

R-3421A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
INVENTORY
SECTION 6

REFERENCE: R-3421A

PROJECT: 34542

DS
ELH
INITIALS

1/8/2016
DATE



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. US74_5950L	STATION 59+50	OFFSET 81 ft LT	ALIGNMENT -US74-
COLLAR ELEV. 321.4 ft	TOTAL DEPTH 20.0 ft	NORTHING 433,947	EASTING 1,747,534
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/11/15	COMP. DATE 02/11/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
325															
320	321.4	0.0	3	3	4									321.4	GROUND SURFACE
	317.9	3.5	8	11	13									319.4	ROADWAY EMBANKMENT Orange, fine to coarse sandy CLAY with gravel (A-6)
315	312.9	8.5	9	12	12									312.2	COASTAL PLAIN Orange, white and pink, clayey fine to coarse SAND (A-2-6/7)
310	307.9	13.5	6	6	7									304.4	White, fine to coarse SAND (A-2-4) with trace clay
305	302.9	18.5	5	6	5									301.4	Yellow, clayey fine to coarse SAND (A-2-6/7) with gravel
															Boring Terminated at Elevation 301.4 ft IN SAND (COASTAL PLAIN)
															Notes 1) 0.1' Topsoil 2) Strata break in split spoon at 9.2'

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. US74_6250L	STATION 62+50	OFFSET 81 ft LT	ALIGNMENT -US74-
COLLAR ELEV. 311.6 ft	TOTAL DEPTH 20.0 ft	NORTHING 434,209	EASTING 1,747,386
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/11/15	COMP. DATE 02/11/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
315															
310	311.6	0.0	1	3	2									311.6	GROUND SURFACE
	308.1	3.5	5	5	5										COASTAL PLAIN Orange and white, clayey fine to coarse SAND (A-2-6/7)
305	303.1	8.5	4	6	3										
300	298.1	13.5	5	4	4										Contains gravel below 13.5'
295	293.1	18.5	11	13	21										
															Boring Terminated at Elevation 291.6 ft IN SAND (COASTAL PLAIN)
															Notes 1) 0.1' Topsoil



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4		TIP R-3421A		COUNTY RICHMOND		GEOLOGIST M. Johnson									
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140							GROUND WTR (ft)								
BORING NO. US74_6500R_80		STATION 65+00		OFFSET 80 ft RT		ALIGNMENT -US74-									
COLLAR ELEV. 304.5 ft		TOTAL DEPTH 30.0 ft		NORTHING 434,506		EASTING 1,747,404									
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic									
DRILLER D. Tignor		START DATE 02/12/15		COMP. DATE 02/12/15		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT				SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75				100	ELEV. (ft)	DEPTH (ft)
305	304.5	0.0	2	3	4								304.5	0.0	GROUND SURFACE
															COASTAL PLAIN
	301.0	3.5	5	8	8								302.5	2.0	Orange and tan, clayey fine to coarse SAND (A-2-6/7) with gravel
300	300.2	4.3											300.2	4.3	Orange and tan, fine to coarse sandy CLAY (A-6)
															Orange and brown, clayey fine to coarse SAND (A-2-6/7)
295	296.0	8.5	5	4	3										
290	291.0	13.5	3	8	8										Clay layers at 13.5'
285	286.0	18.5	20	22	39								285.5	19.0	Gravel at 18.5'
	283.5	21.0											283.5	21.0	Orange and brown, silty fine to coarse SAND (A-2-4) with gravel
280	281.0	23.5	11	14	14										RESIDUAL
															Gray and olive green, fine sandy clayey SILT (A-5) with rock fragments, saprolitic
275	276.0	28.5	75	16	28								274.5	30.0	Boring Terminated at Elevation 274.5 ft IN SILT (RESIDUAL)
															Notes 1) 0.1' Topsoil 2) Strata break in split spoon at depths of 4.3' and 19.0'

WBS 34542.1.FR4		TIP R-3421A		COUNTY RICHMOND		GEOLOGIST M. Johnson									
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140							GROUND WTR (ft)								
BORING NO. US74_6500R_340		STATION 65+00		OFFSET 340 ft RT		ALIGNMENT -US74-									
COLLAR ELEV. 379.3 ft		TOTAL DEPTH 98.6 ft		NORTHING 434,634		EASTING 1,747,631									
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 82% 01/17/2014				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic									
DRILLER D. Tignor		START DATE 02/04/15		COMP. DATE 02/05/15		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT				SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75				100	ELEV. (ft)	DEPTH (ft)
380	379.3	0.0	2	2	3								379.3	0.0	GROUND SURFACE
															COASTAL PLAIN
	375.8	3.5	16	20	27								376.8	2.5	Orange, fine to coarse sandy CLAY (A-6)
375	375.8	3.5													Orange and red, fine to coarse sandy clayey SILT (A-5) with rounded gravel
370	370.8	8.5	49	51/0.4									372.8	6.5	White with orange, fine to coarse SAND (A-1-b) (0) with rounded gravel with trace silt and clay
365	365.8	13.5	19	15	11										
360	360.8	18.5	7	9	9					SS-5	4%				
355	355.8	23.5	15	14	14										
350	350.8	28.5	12	9	6								350.3	29.0	Yellow and white, clayey fine to coarse SAND (A-2-6/7)
345	345.8	33.5	4	5	39										
340	340.8	38.5	6	10	17					SS-9	17%		342.8	36.5	White and gray to orange, pink and gray, fine to coarse sandy CLAY (A-7-6) (14, 5, 10)
335	335.8	43.5	6	7	8										
330	330.8	48.5	1	5	12					SS-11	16%				
325	325.8	53.5	5	6	7					SS-12	28%				
320	320.8	58.5	4	5	6								322.8	56.5	Orange and gray, clayey fine to coarse SAND (A-2-6) with rounded gravel
315	315.8	63.5	4	4	4										
310	310.8	68.5	5	9	13										
305	305.8	73.5	5	4	6										
300	300.8	78.5	5	7	9										

NCDOT BORE DOUBLE R-3421A.GPJ NC_DOT.GDT 6/11/15



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. US74_6500R_340	STATION 65+00	OFFSET 340 ft RT	ALIGNMENT -US74-
COLLAR ELEV. 379.3 ft	TOTAL DEPTH 98.6 ft	NORTHING 434,634	EASTING 1,747,631
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 82% 01/17/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/04/15	COMP. DATE 02/05/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
300															
295	295.8	83.5													
290	290.8	88.5	10	12	17										
285	285.8	93.5	22	60/0.4											
	280.8	98.5	60/0.1												

Orange and gray, clayey fine to coarse SAND (A-2-6) with rounded gravel (continued)

WEATHERED ROCK
Dark gray and orange, GABBRO

RESIDUAL
Greenish gray and black, fine sandy SILT (A-5)(6), saprolitic

Gray and black, fine sandy silty CLAY (A-7-5), saprolitic

WEATHERED ROCK
Gray and black GABBRO

CRYSTALLINE ROCK
Gray and black GABBRO

- Notes
- 1) 0.1' Topsoil
 - 2) Strata break in split spoon at a depth of 29.0'
 - 3) Driller noted harder drilling from depths of 83.0' to 84.0', and from 95.0' to 98.5'

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. US74_6550L	STATION 65+50	OFFSET 81 ft LT	ALIGNMENT -US74-
COLLAR ELEV. 302.8 ft	TOTAL DEPTH 20.0 ft	NORTHING 434,470	EASTING 1,747,239
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/11/15	COMP. DATE 02/11/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
305															
300	302.8	0.0													
295	299.3	3.5	2	3	4										
290	294.3	8.5	2	2	2										
285	289.3	13.5	2	1	3										
	284.3	18.5	11	42	60/0.4										
	283.2	19.6	3	8	21										
	282.8	20.0													

GROUND SURFACE

COASTAL PLAIN
Tan and yellow, fine to coarse SAND (A-2-4) with gravel

Yellow, orange and gray, clayey fine to coarse SAND (A-2-6/7) with gravel and clay seams

RESIDUAL
Gray and green, fine sandy silty CLAY (A-7-6)

Orange and white, clayey fine to coarse SAND (A-2-6/7) with rock fragments

- Notes
- 1) 0.1' Topsoil
 - 2) Strata break in split spoon at 19.6'



NCDOT GEOTECHNICAL ENGINEERING UNIT

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WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. US74_6850L	STATION 68+50	OFFSET 81 ft LT	ALIGNMENT -US74-
COLLAR ELEV. 293.5 ft	TOTAL DEPTH 20.0 ft	NORTHING 434,731	EASTING 1,747,091
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/11/15	COMP. DATE 02/11/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
295	293.5	0.0	2	3	4									293.5	GROUND SURFACE	0.0
290	290.0	3.5	WOH	3	4									291.0	ROADWAY EMBANKMENT Orange, tan and black, fine to coarse SAND (A-2-4) with trace rounded gravel, some thin clay seams	2.5
285	285.0	8.5		3	5	8								283.5	RESIDUAL Gray and green, fine sandy silty CLAY (A-7-6), saprolitic	10.0
280	280.0	13.5		12	17	20								278.5	Dark gray and olive green, fine to coarse sandy SILT (A-4) with little clay and trace mica	10.0
275	275.0	18.5		17	28	35								273.5	Boring Terminated at Elevation 273.5 ft IN SILT (RESIDUAL)	20.0

Notes
1) 0.1' Topsoil

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. US74_7150L	STATION 71+50	OFFSET 92 ft LT	ALIGNMENT -US74-
COLLAR ELEV. 287.4 ft	TOTAL DEPTH 11.4 ft	NORTHING 434,987	EASTING 1,746,934
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/11/15	COMP. DATE 02/11/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
290	287.4	0.0	1	5	3									287.4	GROUND SURFACE	0.0
285	283.9	3.5		2	1	2								282.4	ROADWAY EMBANKMENT Orange, yellow and brown, fine to coarse sandy CLAY (A-6) with plastic fragments	5.0
280	278.9	8.5												278.9	RESIDUAL No sample recovered	8.5
	276.1	11.3												276.1	WEATHERED ROCK Dark gray and black, GABBRO	11.3
	276.0	11.4												276.0	CRYSTALLINE ROCK Dark gray GABBRO	11.4

Notes
1) 0.1' Topsoil
2) Auger refusal at 11.3'



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. US74_7450L	STATION 74+50	OFFSET 97 ft LT	ALIGNMENT -US74-
COLLAR ELEV. 280.8 ft	TOTAL DEPTH 13.1 ft	NORTHING 435,246	EASTING 1,746,782
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/11/15	COMP. DATE 02/11/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
285																
280	280.8	0.0												280.8	GROUND SURFACE	0.0
															ROADWAY EMBANKMENT	
															Orange, brown, white and tan, fine to coarse sandy CLAY (A-6) and trace gravel with rootlets and geotextile fragments	
	277.3	3.5	1	3	3									276.8	RESIDUAL	4.0
															Gray and green, fine to coarse sandy SILT (A-4) with little clay, saprolitic	
	272.3	8.5	6	12	13									271.8	WEATHERED ROCK	9.0
															Dark gray and olive green, GABBRO	
	267.8	13.0	18	35	60/0.4									267.8	CRYSTALLINE ROCK	13.0
														267.7	Dark gray, GABBRO	13.1
															Boring Terminated with Standard Penetration Test Refusal at Elevation 267.7 ft IN CRYSTALLINE ROCK (GABBRO)	
															Notes	
															1) 0.1' Topsoil	
															2) Auger refusal at 13.0'	
															3) Driller indicated hard drilling at a depth of 9.0'	
															3) Strata break in split spoon at 4.0'	

