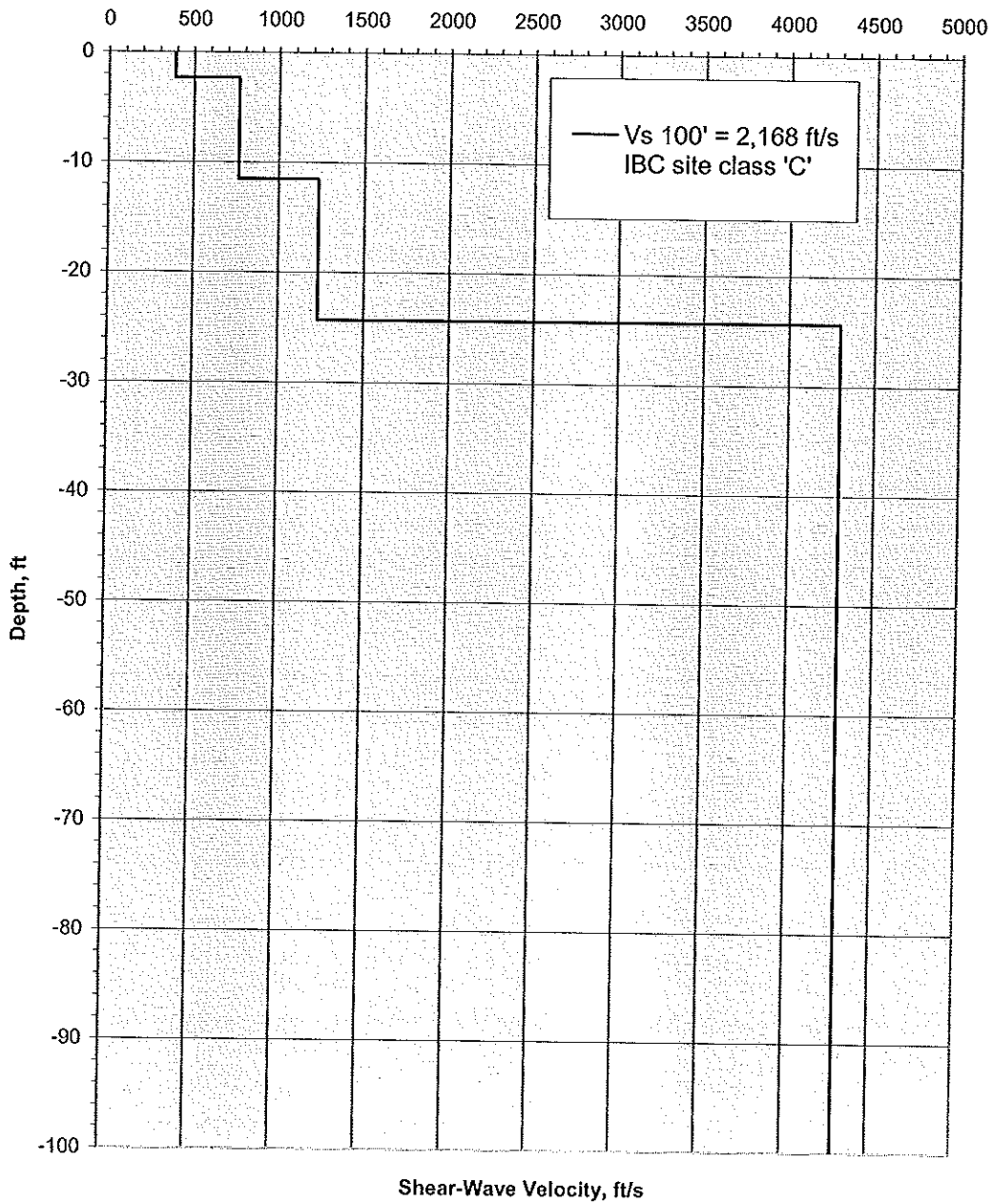
S-103 (Oak Park Road) - RBO Fishing Creek York County, South Carolina File No. 46.169B.1; Project No. BR-BR46 (012) Pin. No. 31919				LOG OF BORING No. B-6 Station: 63+52 Offset: 9 Feet Left of Proposed Centerline										
Date Drilled: 2/14/07		Supervisor: QORE (72720)		Notes: Coordinates: N34°54.344' W81°06.399' EB										
Casing Length: NA		Ground Elevation: 538.0												
Hammer Type: <input checked="" type="checkbox"/> Gravity <input type="checkbox"/> Automatic <input checked="" type="checkbox"/> 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	STD. PENETRATION TEST DATA (blows/ft)				
	0.0	Top of Ground								5	10	20	40	70
	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										
	4.0			4.0	SS-2	2	4	5	9					
533.0		Alluvium - Firm Gray, Brown, and Dark Brown Sandy Silt (ML)		6.0	SS-3	3	3	4	7					
532	6.0	Residuum - Very Stiff Grayish Brown, Brown, and Dark Brown Sandy Silt (ML)		8.0	SS-4	6	9	11	20					
531	8.0	Very Firm Grayish Brown, Yellowish Brown, and Brown Silty Fine Sand (SM)			SS-5	6	15	12	27					
530														
529	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					
528.0														
	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					
523.0														
	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+					
518.0														
514	25.5	Auger Refusal Encountered at 25-1/2 Feet; Boring Terminated												
513.0														
508.0														
503.0														
498.0														
493.0														

SC DOT 72720.GPJ SC DOT.GDT 6/8/07

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	

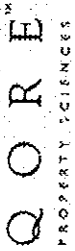
Job No. 72720: S-103 (Oak Park Road) RBO Fishing Creek
File No. 46.169B.1; Project No. BR-BR46 (012) PIN No. 31919
Station: 63+77
Offset: 6 Feet Left of Proposed Centerline
Boring No. SA-1 Vs Model



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. 72720, Report No. 115235

Boring No.	Sample Depth (ft)	Sample No.	Soil Classification		% Fines (% Passing #200 Sieve)	Atterberg Limits		Moistur e 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

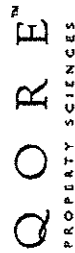
Notes: NP = Non-plastic; N/A = Test Not Performed



AASHTO R18

GRAVEL		SAND		FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	CLAY

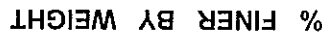




AAR
AASHTO R18

SOIL DESCRIPTION : Brown, Gray, and Red Silty Fine to Medium Sand			
LIQUID LIMIT, % :	N/A	PLASTICITY INDEX, % :	N/A
D10, MM :	-	D30, MM :	0.085
CLASSIFICATION		UNIFIED :	[SM]
		MOISTURE, % :	12.7
		D60, MM :	0.33
		AASHTO :	[A-2-4]
		FINES, % :	27.6
		COEFF. OF CURVATURE, C _c :	-
		COEFF. OF UNIFORMITY, C _u :	-
		SP. GRAVITY, G _s :	-