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. US74_8038L	STATION 80+38	OFFSET 109 ft LT	ALIGNMENT -US74-
COLLAR ELEV. 256.3 ft	TOTAL DEPTH 4.0 ft	NORTHING 435,752	EASTING 1,746,483
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/11/15	COMP. DATE 02/11/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
260																
255	256.3	0.0												256.3	GROUND SURFACE	0.0
															ROADWAY EMBANKMENT	
															Orange, brown and tan, fine to coarse sandy CLAY (A-6) with gravel	
	252.8	3.5	2	3	4									252.8	WEATHERED ROCK	3.5
														252.3	Gray and black, GABBRO	4.0
	252.3	4.0													Boring Terminated with Standard Penetration Test Refusal at Elevation 252.3 ft ON CRYSTALLINE ROCK (GABBRO)	
															Notes	
															1) 0.1' Topsoil	
															2) Auger refusal at 4.0'	



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. I73_8250L	STATION 82+50	OFFSET 147 ft LT	ALIGNMENT -US74-
COLLAR ELEV. 250.1 ft	TOTAL DEPTH 3.1 ft	NORTHING 435,919	EASTING 1,746,345
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/11/15	COMP. DATE 02/11/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
255														
250	250.1	0.0											250.1 GROUND SURFACE 0.0	
													ROADWAY EMBANKMENT Gray and black, fine to coarse sandy CLAY (A-6) with gravel	
	247.0	3.1	2	8	12							M	247.0 Boring Terminated with Standard Penetration Test Refusal at Elevation 247.0 ft ON CRYSTALLINE ROCK (GABBRO)	3.1
													Notes 1) 0.1' Topsoil 2) Auger refusal at 3.1'	

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. I73_7750L	STATION 77+50	OFFSET 97 ft LT	ALIGNMENT -I73-
COLLAR ELEV. 269.2 ft	TOTAL DEPTH 10.0 ft	NORTHING 435,504	EASTING 1,746,636
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/11/15	COMP. DATE 02/11/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
270													269.2 GROUND SURFACE 0.0	
	269.2	0.0											ROADWAY EMBANKMENT White, orange and brown, fine to coarse sandy CLAY (A-6)	2.5
													RESIDUAL Brown, fine sandy SILT (A-4) with trace clay and mica, saprolitic	7.5
	265.7	3.5	3	2	4								WEATHERED ROCK Gray, white and black, GABBRO	9.9
	260.7	8.5											CRYSTALLINE ROCK Dark gray, GABBRO	10.0
	259.3	9.9	24	100	0.4								Boring Terminated with Standard Penetration Test Refusal at Elevation 259.2 ft IN CRYSTALLINE ROCK (GABBRO)	
													Notes 1) 0.1' Topsoil 2) Auger refusal at 9.9' 3) Driller indicated hard drilling at 7.5'	



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. I73_9760L	STATION 97+60	OFFSET 180 ft LT	ALIGNMENT -I73-
COLLAR ELEV. 197.1 ft	TOTAL DEPTH 28.8 ft	NORTHING 437,352	EASTING 1,745,699
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 02/26/15	COMP. DATE 02/26/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
200																
197.1	197.1	0.0	1	1	8									197.1	GROUND SURFACE	0.0
195	194.6	2.5	9	5	4									195.1	ALLUVIAL Brown, fine silty SAND (A-2-4) with trace organics and gravel	2.0
	192.1	5.0	1	2	1									192.1	Brown and black, fine sandy SILT (A-4)	5.0
190	189.6	7.5	9	27	15									190.1	Gray and black, silty CLAY (A-7-5) with trace organics	7.0
	187.1	10.0	4	8	11										RESIDUAL Brown, black and gray, fine sandy SILT (A-4), saprolitic	
185	184.6	12.5	7	10	12											
	182.1	15.0	15	27	31											
180	178.6	18.5	15	29	24											
	173.6	23.5	15	36	55											
170	168.6	28.5	60/0.1											168.6	CRYSTALLINE ROCK Gray, GABBRO	28.5
	168.3	28.8	60/0											168.3	Boring Terminated with Standard Penetration Test Refusal at Elevation 168.3 ft IN CRYSTALLINE ROCK (GABBRO)	28.8
															Notes 1) 0.2' Topsoil 2) Auger refusal at 28.8'	

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. I73_9842	STATION 98+42	OFFSET CL	ALIGNMENT -I73-
COLLAR ELEV. 195.3 ft	TOTAL DEPTH 12.6 ft	NORTHING 437,473	EASTING 1,745,844
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 02/25/15	COMP. DATE 02/25/15	SURFACE WATER DEPTH N/A

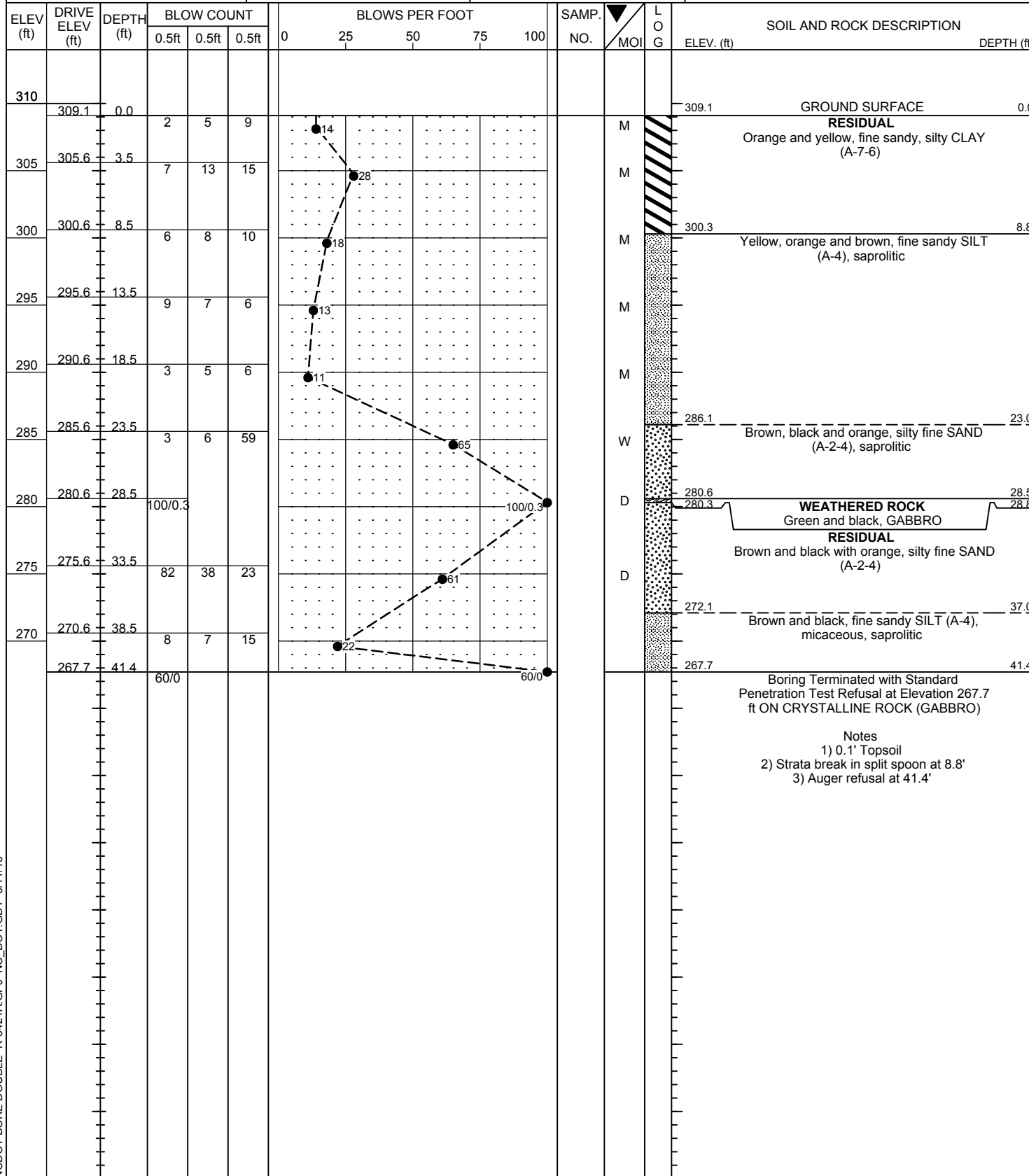
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
200																
195	195.3	0.0	WOH	4	3									195.3	GROUND SURFACE	0.0
	192.8	2.5	1	1	7									192.3	ALLUVIAL Red and brown, silty CLAY (A-7-5), with trace organics	3.0
190	190.3	5.0	5	8	15										Brown, silty fine to coarse SAND (A-2-4) with trace organics and gravel	7.0
	187.8	7.5	2	5	45										RESIDUAL Brown and black, fine sandy SILT (A-4), saprolitic, micaceous	
185	185.3	10.0	11	12	11											
	182.8	12.5	60/0.1													
	182.7	12.6	60/0												CRYSTALLINE ROCK GABBRO	12.6
															Boring Terminated with Standard Penetration Test Refusal at Elevation 182.7 ft IN CRYSTALLINE ROCK (GABBRO)	
															Notes 1) 0.2' Topsoil 2) Strata break in split spoon at 3.0' 3) Auger refusal at 6.7' due to boulder, boring offset 10.0' and continued. Auger refusal at 12.6'	



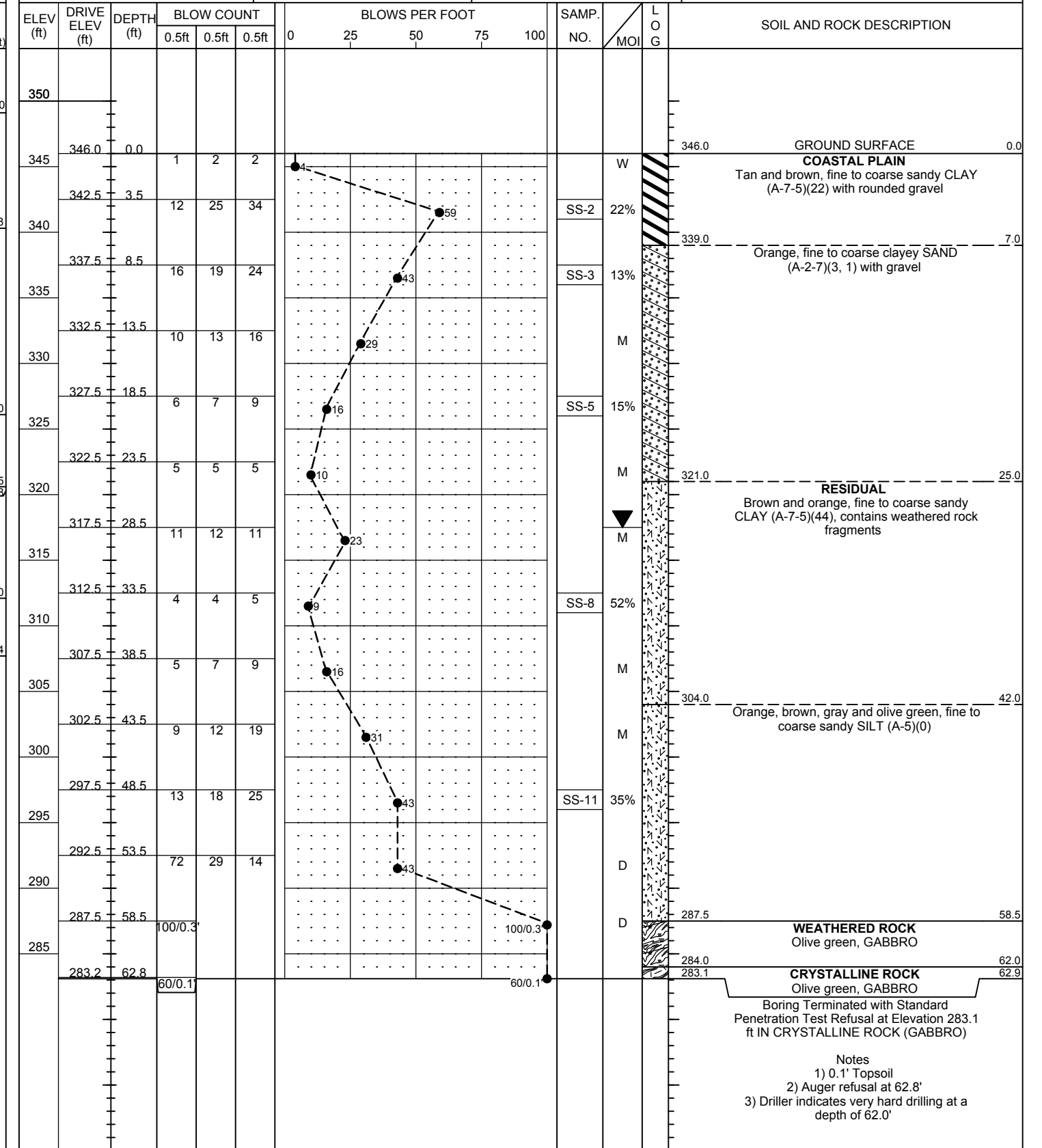
NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft) 0 HR. Dry
BORING NO. I73_11350L	STATION 113+50	OFFSET 180 ft LT	ALIGNMENT -I73-
COLLAR ELEV. 309.1 ft	TOTAL DEPTH 41.4 ft	NORTHING 438,909	EASTING 1,745,371
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/18/15	COMP. DATE 02/18/15	SURFACE WATER DEPTH N/A



WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft) 0 HR. 28.5
BORING NO. I73_12200L	STATION 122+00	OFFSET 150 ft LT	ALIGNMENT -I73-
COLLAR ELEV. 346.0 ft	TOTAL DEPTH 62.9 ft	NORTHING 439,777	EASTING 1,745,361
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/13/15	COMP. DATE 02/13/15	SURFACE WATER DEPTH N/A



NCDOT BORE DOUBLE R-3421A.GPJ NC_DOT.GDT 6/11/15



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. I73_12500L_80	STATION 125+00	OFFSET 80 ft LT	ALIGNMENT -I73-
COLLAR ELEV. 324.3 ft	TOTAL DEPTH 35.0 ft	NORTHING 440,080	EASTING 1,745,440
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/12/15	COMP. DATE 02/12/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
325	324.3	0.0												324.3 GROUND SURFACE	0.0
			1	1	3						SS-S-1	M		COASTAL PLAIN	
														Tan and orange, fine to coarse silty SAND (A-2-4) with rounded gravel	2.0
320	320.8	3.5	2	3	6						SS-S-2	W		Orange and tan, fine to coarse sandy CLAY (A-6) with gravel	
														RESIDUAL	
														Orange, red, and tan, fine sandy clayey SILT (A-5)	7.0
315	315.8	8.5	6	8	9						SS-S-3	M			
310	310.8	13.5	4	5	7						SS-S-4	M			
305	305.8	18.5	5	7	10						SS-S-5	M			
300	300.8	23.5	4	7	10						SS-S-6	M			
295	295.8	28.5	8	14	16						SS-S-7	M		Yellow, brown and black, fine sandy SILT (A-4) with trace clay, saprolitic	26.0
290	290.8	33.5	7	10	12						SS-S-8	M			
														Boring Terminated at Elevation 289.3 ft IN SILT (RESIDUAL)	35.0
														Notes 1) 0.1' Topsoil	

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. I73_12500L_160	STATION 125+00	OFFSET 160 ft LT	ALIGNMENT -I73-
COLLAR ELEV. 338.1 ft	TOTAL DEPTH 49.2 ft	NORTHING 440,083	EASTING 1,745,360
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/13/15	COMP. DATE 02/13/15	SURFACE WATER DEPTH N/A

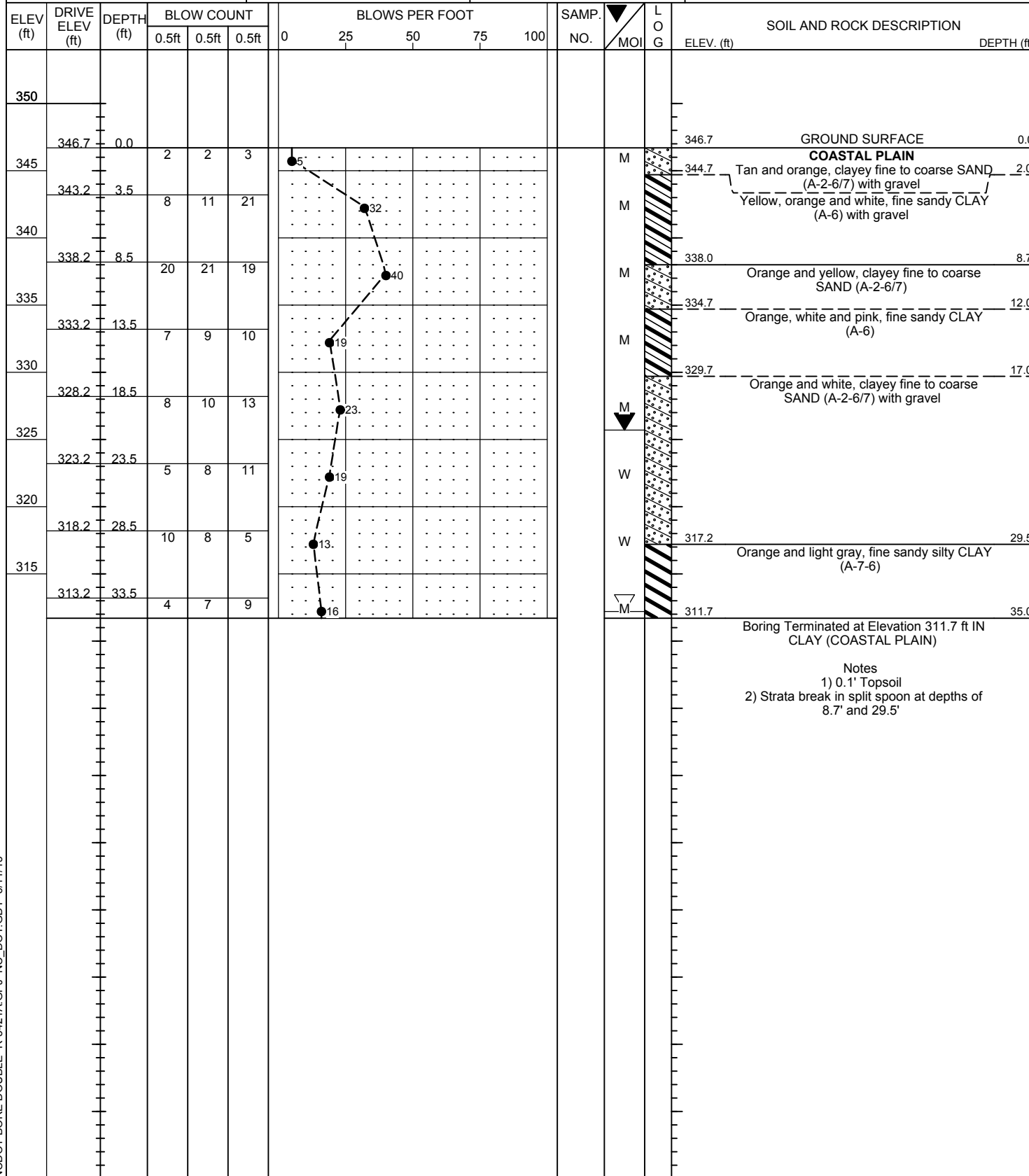
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
340	338.1	0.0												338.1 GROUND SURFACE	0.0
			3	2	4									COASTAL PLAIN	
														GRAVEL (A-1-b) with some fine to coarse sand	3.8
335	334.6	3.5	16	13	11									Orange and tan, clayey fine to coarse SAND (A-2-6/7)	
330	329.6	8.5	15	16	18										
325	324.6	13.5	10	14	17									Orange, pink and light gray mottled, fine sandy CLAY (A-7-6)	11.0
320	319.6	18.5	3	6	8										
315	314.6	23.5	2	3	3									Orange, clayey fine to coarse SAND (A-2-6/7)	21.0
310	309.6	28.5	WOH	3	4									Light gray to orange, silty CLAY (A-7-6) with fine sand	26.0
305	304.6	33.5	4	6	8									Orange, clayey fine to coarse SAND (A-2-6/7)	29.5
300	299.6	38.5	7	15	16									RESIDUAL	34.2
														Orange and green, fine sandy silty CLAY (A-7-5)(35)	
295	294.6	43.5	9	21	28						SS-9	43%		Brown, black, gray and green, silty fine to coarse sandy CLAY (A-7-5)(8), micaceous, saprolitic	42.0
											SS-10	31%			
290	289.6	48.5	70	100/0.2										WEATHERED ROCK	46.0
														Olive green, GABBRO	49.2
														Boring Terminated at Elevation 288.9 ft IN WEATHERED ROCK (GABBRO)	
														Notes 1) Strata breaks in split spoon at 29.5' and 34.2' 2) Driller indicates harder drilling at a depth of 46.0 feet	



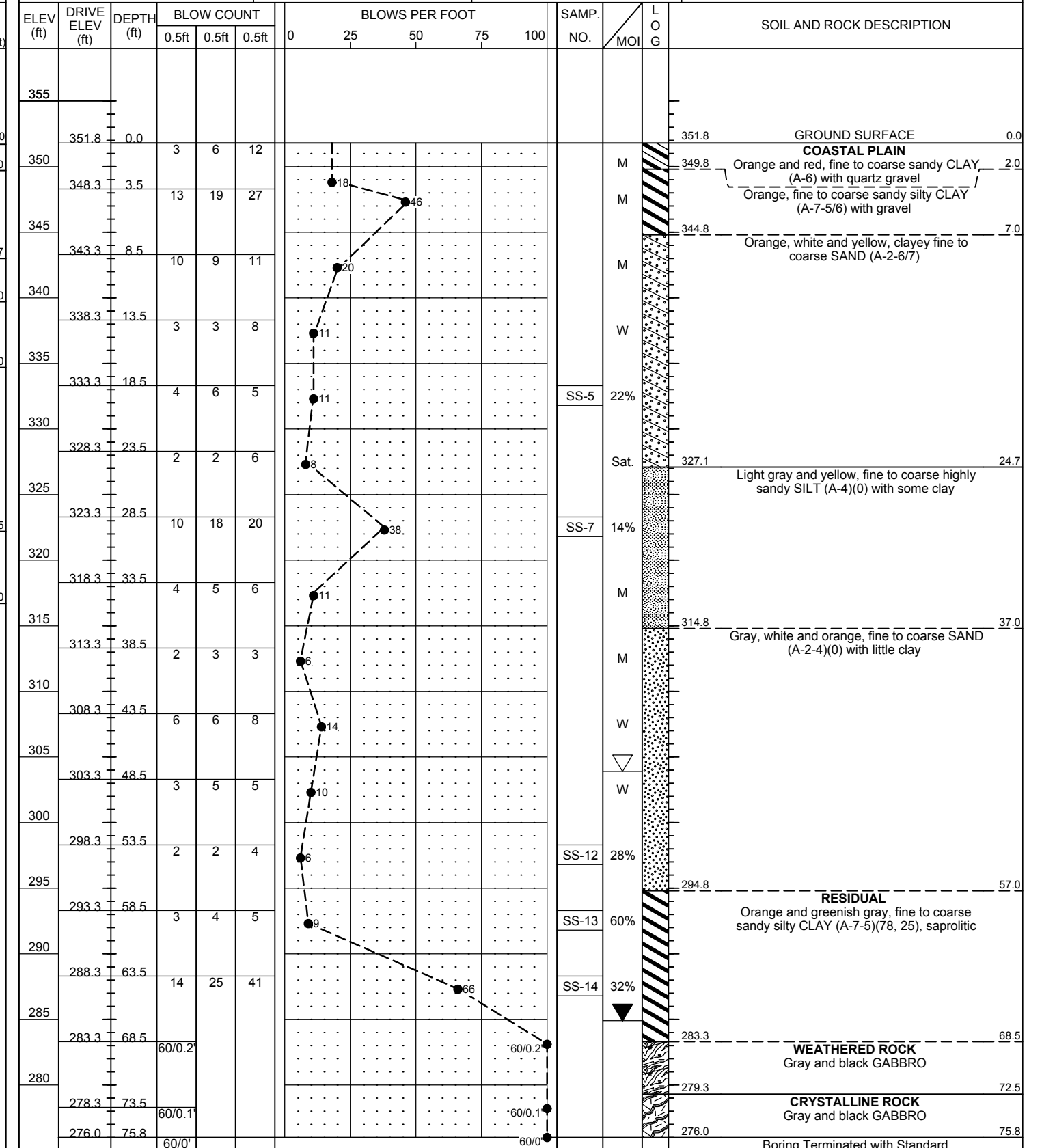
NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. I73_13250R	STATION 132+50	OFFSET 145 ft RT	ALIGNMENT -I73-
COLLAR ELEV. 346.7 ft	TOTAL DEPTH 35.0 ft	NORTHING 440,801	EASTING 1,745,736
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/12/15	COMP. DATE 02/12/15	SURFACE WATER DEPTH N/A



WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. FLY_825R	STATION 8+25	OFFSET 40 ft RT	ALIGNMENT -FLY-
COLLAR ELEV. 351.8 ft	TOTAL DEPTH 75.8 ft	NORTHING 435,029	EASTING 1,747,631
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/05/15	COMP. DATE 02/05/15	SURFACE WATER DEPTH N/A



NCDOT BORE DOUBLE R-3421A.GPJ NC_DOT.GDT 6/11/15



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. FLY_825R	STATION 8+25	OFFSET 40 ft RT	ALIGNMENT -FLY-
COLLAR ELEV. 351.8 ft	TOTAL DEPTH 75.8 ft	NORTHING 435,029	EASTING 1,747,631
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/05/15	COMP. DATE 02/05/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
275															Match Line
															Penetration Test Refusal at Elevation 276.0 ft IN CRYSTALLINE ROCK (GABBRO)
															Notes 1) 0.1' Topsoil 2) Strata break in split spoon at a depth of 24.7' 3) Driller noted harder drilling from a depth of 72.5' to 75.8' 4) Auger refusal at a depth of 75.8'

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. FLY_1825	STATION 18+25	OFFSET CL	ALIGNMENT -FLY-
COLLAR ELEV. 318.9 ft	TOTAL DEPTH 86.5 ft	NORTHING 435,952	EASTING 1,746,888
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/09/15	COMP. DATE 02/10/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
320	318.9	0.0	1	2	2										318.9 GROUND SURFACE 0.0
315	315.4	3.5	7	6	7										315.2 COASTAL PLAIN 3.7
310	310.4	8.5	10	21	30										Orange and brown, clayey fine to coarse SAND (A-2-6/7) with rounded gravel
305	305.4	13.5	7	7	8										308.4 RESIDUAL 10.5
300	300.4	18.5	5	8	11										Orange and light greenish gray, silty CLAY (A-7-5)(23) with fine sand
295	295.4	23.5	8	15	19										303.4 Yellow and orange, fine sandy clayey SILT (A-5)(4), micaceous, saprolitic 15.5
290	290.4	28.5	16	50	60/0.3										289.9 WEATHERED ROCK 29.0
285	285.4	33.5	19	100/0.4											Gray and olive green, GABBRO
280	282.4	36.5	60/0												282.4 CRYSTALLINE ROCK 36.5
275															Gray and black with white and pink, GABBRO
270															
265															
260															
255															
250															
245															
240															

NCDOT BORE DOUBLE R-3421A.GPJ NC_DOT.GDT 6/11/15



NCDOT GEOTECHNICAL ENGINEERING UNIT

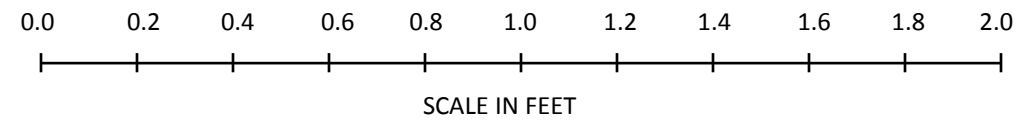
BORELOG REPORT

WBS 34542.1.FR4		TIP R-3421A		COUNTY RICHMOND		GEOLOGIST M. Johnson									
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140							GROUND WTR (ft)								
BORING NO. FLY_1825		STATION 18+25		OFFSET CL		ALIGNMENT -FLY-									
COLLAR ELEV. 318.9 ft		TOTAL DEPTH 86.5 ft		NORTHING 435,952		EASTING 1,746,888									
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER D. Tignor		START DATE 02/09/15		COMP. DATE 02/10/15		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
240														Match Line	
235															
															232.4
<p>Boring Terminated at Elevation 232.4 ft IN CRYSTALLINE ROCK (GABBRO)</p> <p>Notes</p> <ol style="list-style-type: none"> 0.2' Topsoil Strata break in split spoon at 3.7' Auger refusal at 36.5' Boring dry at completion of auger drilling prior to coring 															

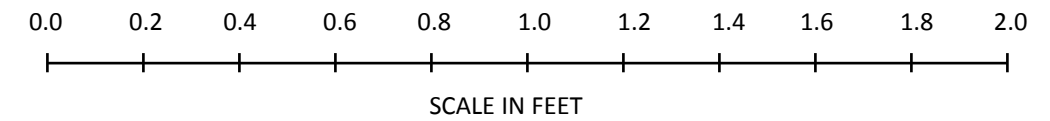
WBS 34542.1.FR4		TIP R-3421A		COUNTY RICHMOND		GEOLOGIST M. Johnson						
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140							GROUND WTR (ft)					
BORING NO. FLY_1825		STATION 18+25		OFFSET CL		ALIGNMENT -FLY-						
COLLAR ELEV. 318.9 ft		TOTAL DEPTH 86.5 ft		NORTHING 435,952		EASTING 1,746,888						
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic							
DRILLER D. Tignor		START DATE 02/09/15		COMP. DATE 02/10/15		SURFACE WATER DEPTH N/A						
CORE SIZE NQ3		TOTAL RUN 50.0 ft										
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (%)	RQD (%)		REC. (%)	RQD (%)			
282.4	282.4	36.5	5.0	N=60/0 2:20/1.0 1:45/1.0 2:06/1.0 1:57/1.0 2:13/1.0	(4.9) 98%	(5.0) 100%		(50.0) 100%	(48.5) 97%		Continued from previous page	
280							RS-7				CRYSTALLINE ROCK Gray and black with white and pink, fresh to slightly weathered, moderately hard to very hard, GABBRO with quartz seams, close to wide fracture spacing, thick bedded	36.5
275	277.4	41.5	5.0	1:52/1.0 1:55/1.0 1:56/1.0 2:00/1.0 2:04/1.0	(5.0) 100%	(4.3) 86%					RS-7 39.1 to 39.5 feet, UCS = 15,964 psi	
270	272.4	46.5	5.0	2:15/1.0 2:31/1.0 2:16/1.0 2:13/1.0 2:29/1.0	(5.0) 100%	(4.7) 94%	RS-8				RS-8 46.7 to 47.2 feet, UCS = 13,970 psi	
265	267.4	51.5	5.0	2:45/1.0 2:16/1.0 2:42/1.0 2:38/1.0 2:29/1.0	(5.0) 100%	(5.0) 100%					R1 = 7, R2 = 20, R3 = 2, R4 = 20, R5 = 7, RMR = 74, Rock type E	
260	262.4	56.5	5.0	2:40/1.0 2:33/1.0 2:20/1.0 2:05/1.0 3:43/1.0	(4.9) 98%	(4.5) 90%						
255	257.4	61.5	5.0	2:47/1.0 2:21/1.0 2:04/1.0 2:08/1.0 2:10/1.0	(5.0) 100%	(5.0) 100%						
250	252.4	66.5	5.0	2:55/1.0 2:19/1.0 2:20/1.0 2:35/1.0 2:00/1.0	(5.0) 100%	(5.0) 100%						
245	247.4	71.5	5.0	2:11/1.0 2:21/1.0 2:17/1.0 1:36/1.0 1:47/1.0	(5.0) 100%	(5.0) 100%						
240	242.4	76.5	5.0	2:00/1.0 2:08/1.0 1:54/1.0 1:58/1.0 1:52/1.0	(5.0) 100%	(5.0) 100%						
235	237.4	81.5	5.0	1:51/1.0 1:39/1.0 1:40/1.0 1:54/1.0 1:47/1.0	(5.0) 100%	(5.0) 100%						
	232.4	86.5										232.4
<p>Boring Terminated at Elevation 232.4 ft IN CRYSTALLINE ROCK (GABBRO)</p> <p>Notes</p> <ol style="list-style-type: none"> 0.2' Topsoil Strata break in split spoon at 3.7' Auger refusal at 36.5' Boring dry at completion of auger drilling prior to coring 												

CORE PHOTOGRAPHS: Boring No. FLY_1825 -FLY- Station 18+25, CL

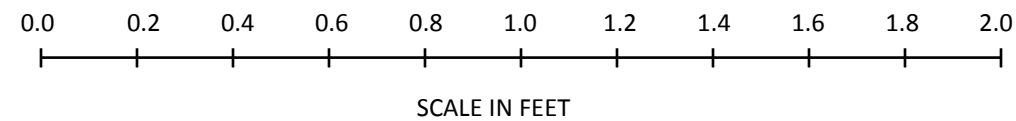
Begin Run 1
36.5 feet



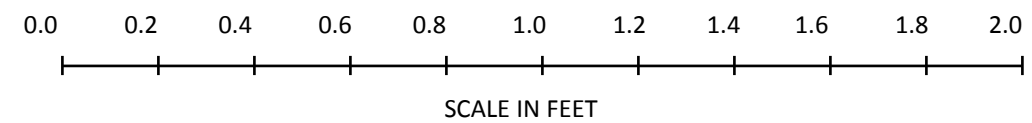
Begin Run 5
56.5 feet



Begin Run 3
46.5 feet

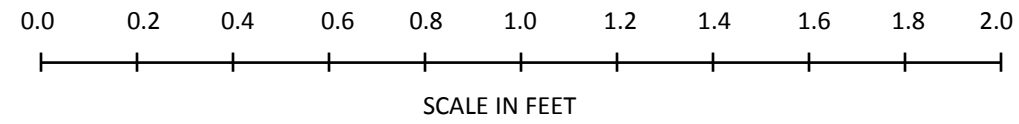


Begin Run 7
66.5 feet



CORE PHOTOGRAPHS: Boring FLY_1825 -FLY- Station 18+25, CL

Begin Run 9
76.5 feet

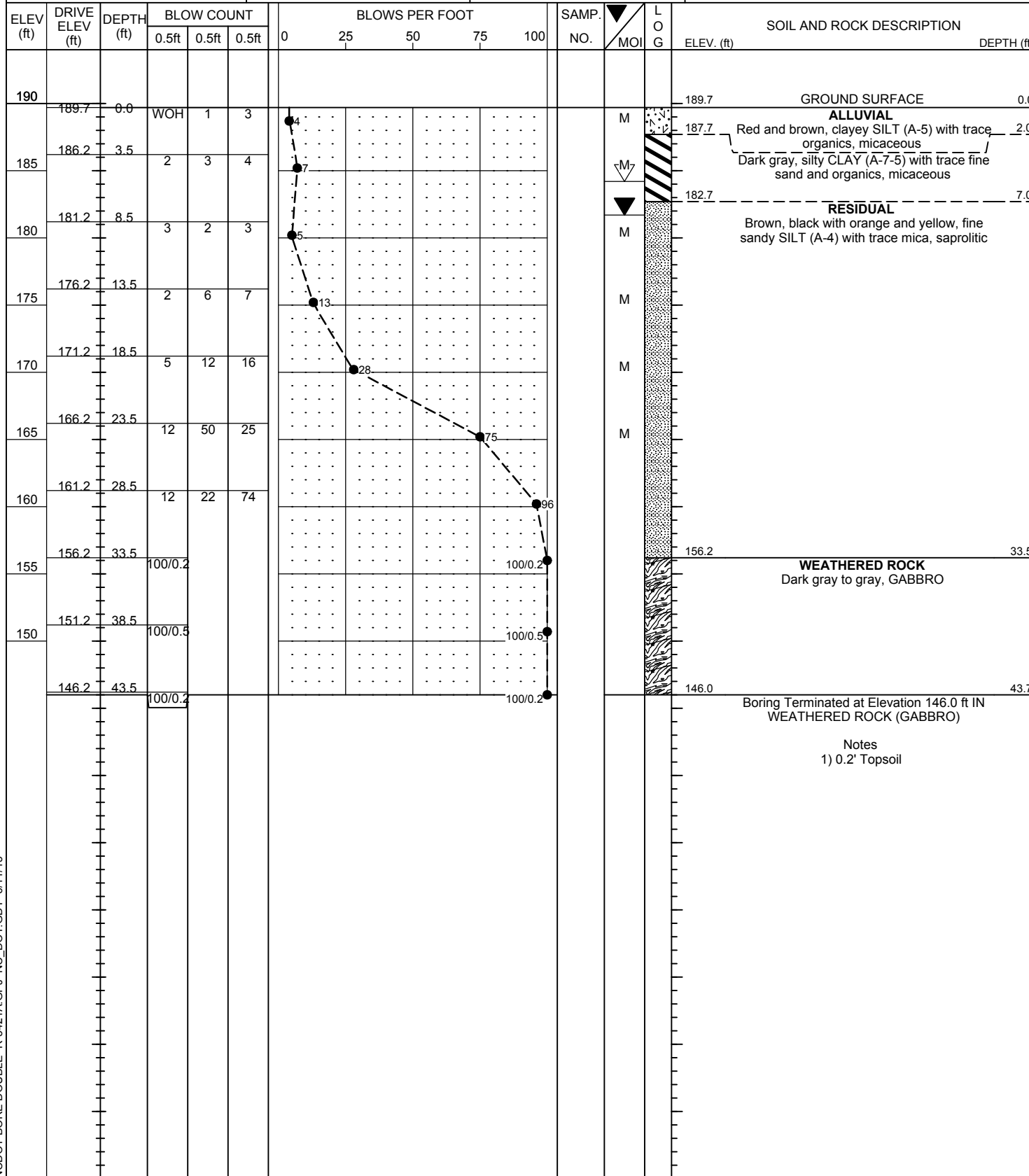




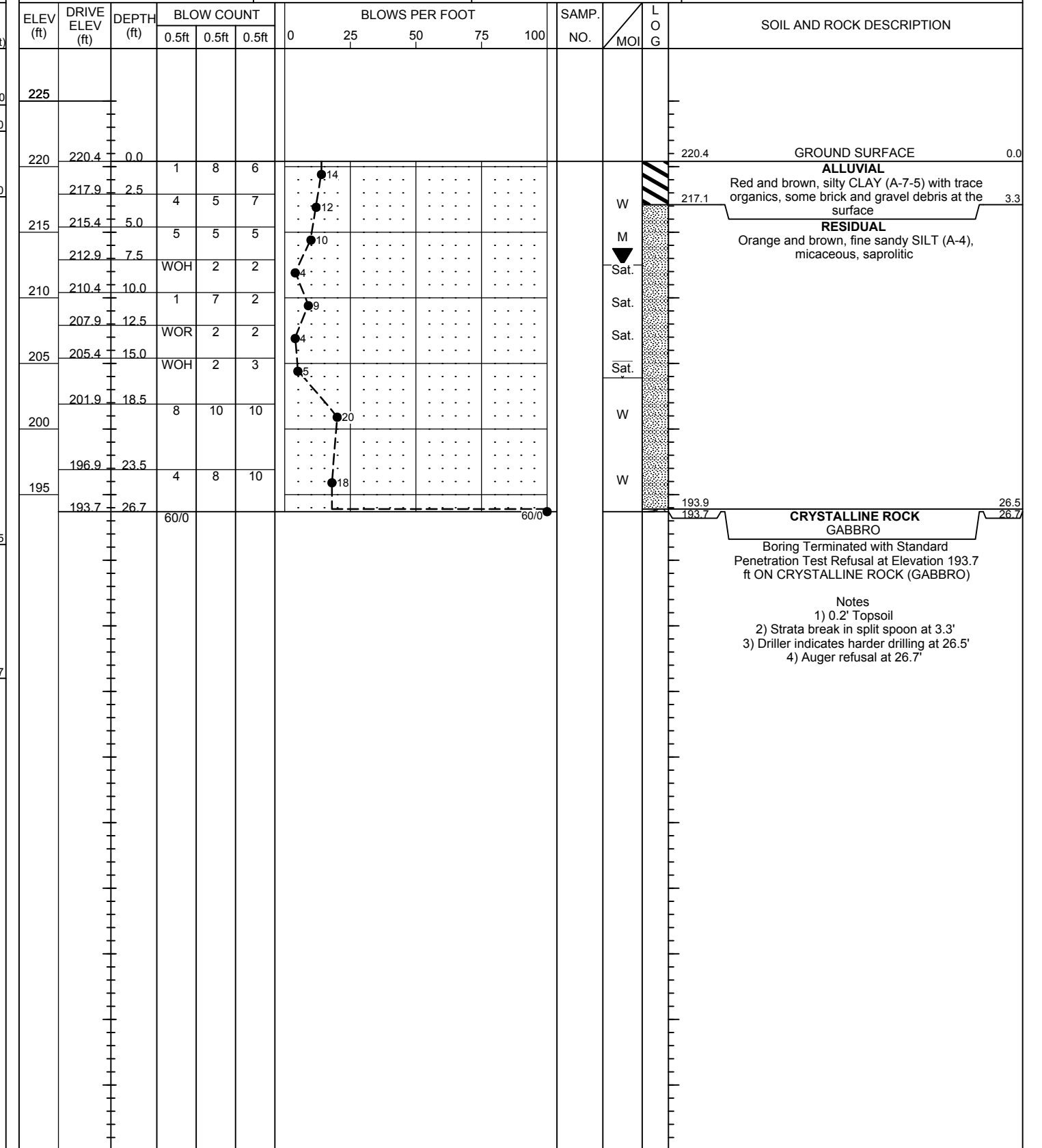
NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. FLY_3696R	STATION 36+96	OFFSET 67 ft RT	ALIGNMENT -FLY-
COLLAR ELEV. 189.7 ft	TOTAL DEPTH 43.7 ft	NORTHING 436,849	EASTING 1,745,286
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 02/18/15	COMP. DATE 02/19/15	SURFACE WATER DEPTH N/A



WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. L2_4263L	STATION 42+63	OFFSET 203 ft LT	ALIGNMENT -L2-
COLLAR ELEV. 220.4 ft	TOTAL DEPTH 26.7 ft	NORTHING 438,931	EASTING 1,747,593
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 02/26/15	COMP. DATE 02/26/15	SURFACE WATER DEPTH N/A





NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. L2CONN_2700R	STATION 27+00	OFFSET 20 ft RT	ALIGNMENT -L2CONN-
COLLAR ELEV. 215.9 ft	TOTAL DEPTH 13.9 ft	NORTHING 437,037	EASTING 1,744,154
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/12/15	COMP. DATE 02/12/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
220																
215	215.9	0.0												215.9	GROUND SURFACE	0.0
			WOH	1	2											
	212.4	3.5														
210			2	2	2									209.9	RESIDUAL Red and brown, fine sandy SILT (A-4), micaceous	6.0
	207.4	8.5												206.9	Brown, black and orange, silty fine SAND (A-2-4), micaceous	9.0
205			36	100/0.4										202.0	WEATHERED ROCK Brown, black and orange, GABBRO	13.9
	202.4	13.5														
			100/0.4													

Boring Terminated at Elevation 202.0 ft IN WEATHERED ROCK (GABBRO)

Notes
1) 0.1' Topsoil

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Jones
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPA_1050R	STATION 10+50	OFFSET 100 ft RT	ALIGNMENT -RPA-
COLLAR ELEV. 315.2 ft	TOTAL DEPTH 74.0 ft	NORTHING 438,060	EASTING 1,745,327
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/23/15	COMP. DATE 02/23/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
320																
315	315.2	0.0												315.2	GROUND SURFACE	0.0
			1	2	4											
	311.7	3.5												312.2	COASTAL PLAIN Red, pink and white, CLAY (A-6) with some fine sand and trace gravel	3.0
310			6	12	11											
	306.7	8.5														
305			4	15	17											
	301.7	13.5														
300			5	5	8											
	296.7	18.5														
295			3	5	4											
	291.7	23.5														
290			2	3	4											
	286.7	28.5														
285			3	3	6											
	281.7	33.5														
280			7	14	10											
	276.7	38.5														
275			7	8	14											
	271.7	43.5														
270			8	13	18											
	266.7	48.5														
265			8	27	31											
	261.7	53.5														
260			8	11	14											
	256.7	58.5														
255			5	8	11											
	251.7	63.5														
250			6	8	13											
	246.7	68.5														
245			11	10	25											
	241.7	73.5														
			100/0.5													

303.2

Brown, tan, white, black and orange, SILT (A-4) with trace fine sand, saprolitic

12.0

283.2

Brown, black and gray, fine sandy SILT (A-4) with fine to coarse quartz rock fragments, saprolitic

32.0

278.2

Orange, tan, white and black mottled, SILT (A-4) with trace fine sand, saprolitic

37.0

241.7

WEATHERED ROCK

73.5

74.0

NCDOT BORE DOUBLE R-3421A.GPJ NC_DOT.GDT 6/11/15



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Jones
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPA_1050R	STATION 10+50	OFFSET 100 ft RT	ALIGNMENT -RPA-
COLLAR ELEV. 315.2 ft	TOTAL DEPTH 74.0 ft	NORTHING 438,060	EASTING 1,745,327
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/23/15	COMP. DATE 02/23/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
240															Match Line
															Tan, orange with black, GABBRO Boring Terminated at Elevation 241.2 ft IN WEATHERED ROCK (GABBRO)

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Jones
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPA_1325R	STATION 13+25	OFFSET 80 ft RT	ALIGNMENT -RPA-
COLLAR ELEV. 280.3 ft	TOTAL DEPTH 50.0 ft	NORTHING 437,817	EASTING 1,745,242
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/23/15	COMP. DATE 02/23/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
285															
280	280.3	0.0	1	2	2										280.3 GROUND SURFACE 0.0
275	276.8	3.5	4	5	5										COASTAL PLAIN Red, fine sandy CLAY (A-6)
270	271.8	8.5	4	5	6										RESIDUAL Red and orange, fine sandy clay (A-6)
265	266.8	13.5	6	8	11										268.3 Tan and orange, fine sandy SILT (A-4) 12.0
260	261.8	18.5	3	4	5										263.3 Brown, tan, orange and black mottled, fine sandy SILT (A-4), saprolitic 17.0
255	256.8	23.5	3	5	7										
250	251.8	28.5	4	4	6										
245	246.8	33.5	4	4	7										
240	241.8	38.5	4	4	7										
235	236.8	43.5	16	12	8										Layer of quartz fragments in sample at 43.5 to 45.0 feet
	231.8	48.5	4	6	7										230.3 Boring Terminated at Elevation 230.3 ft IN SILT (RESIDUAL) 50.0
															Notes 1) 0.2' Topsoil