FINES



GRAIN SIZE IN MILLIMETERS

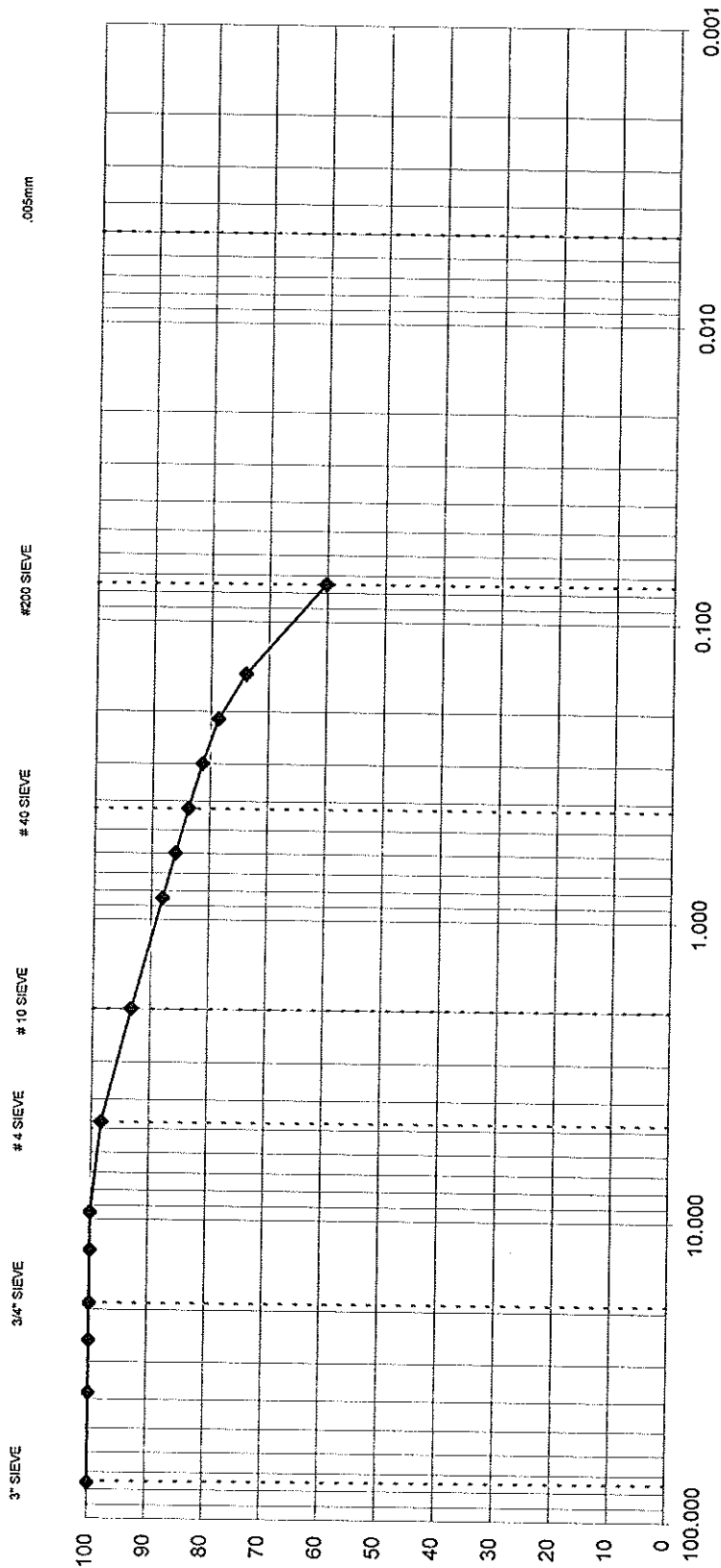


QORESM
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GRAIN SIZE DISTRIBUTION TEST REPORT (ASTM D422)



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.:	72720	REPORT NO.:	115235	DATE:	5/30/2007
BORING / PIT NO.:	B - 2	DEPTH / ELEV.:	8' - 10'	SAMPLE NO.:	SS-5
SAMPLE LOCATION:	SS				
SOIL DESCRIPTION:	Grayish Brown, Brown, and Dark Brown Sandy Lean Clay				
LIQUID LIMIT, %:	24	PLASTICITY INDEX, %:	8	MOISTURE, %:	18.1
D ₁₀ , MM:	-	D ₃₀ , MM:	-	D ₆₀ , MM:	0.074
CLASSIFICATION	UNIFIED:		CL	AASHTO:	A-4(2)
GRAVEL		SAND		FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT
CLAY		CLAY		CLAY	
SP. GRAVITY, G _s :		FINES, %:			
-		60.2			
COEFF. OF CURVATURE, C _c :		-			
COEFF. OF UNIFORMITY, C _u :		-			



PARTICLE-SIZE DISTRIBUTION TEST REPORT SIEVE AND HYDROMETER ASTM D422



REV 1.0/17/03

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. : 72720

REPORT NO. : 115235

DATE : 5/30/07

REVIEWED BY : *[Signature]*

BORING / PIT NO. : B-3

DEPTH / ELEV. : 9' - 11'

SAMPLE NO. : SS-1

SAMPLE TYPE : SS

SOIL DESCRIPTION : Brown and Reddish Brown Sandy Lean Clay

LIQUID LIMIT, % : 29

PLASTICITY INDEX, % : 10

MOISTURE, % : 24.6

SP. GRAVITY, G_s : 2.68

D₁₀, MM : -

D₃₀, MM : 0.0098

D₆₀, MM : 0.061

FINES, % : 65.6

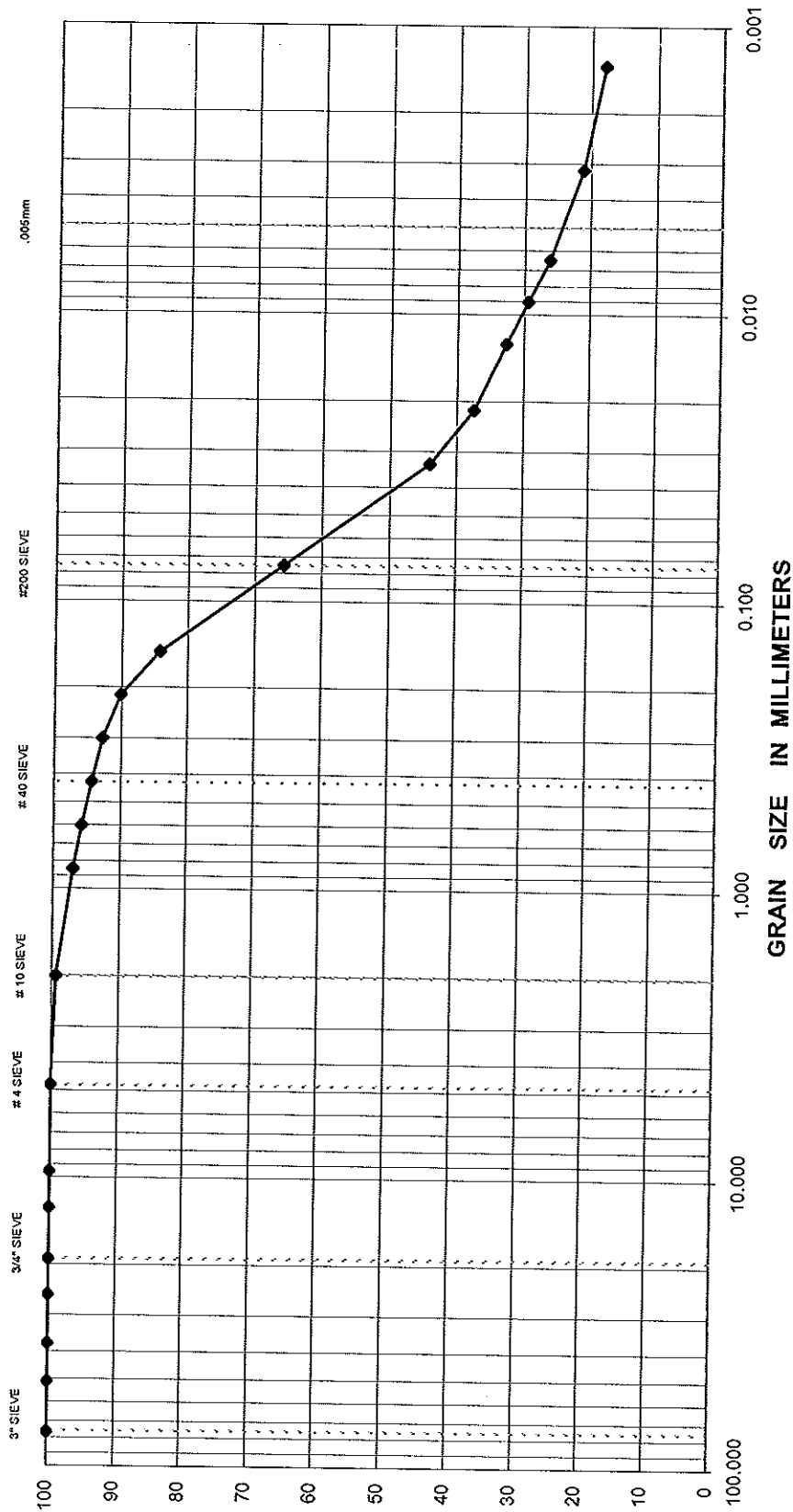
CLASSIFICATION : UNIFIED : CL

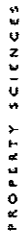
AASHTO : A-4(4)

COEFF. OF CURVATURE, C_c : -

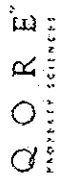
COEFF. OF UNIFORMITY, C_u : -

GRAVEL			SAND			FINES		
COARSE	FINE		COARSE	MEDIUM	FINE	SILT	CLAY	





GRAIN SIZE IN MILLIMETERS



ASHTO R18
AAR

JOB NAME :

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.:	72720	REPORT NO.:	115235	DATE:	5/30/07	REVIEWED BY:	
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DATE:	3/30/01	REVIEWED BY:	
DEPTH / ELEV.:	6' - 8'	SAMPLE NO.:	SS-4
BORING / PIT NO.:	B - 5	SAMPLE TYPE:	SS

SAMPLE LOCATION :

SOIL DESCRIPTION : Yellowish Brown and Reddish Brown Sandy Lean Clay

SOIL DESCRIPTION :	Yellowish Brown and Reddish Brown Sandy Lean Clay	2.66
PORE LIMIT %		
SP. GRAVITY, Gs :		2.66

LIQUID LIMIT, % :	34	PLASTICITY INDEX, % :	12	MOISTURE, % :	23.2	FINES, % :	70.5
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LINE, %	COEFF OF CURVATURE	0.03	
D10, MM :	D30, MM :	0.0083	0.054
D60, MM :			

CLASSIFICATION	D60, MM :	0.0083	0.054	COEFF. OF CURVATURE, C_c :
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CLASSIFICATION	UNIFIED :	CL	AASHTO :	COEFF. OF UNIFORMITY, C_u :
			A-6(7)	

GRAVEL	SAND	FINES
0.075	0.075	0.075
0.15	0.15	0.15
0.3	0.3	0.3
0.6	0.6	0.6
1.18	1.18	1.18
2.5	2.5	2.5
4.75	4.75	4.75
7.5	7.5	7.5
15	15	15
30	30	30
60	60	60
100	100	100
200	200	200
425	425	425
850	850	850
1750	1750	1750
3550	3550	3550
7100	7100	7100
14200	14200	14200
28400	28400	28400
56800	56800	56800
113600	113600	113600
227200	227200	227200
454400	454400	454400
908800	908800	908800
1817600	1817600	1817600
3635200	3635200	3635200
7270400	7270400	7270400
14540800	14540800	14540800
29081600	29081600	29081600
58163200	58163200	58163200
116326400	116326400	116326400
232652800	232652800	232652800
465305600	465305600	465305600
930611200	930611200	930611200
1861222400	1861222400	1861222400
3722444800	3722444800	3722444800
7444889600	7444889600	7444889600
14889779200	14889779200	14889779200
29779558400	29779558400	29779558400
59559116800	59559116800	59559116800
119118233600	119118233600	119118233600
238236467200	238236467200	238236467200
476472934400	476472934400	476472934400
952945868800	952945868800	952945868800
1905891737600	1905891737600	1905891737600
3811783475200	3811783475200	3811783475200
7623566950400	7623566950400	7623566950400
15247133900800	15247133900800	15247133900800
30494267801600	30494267801600	30494267801600
60988535603200	60988535603200	60988535603200
121977071206400	121977071206400	121977071206400
243954142412800	243954142412800	243954142412800
487908284825600	487908284825600	487908284825600
975816569651200	975816569651200	975816569651200
1951633139302400	1951633139302400	1951633139302400
3903266278604800	3903266278604800	3903266278604800
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62452260457676800	62452260457676800	62452260457676800
124904520915353600	124904520915353600	124904520915353600
249809041830707200	249809041830707200	249809041830707200
499618083661414400	499618083661414400	499618083661414400
999236167322828800	999236167322828800	999236167322828800
1998472334645657600	1998472334645657600	1998472334645657600
3996944669291315200	3996944669291315200	3996944669291315200
7993889338582630400	7993889338582630400	7993889338582630400
15987778677165260800	15987778677165260800	15987778677165260800
31975557354330521600	31975557354330521600	31975557354330521600
63951114708661043200	63951114708661043200	63951114708661043200
127902229417322086400	127902229417322086400	127902229417322086400
255804458834644172800		