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4		TIP R-3421A		COUNTY RICHMOND		GEOLOGIST M. Johnson	
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140							GROUND WTR (ft)
BORING NO. RPC_1800R		STATION 18+00		OFFSET 190 ft RT		ALIGNMENT -RPC-	
COLLAR ELEV. 330.4 ft		TOTAL DEPTH 67.7 ft		NORTHING 437,017		EASTING 1,746,589	
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 82% 01/17/2014		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic			
DRILLER D. Tignor		START DATE 01/27/15		COMP. DATE 01/27/15		SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
335																
															330.4	GROUND SURFACE
																COASTAL PLAIN
																Red, fine to coarse sandy silty CLAY (A-6)
	330.4	0.0	2	3	3											
	326.9	3.5	6	8	8											
	321.9	8.5	5	6	8											
	316.9	13.5	12	14	14											
	311.9	18.5	9	12	14											
	306.9	23.5	4	5	8											
	301.9	28.5	4	5	6											
	296.9	33.5	4	7	9											
	291.9	38.5	8	12	12											
	286.9	43.5	1	5	7											
	281.9	48.5	2	4	7											
	276.9	53.5	2	3	4											
	271.9	58.5	3	17	11											
	266.9	63.5	3	8	6											
	262.7	67.7	60/0													

WBS 34542.1.FR4		TIP R-3421A		COUNTY RICHMOND		GEOLOGIST M. Johnson	
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140							GROUND WTR (ft)
BORING NO. RPC_1800R		STATION 18+00		OFFSET 190 ft RT		ALIGNMENT -RPC-	
COLLAR ELEV. 330.4 ft		TOTAL DEPTH 67.7 ft		NORTHING 437,017		EASTING 1,746,589	
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 82% 01/17/2014		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic			
DRILLER D. Tignor		START DATE 01/27/15		COMP. DATE 01/27/15		SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
255																
																Match Line
																1) 0.2' of Topsoil
																2) Strata breaks in split spoon at a depth of 9.4', 14.1', and 59.8'
																3) Auger refusal at a depth of 67.7'
																4) Driller indicates hard drilling at a depth of 67.1'

NCDOT BORE DOUBLE R-3421A.GPJ NC_DOT.GDT 6/11/15

Notes

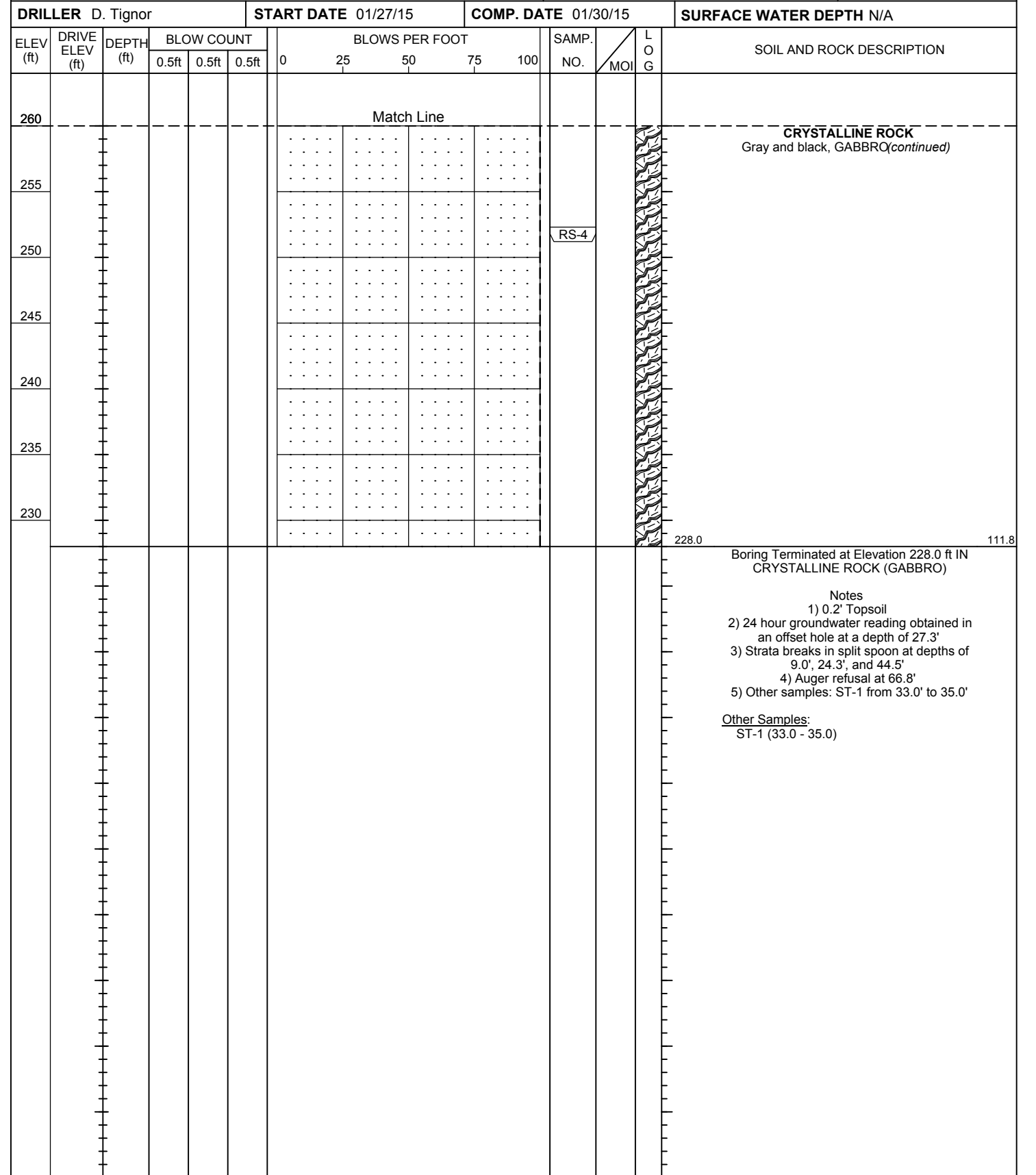
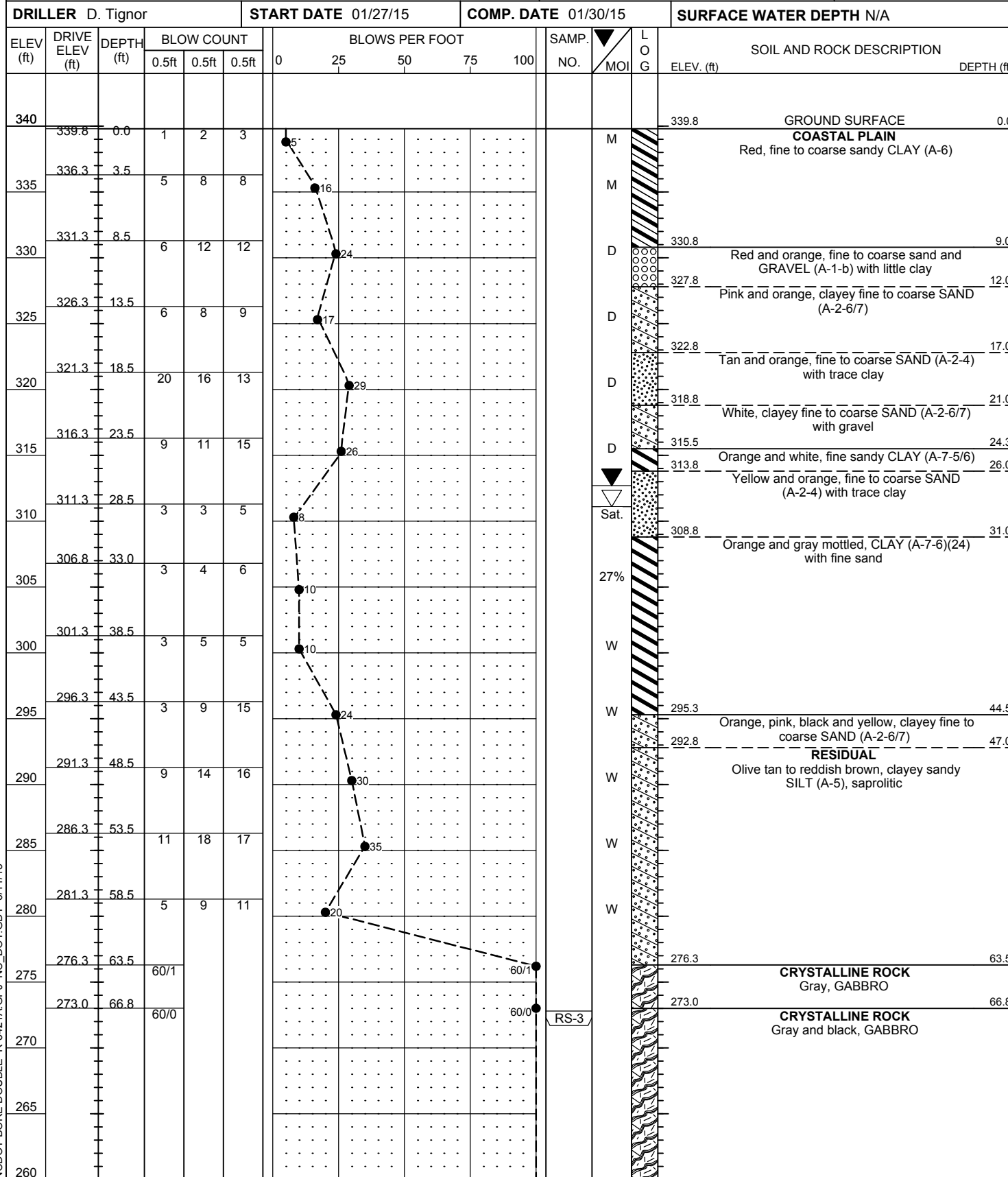


NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPC_2100R	STATION 21+00	OFFSET 240 ft RT	ALIGNMENT -RPC-
COLLAR ELEV. 339.8 ft	TOTAL DEPTH 111.8 ft	NORTHING 437,267	EASTING 1,746,691
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 82% 01/17/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 01/27/15	COMP. DATE 01/30/15	SURFACE WATER DEPTH N/A

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPC_2100R	STATION 21+00	OFFSET 240 ft RT	ALIGNMENT -RPC-
COLLAR ELEV. 339.8 ft	TOTAL DEPTH 111.8 ft	NORTHING 437,267	EASTING 1,746,691
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 82% 01/17/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 01/27/15	COMP. DATE 01/30/15	SURFACE WATER DEPTH N/A



- Notes
- 1) 0.2' Topsoil
 - 2) 24 hour groundwater reading obtained in an offset hole at a depth of 27.3'
 - 3) Strata breaks in split spoon at depths of 9.0', 24.3', and 44.5'
 - 4) Auger refusal at 66.8'
 - 5) Other samples: ST-1 from 33.0' to 35.0'
- Other Samples:
ST-1 (33.0 - 35.0)