GRAVEL

COARSE

32

COARSE |

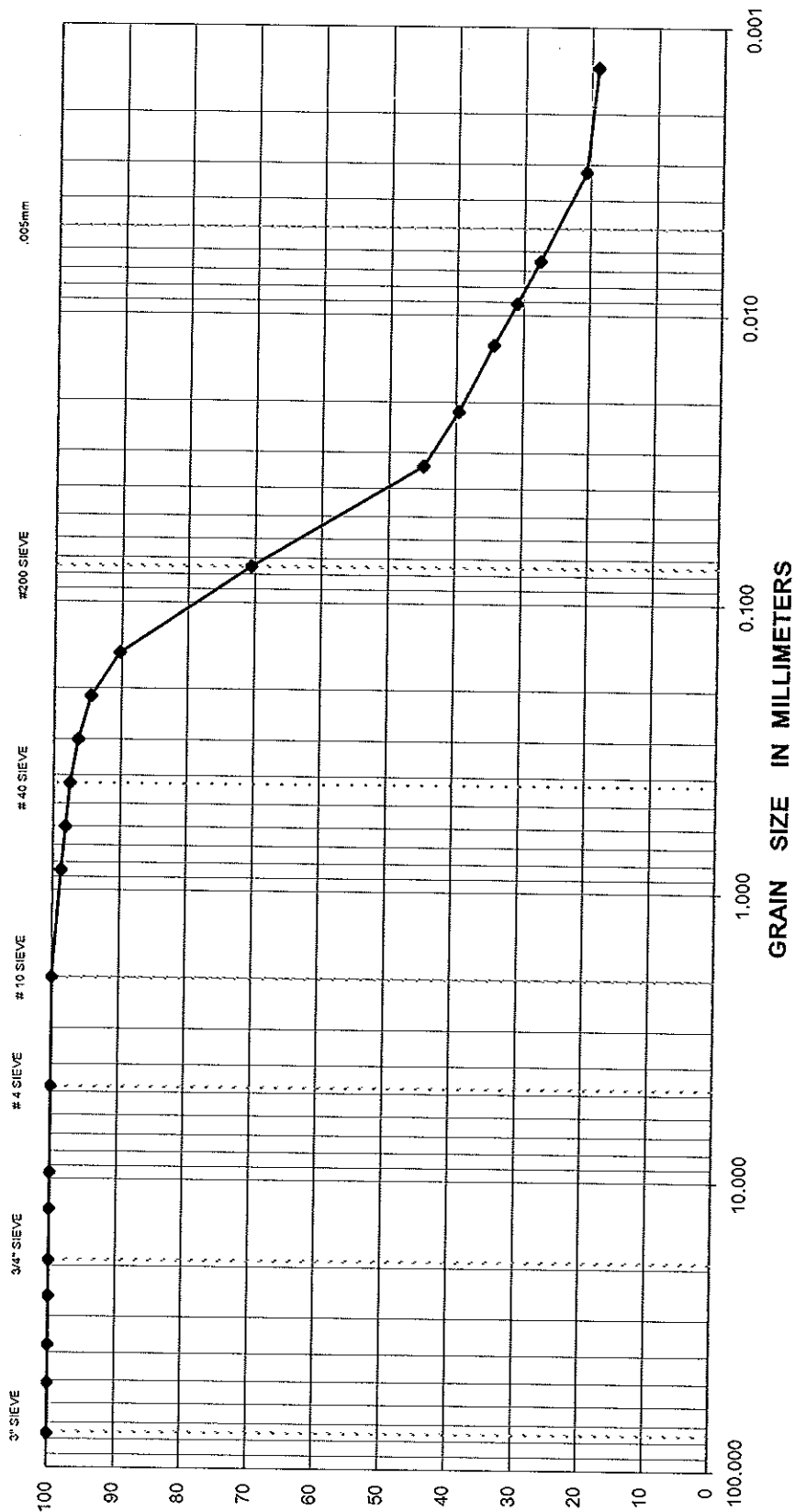
MEDIUM

END

4

FINES

1000000



PARTICLE-SIZE DISTRIBUTION TEST REPORT SIEVE AND HYDROMETER

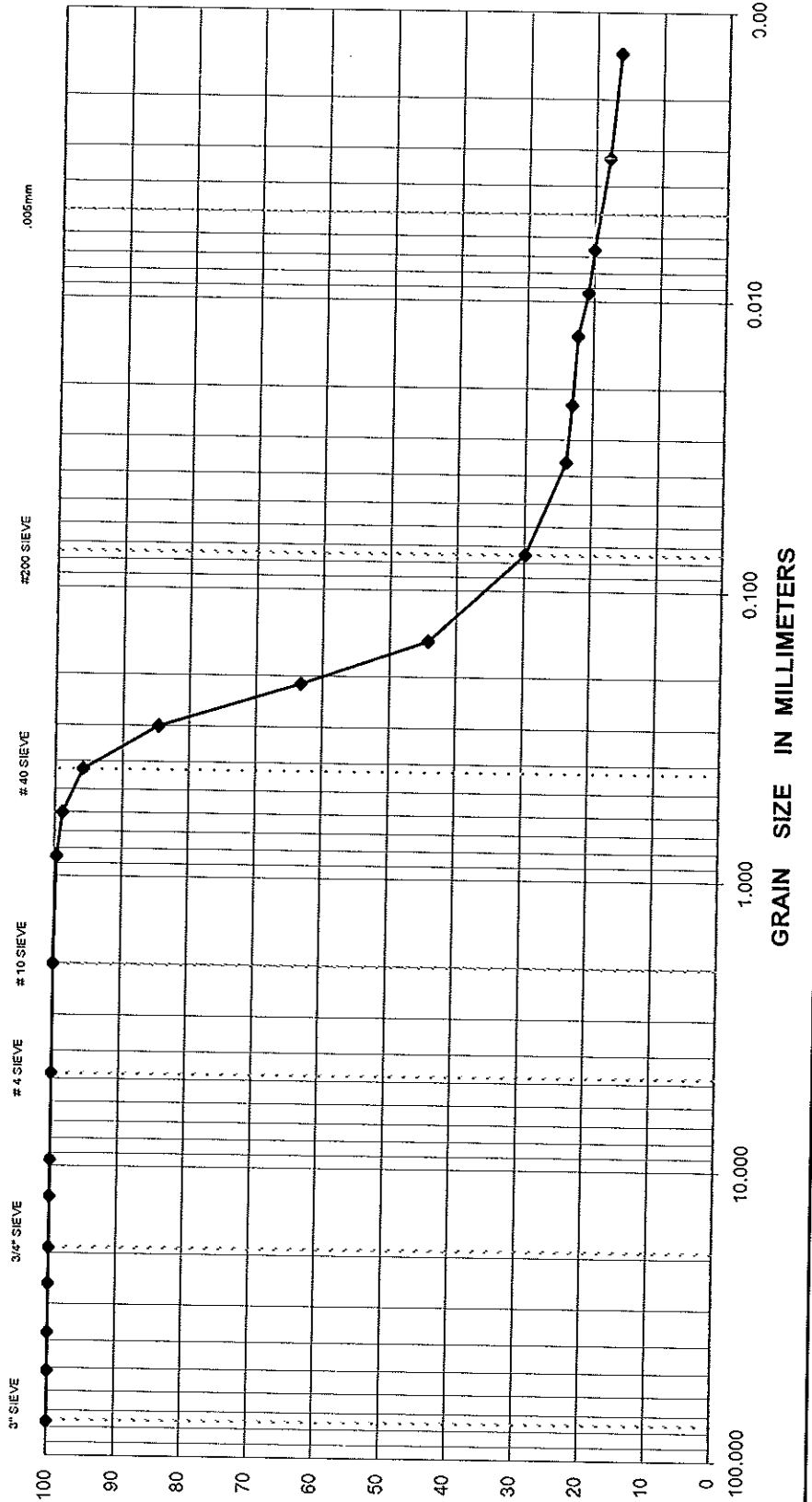
ASTM D422



REV1.0/17/03

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. : 72720	REPORT NO. : 115235	DATE : 5/30/07	REVIEWED BY : <i>[Signature]</i>
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			
LIQUID LIMIT, % : 22	PLASTICITY INDEX, % : 5	MOISTURE, % : 18.7	SP. GRAVITY, Gs : 2.65
D10, MM : -	D30, MM : 0.075	D60, MM : 0.200	FINES, % : 29.7
CLASSIFICATION		COEFF. OF CURVATURE, C_c : -	COEFF. OF UNIFORMITY, C_u : -
UNIFIED : SC-SM		AASHTO : A-2-4	

GRAVEL		SAND		FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	CLAY





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PARTICLE-SIZE DISTRIBUTION TEST REPORT

SIEVE AND HYDROMETER

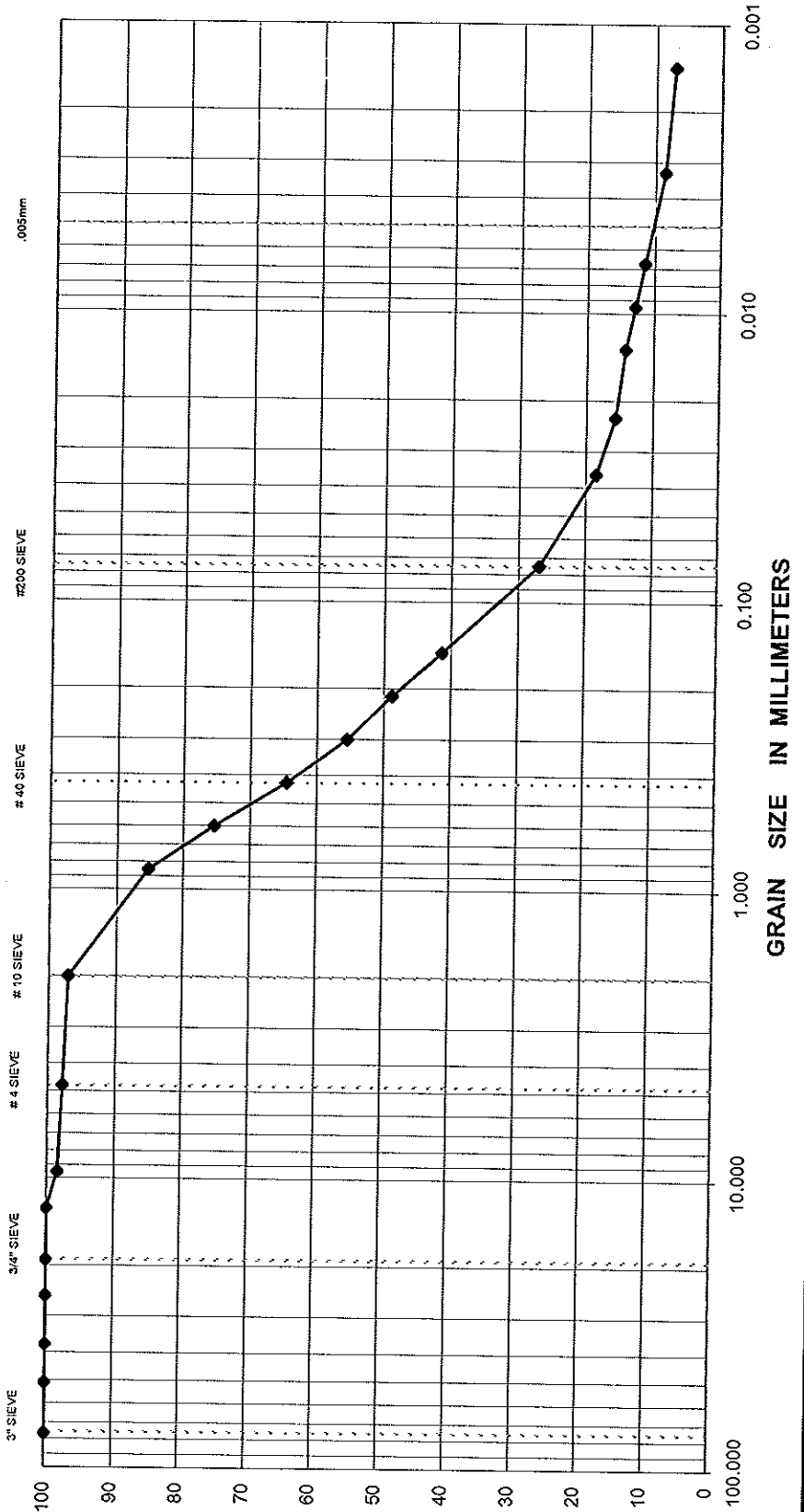
ASTM D422



REV 1.0/1/03

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. :		72720		REPORT NO. :	115235	DATE :	5/30/07	REVIEWED BY :	K		
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											
LIQUID LIMIT, % :		31		PLASTICITY INDEX, % :	6		MOISTURE, % :	24.7		SP. GRAVITY, Gs :	2.69
D10, MM :		0.0050		D30, MM :	0.088		D60, MM :	0.36		COEFF. OF CURVATURE, C _c :	26.9
CLASSIFICATION		UNIFIED :		SM		AASHTO :	A-2-4		COEFF. OF UNIFORMITY, C _u :	4.3	
										72.0	

GRAVEL		SAND		FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	CLAY





Q O R E[™]

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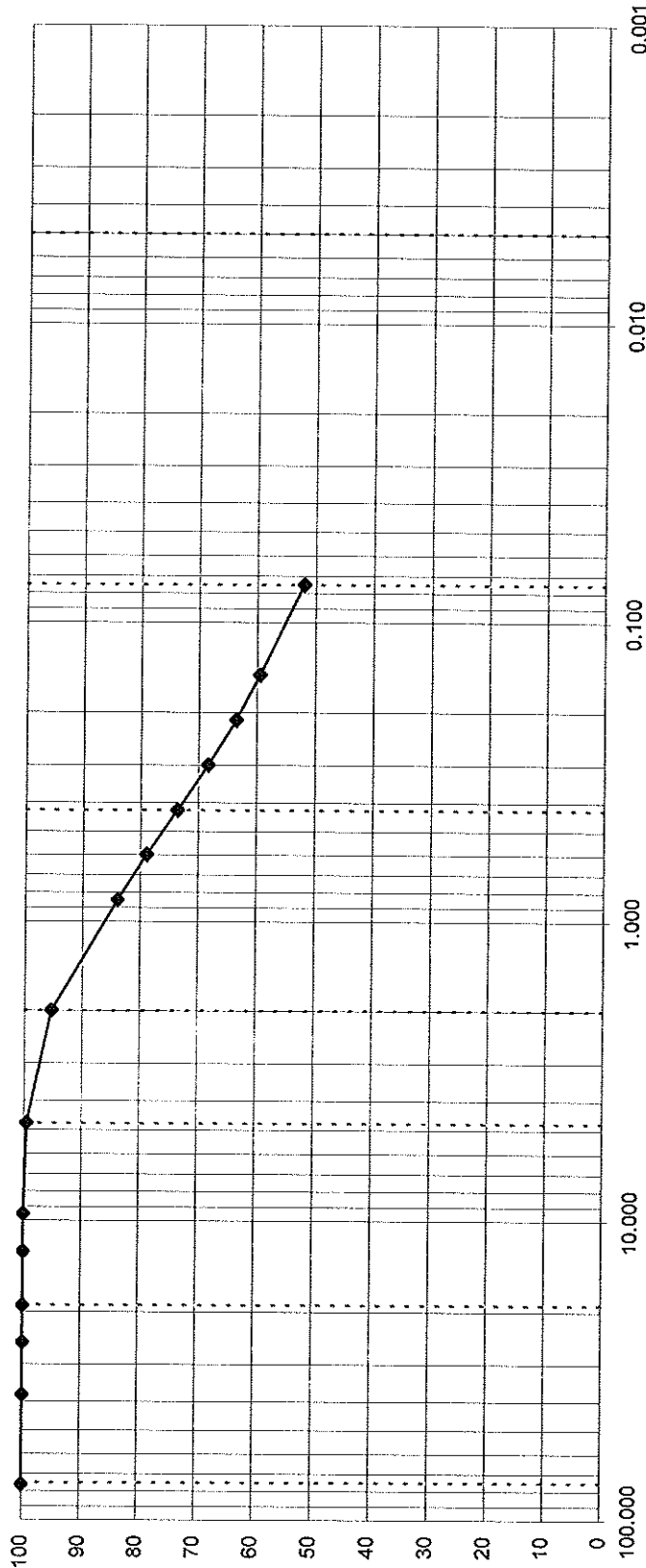
GRAIN SIZE DISTRIBUTION TEST REPORT (ASTM D422)



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. :		72720		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									
LIQUID LIMIT, % :		35		PLASTICITY INDEX, % :	15	MOISTURE, % :	19.7	SP. GRAVITY, G _s :	-
D ₁₀ , MM :		-		D ₃₀ , MM :	-	D ₆₀ , MM :	0.16	FINES, % :	52.0
CLASSIFICATION		UNIFIED :		CL		AASHTO :		A-6(5)	
		COEFF. OF CURVATURE, C _c :				COEFF. OF UNIFORMITY, C _u :			

GRAVEL		SAND		FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	CLAY

3" SIEVE #4 SIEVE #10 SIEVE #20 SIEVE .005mm



GRAIN SIZE IN MILLIMETERS



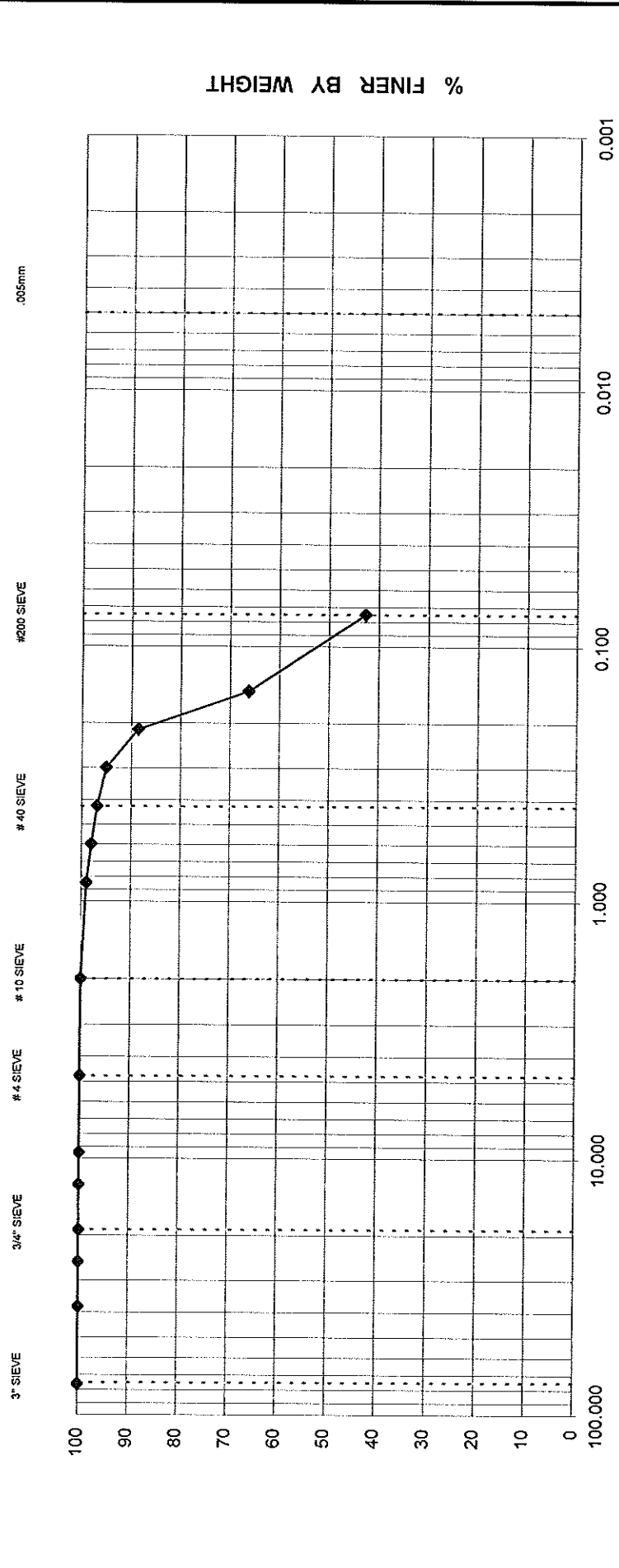
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PROPERTY SCIENCES

GRAIN SIZE DISTRIBUTION TEST REPORT (ASTM D422)