NCDOT BORE DOUBLE R-3421A.GPJ NC_DOT_GDT 6/11/15



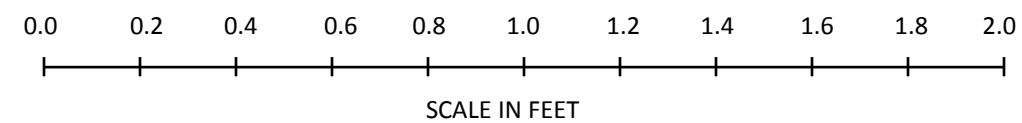
NCDOT GEOTECHNICAL ENGINEERING UNIT CORE BORING REPORT

WBS 34542.1.FR4		TIP R-3421A		COUNTY RICHMOND		GEOLOGIST M. Johnson					
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140							GROUND WTR (ft)				
BORING NO. RPC_2100R		STATION 21+00		OFFSET 240 ft RT		ALIGNMENT -RPC-					
COLLAR ELEV. 339.8 ft		TOTAL DEPTH 111.8 ft		NORTHING 437,267		EASTING 1,746,691					
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 82% 01/17/2014				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic					
DRILLER D. Tignor		START DATE 01/27/15		COMP. DATE 01/30/15		SURFACE WATER DEPTH N/A					
CORE SIZE NQ3		TOTAL RUN 45.0 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	LOG	DESCRIPTION AND REMARKS
273	273.0	66.8	5.0	2:02/1.0 1:53/1.0 2:10/1.0 2:02/1.0 2:03/1.0	(5.0) 100%	(4.9) 98%	RS-3	(45.0) 100%	(44.8) 100%		Continued from previous page CRYSTALLINE ROCK Gray and black, fresh, hard to very hard, GABBRO, close to very wide fracture spacing RS-3 = 67.0' to 67.5', UCS = 7,930 psi
270	268.0	71.8	5.0	1:47/1.0 2:10/1.0 2:08/1.0 2:06/1.0 2:11/1.0	(5.0) 100%	(4.9) 98%					
265	263.0	76.8	5.0	1:47/1.0 2:04/1.0 1:56/1.0 2:02/1.0 2:08/1.0	(5.0) 100%	(5.0) 100%					
260	258.0	81.8	5.0	1:58/1.0 2:15/1.0 1:57/1.0 1:59/1.0 1:55/1.0	(5.0) 100%	(5.0) 100%					
255	253.0	86.8	5.0	1:55/1.0 2:07/1.0 1:56/1.0 1:56/1.0 1:53/1.0	(5.0) 100%	(5.0) 100%	RS-4				RS-4 = 87.5' to 88.0', UCS = 12,539 psi R1 = 7, R2 = 20, R3 = 20, R4 = 20, R5 = 7, RMR = 74, Rock type E
250	248.0	91.8	5.0	2:13/1.0 2:07/1.0 2:10/1.0 2:06/1.0 2:07/1.0	(5.0) 100%	(5.0) 100%					
245	243.0	96.8	5.0	2:07/1.0 2:09/1.0 2:18/1.0 2:10/1.0 2:03/1.0	(5.0) 100%	(5.0) 100%					
240	238.0	101.8	5.0	2:07/1.0 2:07/1.0 1:58/1.0 2:02/1.0 1:58/1.0	(5.0) 100%	(5.0) 100%					
235	233.0	106.8	5.0	1:58/1.0 1:58/1.0 1:51/1.0 2:02/1.0 1:53/1.0	(5.0) 100%	(5.0) 100%					
230	228.0	111.8	5.0	1:58/1.0 1:58/1.0 1:51/1.0 2:02/1.0 1:53/1.0	(5.0) 100%	(5.0) 100%					Boring Terminated at Elevation 228.0 ft IN CRYSTALLINE ROCK (GABBRO) Notes 1) 0.2' Topsoil 2) 24 hour groundwater reading obtained in an offset hole at a depth of 27.3' 3) Strata breaks in split spoon at depths of 9.0', 24.3', and 44.5' 4) Auger refusal at 66.8' 5) Other samples: ST-1 from 33.0' to 35.0' <u>Other Samples:</u> ST-1 (33.0 - 35.0)

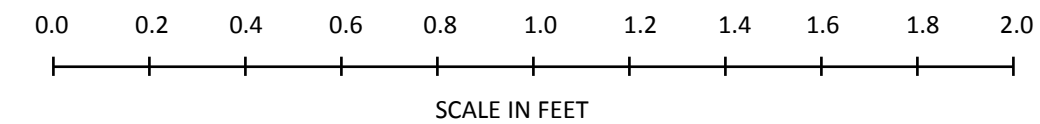


CORE PHOTOGRAPHS: Boring RPC_2100R -RPC- Station 21+00, 240 feet Right

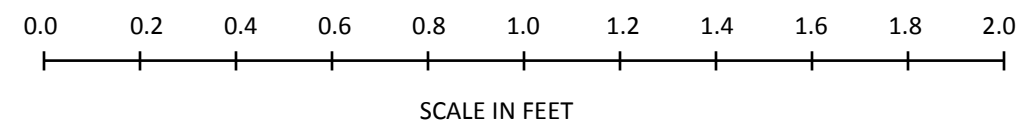
Begin Run 1
66.8 feet



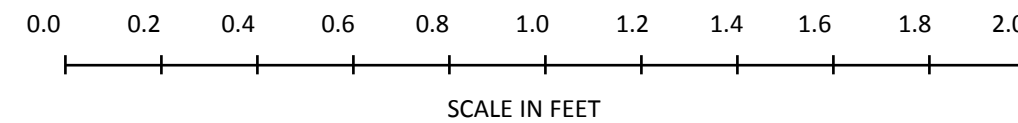
Begin Run 5
86.8 feet



Begin Run 3
76.8 feet



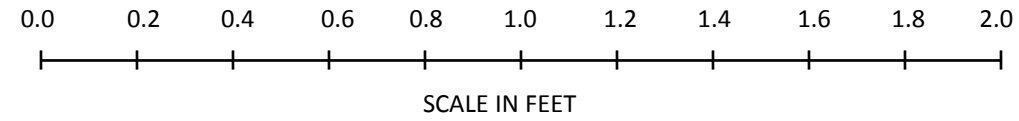
Begin Run 7
96.8 feet





CORE PHOTOGRAPHS: Boring RPC_2100R -RPC- Station 21+00, 240 feet Right

Begin Run 9
106.8 feet





NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

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SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPC_2750R	STATION 27+50	OFFSET 40 ft RT	ALIGNMENT -RPC-
COLLAR ELEV. 270.8 ft	TOTAL DEPTH 60.7 ft	NORTHING 437,914	EASTING 1,746,747
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/26/15	COMP. DATE 02/27/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
275														
270	270.8	0.0	1	2	4							M	GROUND SURFACE	0.0
265	267.3	3.5	7	10	14							M	COASTAL PLAIN Red, CLAY (A-7-6), trace fine sand	
260	262.3	8.5	5	5	9							M	RESIDUAL Red and orange, clayey SILT (A-5)	7.0
255	257.3	13.5	2	2	3							D	RESIDUAL Tan, orange and black, fine sandy SILT (A-4), saprolitic	12.0
250	252.3	18.5	3	2	3							D		
245	247.3	23.5	60/0.1										CRYSTALLINE ROCK Gray and black, GABBRO	23.5
240	245.1	25.7	60/0										CRYSTALLINE ROCK Gray and black, GABBRO Boulder	25.7
235													RESIDUAL Brown and olive tan, clayey SILT (A-5) with rock fragments	30.7
230														
225														
220													CRYSTALLINE ROCK Gray and black, GABBRO Boulder	50.7
215													CRYSTALLINE ROCK Gray and black, GABBRO	55.7
												RS-5	CRYSTALLINE ROCK Gray and black, GABBRO	60.7
													Boring Terminated at Elevation 210.1 ft IN CRYSTALLINE ROCK (GABBRO)	
													Notes 1) 0.2' Topsoil 2) Auger refusal at 25.7'	

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Jones
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPC_2750R	STATION 27+50	OFFSET 40 ft RT	ALIGNMENT -RPC-
COLLAR ELEV. 270.8 ft	TOTAL DEPTH 60.7 ft	NORTHING 437,914	EASTING 1,746,747
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/26/15	COMP. DATE 02/27/15	SURFACE WATER DEPTH N/A

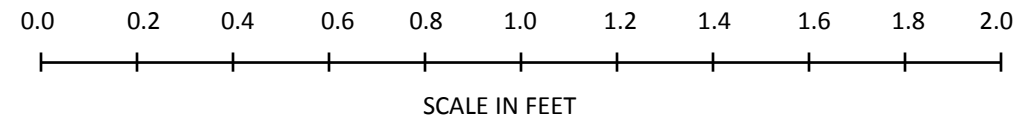
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft)	RQD (ft)		REC. (ft)	RQD (ft)			
245.1	245.1	25.7	5.0	N=60/0 1:17/1.0 1:00/1.0 0:41/1.0 0:35/1.0 0:47/1.0	(0.4)	(0.0)		(0.4)	(0.0)		Continued from previous page CRYSTALLINE ROCK GABBRO boulder, went back into soil, red water return R1 = 0, R2 = 3, R3 = 5, R4 = 0, R5 = 7, RMR = 15, Rock type E	25.7
240	240.1	30.7	5.0	0:36/1.0 0:44/1.0 0:58/1.0 1:07/1.0 1:03/1.0	(0.0)	(0.0)		(0.0)	(0.0)		RESIDUAL Brown and olive tan, clayey SILT (A-5) with rock fragments	30.7
235	235.1	35.7	5.0	1:19/1.0 0:55/1.0 0:50/1.0 0:49/1.0 0:31/1.0	(0.0)	(0.0)						
230	230.1	40.7	5.0	1:18/1.0 1:21/1.0 1:20/1.0 1:05/1.0 0:50/1.0	(0.0)	(0.0)						
225	225.1	45.7	5.0	1:27/1.0 1:40/1.0 1:14/1.0 1:11/1.0 1:20/1.0	(0.0)	(0.0)						
220	220.1	50.7	5.0	3:01/1.0 2:25/1.0 2:38/1.0 2:12/1.0 1:46/1.0	(1.2)	(0.0)		(1.2)	(0.0)		CRYSTALLINE ROCK GABBRO boulder from 52.5 to 54.2 feet, soil from 50.7 to 52.5 feet and 54.2 to 55.7 feet R1 = 0, R2 = 3, R3 = 5, R4 = 0, R5 = 7, RMR = 15, Rock type E	50.7
215	215.1	55.7	5.0	2:22/1.0 2:35/1.0 2:40/1.0 2:35/1.0 1:20/1.0	(2.7)	(2.2)					CRYSTALLINE ROCK Gray and black, fresh to slightly weathered, very hard GABBRO, no bedding, last foot of run went back into soil, RS-5 = 5, 59.0' to 59.5', UCS = 10,371 psi R1 = 7, R2 = 13, R3 = 20, R4 = 20, R5 = 7, RMR = 67, Rock type E	55.7
	210.1	60.7					RS-5				Boring Terminated at Elevation 210.1 ft IN CRYSTALLINE ROCK (GABBRO)	60.7
											Notes 1) 0.2' Topsoil 2) Auger refusal at 25.7'	