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. :		72720	REPORT NO. :	115235	DATE :	5/30/2007	REVIEWED BY :	<i>[Signature]</i>
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						
LIQUID LIMIT, % :		22	PLASTICITY INDEX, % :	NP	MOISTURE, % :	16.9	SP. GRAVITY, Gs :	-
D ₁₀ , MM :		-	D ₃₀ , MM :	-	D ₆₀ , MM :	0.13	FINES, % :	42.6
CLASSIFICATION		UNIFIED :		SM	AASHTO :	A-4	COEFF. OF CURVATURE, C _c :	-
							COEFF. OF UNIFORMITY, C _u :	-

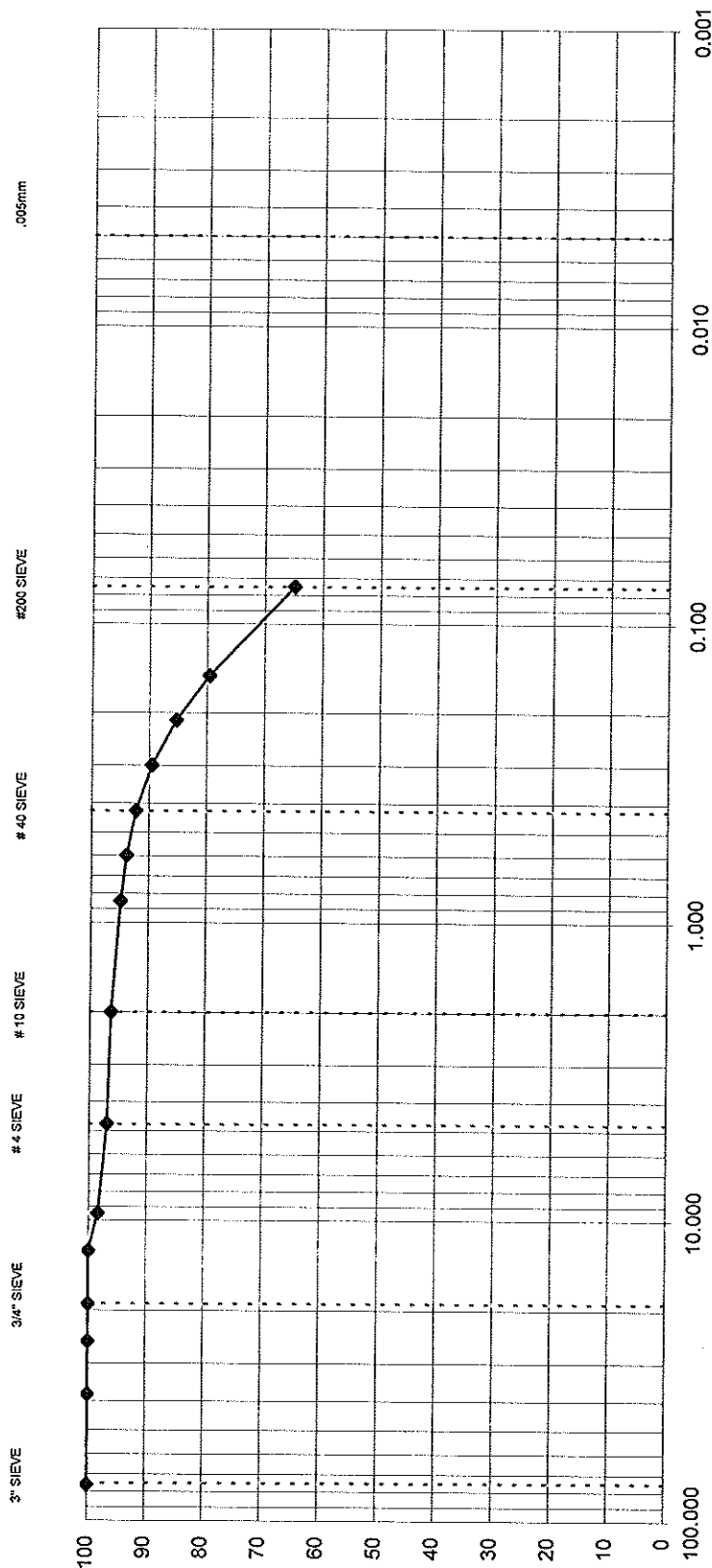
GRAVEL			SAND			FINES		
COARSE	FINE		COARSE	MEDIUM	FINE	SILT	CLAY	





PROPERTY SCIENCES

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GRAIN SIZE IN MILLIMETERS

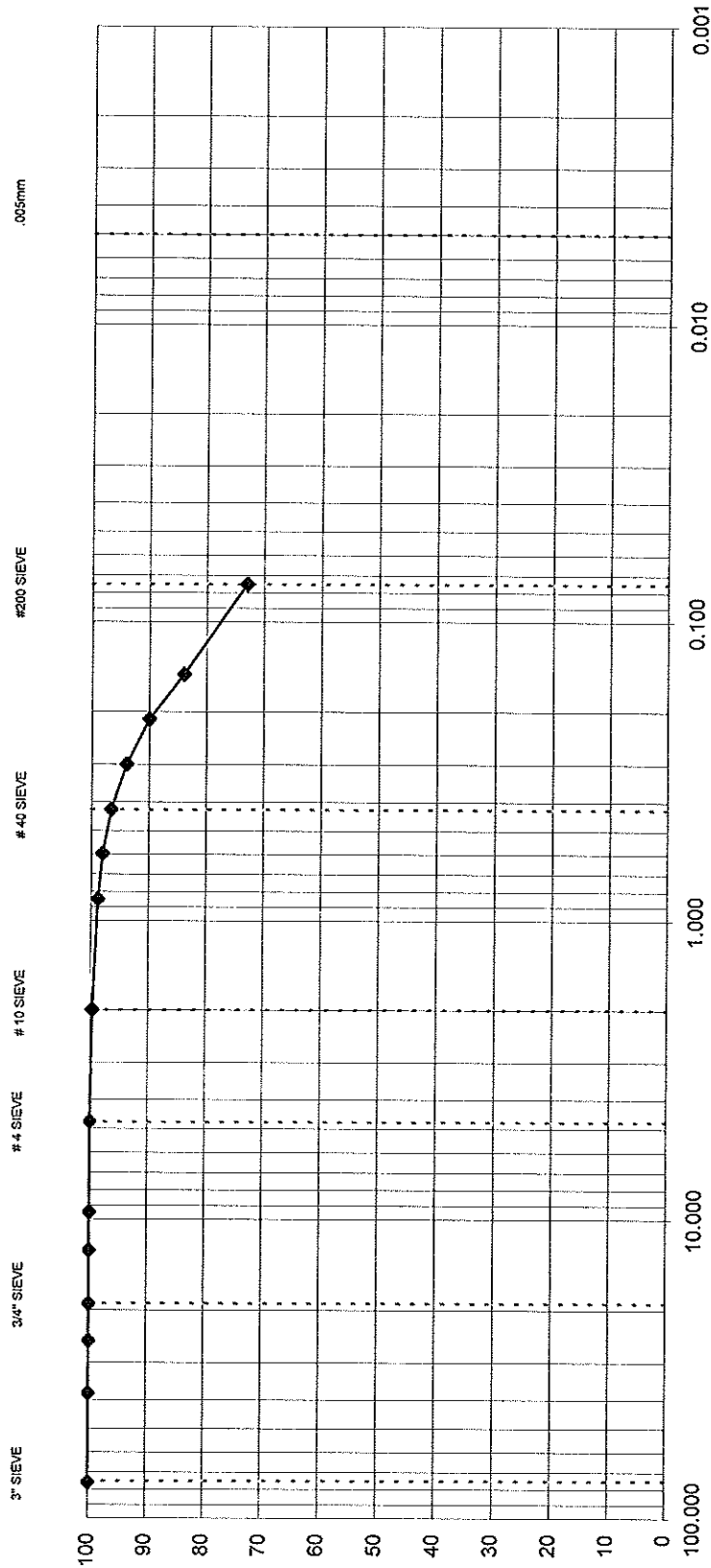


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PROPERTY SCIENCES

GRAIN SIZE DISTRIBUTION TEST REPORT (ASTM D422)



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. :	72720	REPORT NO. :	115235	DATE :	5/30/2007
BORING / PIT NO. :	B-7	DEPTH / ELEV. :	6' - 8'	SAMPLE NO. :	SS-4
SAMPLE LOCATION :	SS				
SOIL DESCRIPTION : Gray, Brown, and Light Brown Lean Clay with Sand					
LIQUID LIMIT, % :	39	PLASTICITY INDEX, % :	25	MOISTURE, % :	19.0
D10, MM :	-	D30, MM :	-	D60, MM :	-
CLASSIFICATION	UNIFIED :		CL	AASHTO :	A-6(16)
GRAVEL		SAND		FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT
CLAY					
SP. GRAVITY, Gs :					
FINES, % :					
COEFF. OF CURVATURE, C _c :					
COEFF. OF UNIFORMITY, C _u :					





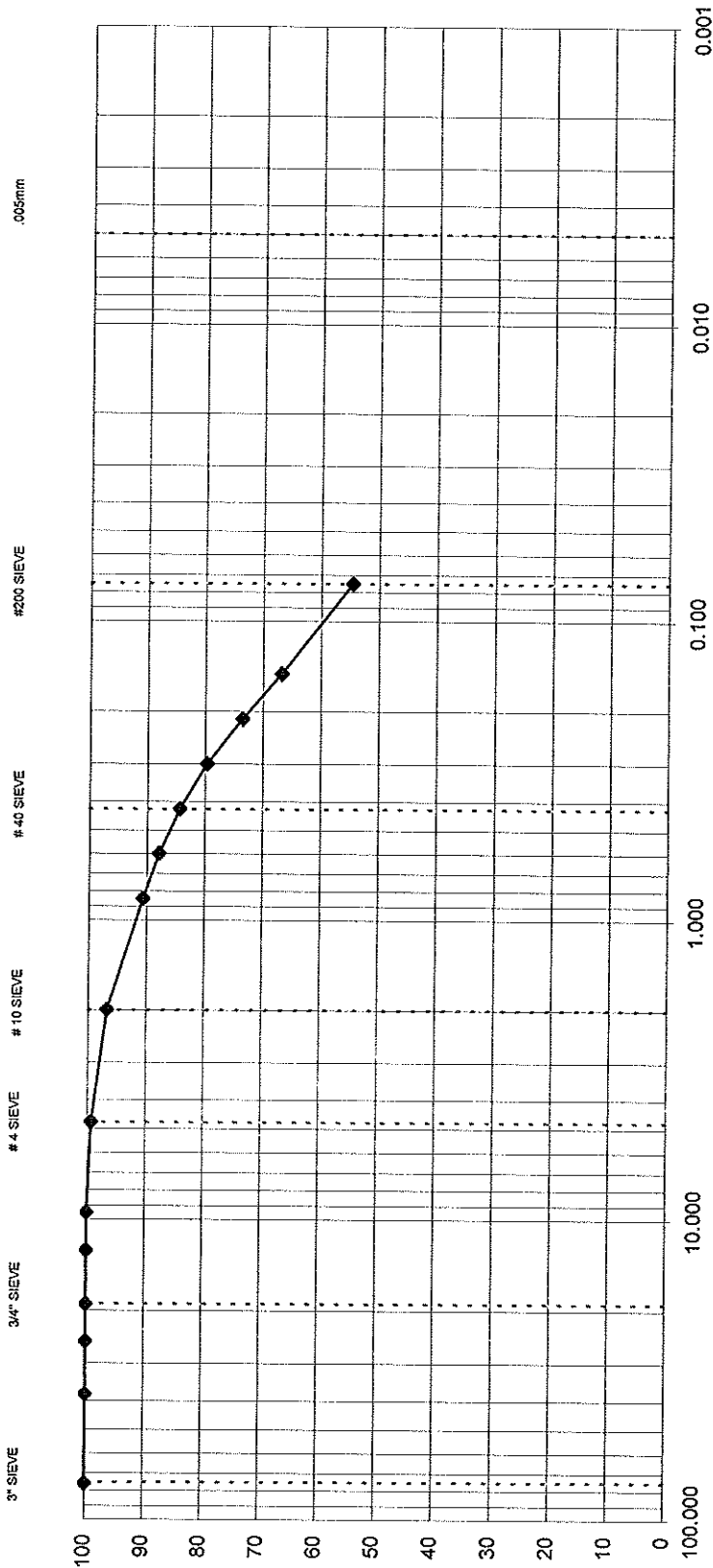
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PROPERTY SCIENCES

GRAIN SIZE DISTRIBUTION TEST REPORT (ASTM D422)



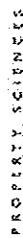
JOB NAME :	S-103 (Oak Park Road) - RBO Fishing Creek; York County, South Carolina; File No. 46.169B.1; Project No. BR-BR46(012); Pin No. 31919				
JOB NO. :	72720	REPORT NO. :	115235	DATE :	5/30/2007
BORING / PIT NO. :	B-8	DEPTH / ELEV. :	2' - 4'	SAMPLE NO. :	SS-2
SAMPLE LOCATION :	SS				
SOIL DESCRIPTION :	Brown Sandy Lean Clay with Small Roots and Gravel				
LIQUID LIMIT, % :	29	PLASTICITY INDEX, % :	13	MOISTURE, % :	17.3
D10, MM :	-	D30, MM :	-	D60, MM :	0.11
CLASSIFICATION	UNIFIED :		CL	AASHTO :	A-6(4)

GRAVEL		SAND		FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	CLAY



GRAIN SIZE IN MILLIMETERS





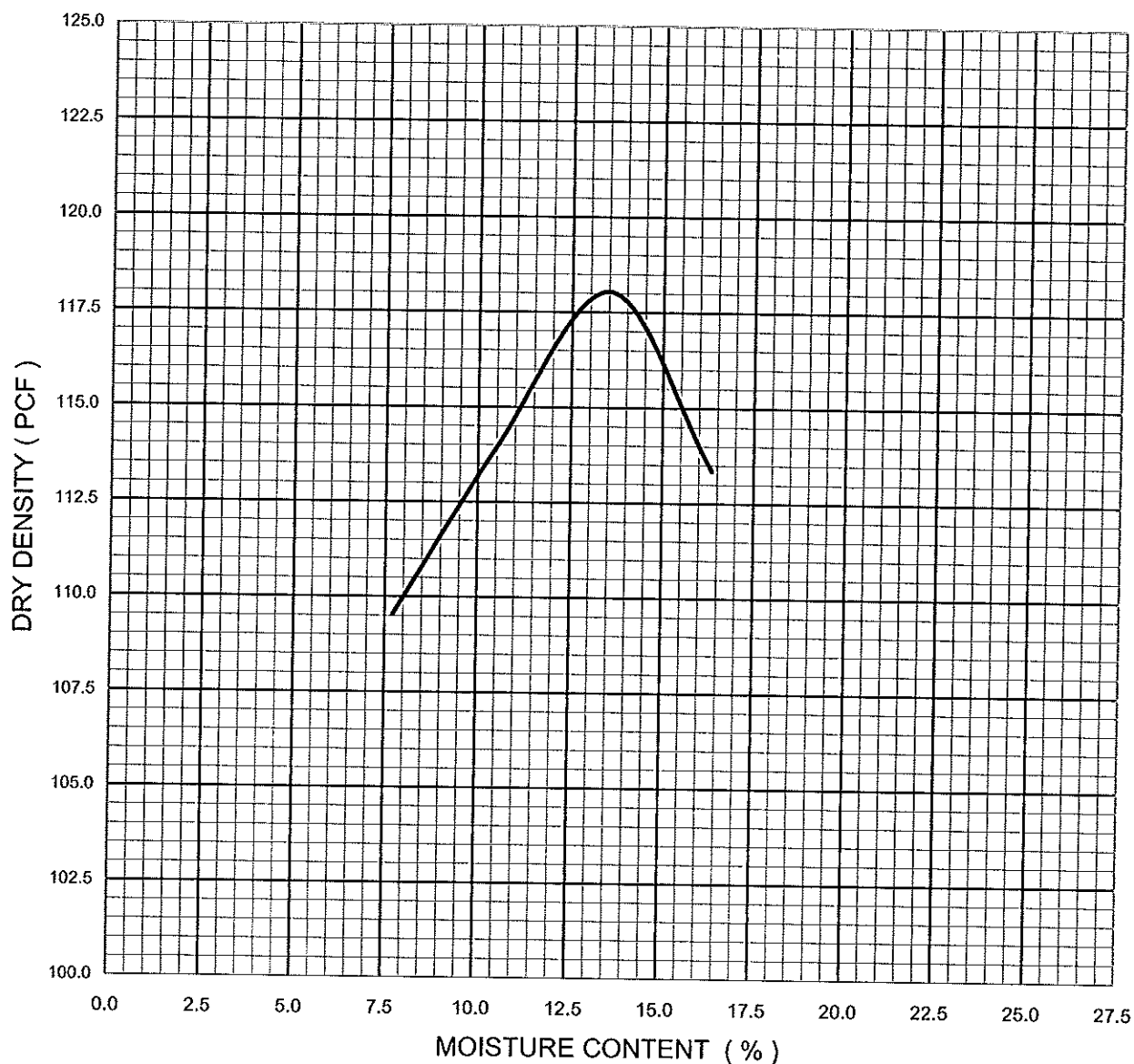
GRAIN SIZE IN MILLIMETERS



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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. :	72720	REPORT NO. :	115235	DATE : 02/21/07
BORING / PIT NO. :	-	DEPTH / ELEV. :	0 - 5'	REVIEWED BY : KBF
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, % :	-
UNCORRECTED MAXIMUM DRY DENSITY, PCF :			118.1	CORRECTED MAXIMUM DRY DENSITY, PCF : -
UNCORRECTED OPTIMUM MOISTURE CONTENT, % :			13.4	CORRECTED OPTIMUM MOISTURE CONTENT, % : -




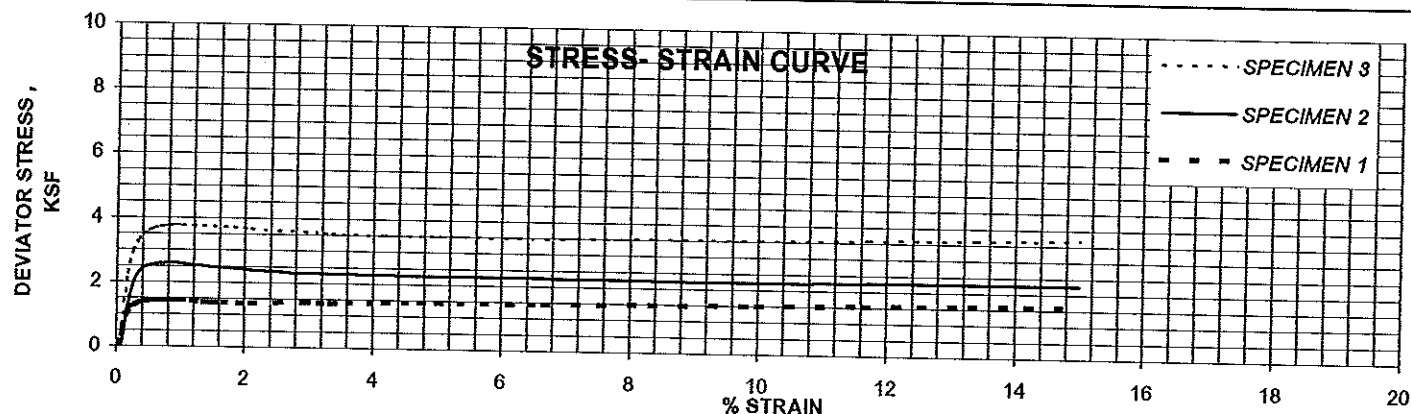
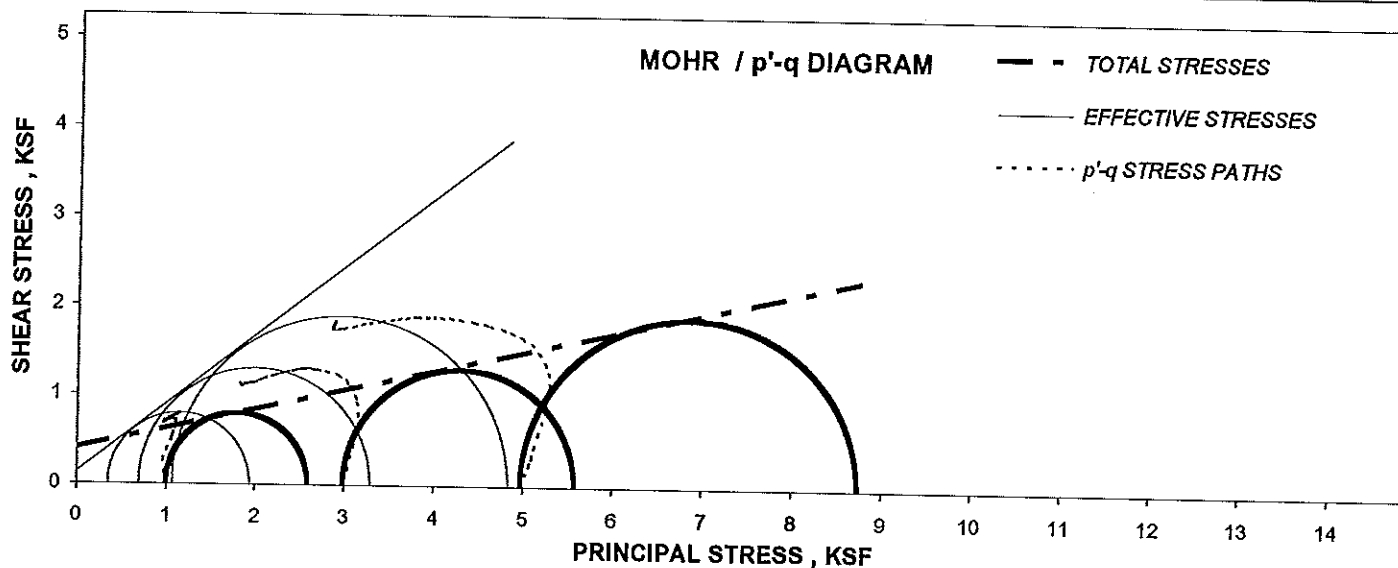
DISTRIBUTION :

TRIAXIAL SHEAR TEST REPORT (ASTM D 4767)

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.: 72720 **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									TEST PARAMETERS , TEST TYPE : CU/PP				
	INITIAL			AFTER CONSOLIDATION			SPECIMEN NO.			1	2	3	
SPECIMEN NO.		1	2	3		1	2	3	B Value		0.95	0.95	0.95
DIAMETER, INCHES	D _o	2.82	2.82	2.82	D _c	2.81	2.80	2.79	BACK PRESSURE, ksf	U _o	8.6	8.6	8.6
HEIGHT, INCHES	H _o	6.03	6.03	6.03	H _c	6.01	5.99	5.98	CONFINING PRESSURE , ksf	σ ₃	1.0	3.0	5.0
WATER CONTENT, %	W _o	13.4	13.4	13.4	W _c	18.1	17.3	17.0	MAX. DEVIATOR STRESS ,ksf	σ ₁ -σ ₃	1.6	2.6	3.8
DRY DENSITY, PCF	γ _{dryo}	112.5	112.5	112.5	γ _{dryc}	113.2	114.8	115.5	ULT. DEVIATOR STRESS , ksf	σ ₁ -σ ₃	1.6	2.3	3.7
SATURATION, %	S _o	72.7	72.8	72.8	S _c	95.1	93.6	92.2	Specimen Shape @				
VOID RATIO	e _o	0.498	0.497	0.497	e _c	0.489	0.468	0.459	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
Dneg =	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
Lfg =	#DIV/0!	ft.	Lfg, 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
nh =	40	tsf/ft	nh, 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
Lfg =	26.3	ft.	Lfg, 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
Dneg =	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
Lfg =	#DIV/0! ft.	Lfg, 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
Lfg =	34.3 ft.	Lfg, 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
Dneg =	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
Lfg =	#DIV/0!	ft.	Lfg, 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
nh =	40	tsf/ft	nh, 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
Lfg =	31.3	ft.	Lfg, 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
Dneg =	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
Lfg =	#DIV/0! ft.	Lfg, 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
nh =	100 tsf/ft	nh, 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
Lfg =	6.7 ft.	Lfg, 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