NCDOT BORE DOUBLE R-3421A.GPJ NC_DOT_GDT 6/11/15



CORE PHOTOGRAPHS: Boring RPC_2750R -RPC- Station 27+50, 40 feet Right

Begin Run 1
25.7 feet





NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPC_3234L	STATION 32+34	OFFSET 59 ft LT	ALIGNMENT -RPC-
COLLAR ELEV. 212.9 ft	TOTAL DEPTH 16.4 ft	NORTHING 438,368	EASTING 1,746,946
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 02/24/15	COMP. DATE 02/24/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
215	212.9	0.0											GROUND SURFACE	0.0
			WOH	WOH	1							M	ALLUVIAL	
210	210.4	2.5	3	6	11							W	Red and brown, fine sandy SILT (A-4) with trace organics	2.9
	207.9	5.0	6	7	5							Sat.	Dark gray, silty CLAY (A-7-5) with some gravel, micaceous	5.0
205	205.4	7.5	17	12	17							M	Brown, coarse SAND (A-1-b) and gravel	7.0
	202.9	10.0	16	24	21							M	RESIDUAL	
	200.4	12.5	25	38	60							M	Gray and brown, fine sandy SILT (A-4), micaceous, saprolitic	
200	197.9	15.0	12	20	80/0.1							M		
	196.5	16.4	60/0									M	WEATHERED ROCK	15.5
												M	Gray, GABBRO	16.4
													Boring Terminated with Standard Penetration Test Refusal at Elevation 196.5 ft ON CRYSTALLINE ROCK (GABBRO)	
													Notes	
													1) 0.2' Topsoil	
													2) Auger refusal at 16.4'	

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPC_3386R	STATION 33+86	OFFSET 89 ft RT	ALIGNMENT -RPC-
COLLAR ELEV. 218.0 ft	TOTAL DEPTH 12.0 ft	NORTHING 438,362	EASTING 1,747,157
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 02/23/15	COMP. DATE 02/23/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
220	218.0	0.0											GROUND SURFACE	0.0
			WOH	3	3							M	ALLUVIAL	
215	215.5	2.5	WOH	1	2							W	Red, silty CLAY (A-7-5) with trace organics, micaceous	3.5
	213.0	5.0	2	2	5							M	Dark gray, silty CLAY (A-7-5/6) with trace sand and organics	5.8
210	210.5	7.5	1	2	8							M	RESIDUAL	
	208.0	10.0	3	3	80							M	Gray, clayey fine sandy SILT (A-5) with trace rock fragments, micaceous, saprolitic	8.5
	206.1	11.9	60/0.1									M	Red, brown, silty fine SAND (A-2-4), micaceous, saprolitic	11.6
												M	CRYSTALLINE ROCK	12.0
													Gabbro	
													Boring Terminated with Standard Penetration Test Refusal at Elevation 206.0 ft IN CRYSTALLINE ROCK (GABBRO)	
													Notes	
													1) 0.2' Topsoil	
													2) Strata breaks in split spoon at 3.5', 5.8' and 8.5'	
													3) Hard drilling at 11.6'	
													4) Auger refusal at 11.9'	



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPC_3764R	STATION 37+64	OFFSET 128 ft RT	ALIGNMENT -RPC-
COLLAR ELEV. 222.9 ft	TOTAL DEPTH 32.7 ft	NORTHING 438,517	EASTING 1,747,472
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 02/23/15	COMP. DATE 02/23/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
225																
	222.9	0.0													222.9	0.0
	220.4	2.5														
	217.9	5.0														
	215.4	7.5														
	212.9	10.0														
	210.4	12.5														
	207.9	15.0														
	204.4	18.5														
	199.4	23.5														
	194.4	28.5														
	190.2	32.7														

WEATHERED ROCK
Dark gray, GABBRO

Boring Terminated with Standard Penetration Test Refusal at Elevation 190.2 ft ON CRYSTALLINE ROCK (GABBRO)

Notes
1) 0.2' Topsoil
2) Auger refusal at 32.7'

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Jones
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPD_500R	STATION 5+00	OFFSET 145 ft RT	ALIGNMENT -RPD-
COLLAR ELEV. 280.6 ft	TOTAL DEPTH 49.1 ft	NORTHING 438,060	EASTING 1,745,327
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/25/15	COMP. DATE 02/25/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
285																
	280.6	0.0													280.6	0.0
	277.1	3.5														
	272.1	8.5														
	267.1	13.5														
	262.1	18.5														
	257.1	23.5														
	252.1	28.5														
	247.1	33.5														
	242.1	38.5														
	237.1	43.5														
	232.1	48.5														

CRYSTALLINE ROCK
Gray and tan, GABBRO

Boring Terminated at Elevation 231.5 ft IN CRYSTALLINE ROCK (GABBRO)

Notes
1) 0.1' Topsoil

NCDOT BORE DOUBLE R-3421A.GPJ NC_DOT.GDT 6/11/15



NCDOT GEOTECHNICAL ENGINEERING UNIT

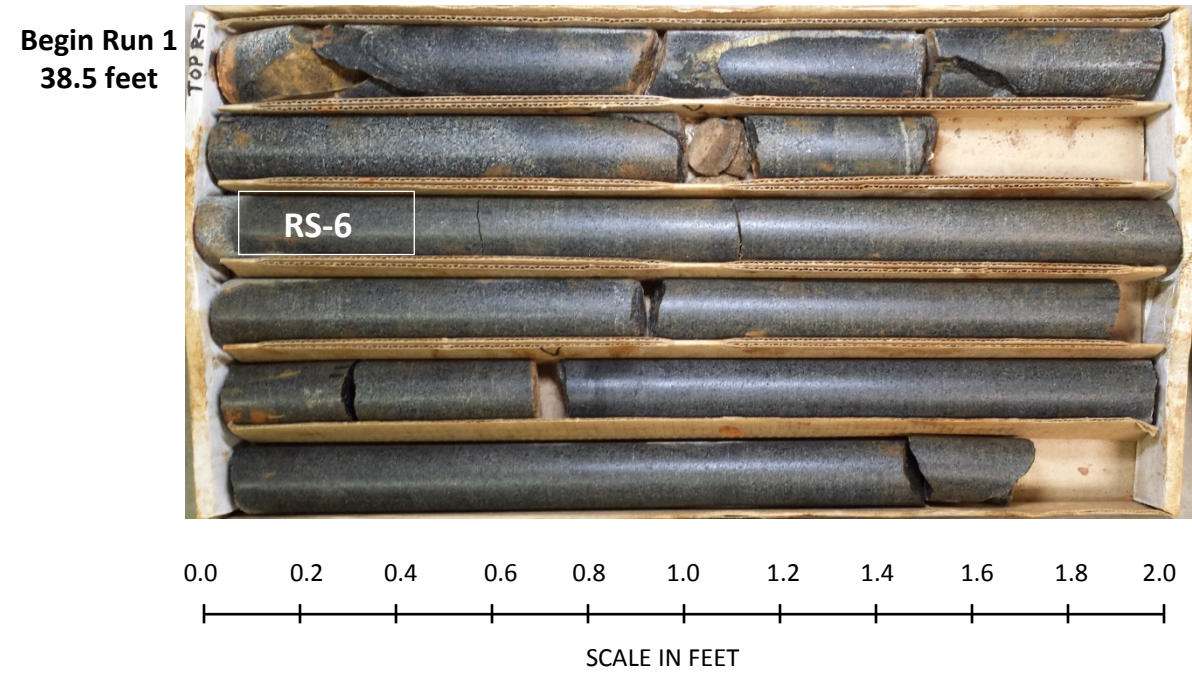
BORELOG REPORT

WBS 34542.1.FR4		TIP R-3421A		COUNTY RICHMOND		GEOLOGIST C. Jones										
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140							GROUND WTR (ft)									
BORING NO. RPD_720R		STATION 7+20		OFFSET 40 ft RT		ALIGNMENT -RPD-										
COLLAR ELEV. 267.2 ft		TOTAL DEPTH 49.5 ft		NORTHING 438,727		EASTING 1,746,595										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER D. Tignor		START DATE 02/24/15		COMP. DATE 02/24/15		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
270																
265	267.2	0.0	WOH	WOH	1									267.2	GROUND SURFACE	0.0
260	263.7	3.5	6	8	9									260.2	RESIDUAL Red, CLAY (A-7-5/6) with little fine sand and roots	7.0
255	258.7	8.5	6	6	7									255.2	Orange and red, SILT (A-4) with little fine sand	12.0
250	253.7	13.5	3	4	4										Tan, orange and black mottled, SILT (A-4) with little fine sand, micaceous, saprolitic	
245	248.7	18.5	2	3	5											
240	243.7	23.5	2	5	5											
235	238.7	28.5	5	6	7											
230	233.7	33.5	13	39	100/0.3									232.7	WEATHERED ROCK Brown and black with orange, GABBRO	34.5
225	228.7	38.5	100/0											228.7	CRYSTALLINE ROCK Gray and black, GABBRO	38.5
220														217.7	Boring Terminated at Elevation 217.7 ft IN CRYSTALLINE ROCK (GABBRO)	49.5

WBS 34542.1.FR4		TIP R-3421A		COUNTY RICHMOND		GEOLOGIST C. Jones					
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140							GROUND WTR (ft)				
BORING NO. RPD_720R		STATION 7+20		OFFSET 40 ft RT		ALIGNMENT -RPD-					
COLLAR ELEV. 267.2 ft		TOTAL DEPTH 49.5 ft		NORTHING 438,727		EASTING 1,746,595					
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic					
DRILLER D. Tignor		START DATE 02/24/15		COMP. DATE 02/24/15		SURFACE WATER DEPTH N/A					
CORE SIZE NQ3			TOTAL RUN 11.0 ft								
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (%)	RQD (%)	SAMP. NO.	STRATA REC. (%)	RQD (%)	LOG	DESCRIPTION AND REMARKS
228.7	228.7	38.5	3.0	N=100/0 2-53/1.0 2-53/1.0 2-22/1.0 2-23/1.0	(3.0) 100%	(2.6) 87%		(11.0) 100%	(10.3) 94%		Continued from previous page CRYSTALLINE ROCK Gray and black, fresh to slightly weathered, very hard, thin seams of quartz, thickly bedded, close to wide fracture spacing RS-6, 42.0' to 42.5', UCS = 13,040 psi R1 = 7, R2 = 20, R3 = 20, R4 = 20, R5 = 7, RMR = 74, Rock type E
225	225.7	41.5	5.0	2-43/1.0 2-50/1.0 2-54/1.0 2-30/1.0 2-27/1.0	(5.0) 100%	(5.0) 100%	RS-6				
220	220.7	46.5	3.0	3-00/1.0 2-49/1.0 2-27/1.0	(3.0) 100%	(2.7) 90%					
	217.7	49.5									Boring Terminated at Elevation 217.7 ft IN CRYSTALLINE ROCK (GABBRO)
Notes 1) Auger refusal at 38.5 feet											



CORE PHOTOGRAPHS: Boring RPD_720R -RPD- Station 7+20, 40 feet Right





NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPD_2000	STATION 20+00	OFFSET CL	ALIGNMENT -RPD-
COLLAR ELEV. 320.5 ft	TOTAL DEPTH 50.0 ft	NORTHING 439,462	EASTING 1,745,646
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/19/15	COMP. DATE 02/19/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
325														
320	320.5	0.0	2	3	2							M	GROUND SURFACE COASTAL PLAIN Brown, clayey fine SAND (A-2-6/7)	0.0
315	317.0	3.5	7	11	16							M	RESIDUAL Red and orange, fine sandy CLAY (A-7-6)	1.0
310	312.0	8.5	7	10	13							M		
305	307.0	13.5	4	6	6							M	Orange, red and brown, clayey SILT (A-5) with trace fine sand, saprolitic	12.0
300	302.0	18.5	3	4	5							M		
295	297.0	23.5	3	4	5							M	Yellow, orange, black and tan, fine sandy SILT (A-4), saprolitic	23.0
290	292.0	28.5	4	7	9							M		
285	287.0	33.5	3	4	6							M		
280	282.0	38.5	3	4	5							M		
275	277.0	43.5	4	8	13							M		
	272.0	48.5	4	9	13							M		

47%

Boring Terminated at Elevation 270.5 ft IN SILT (RESIDUAL)

Notes
1) 0.1' Topsoil
2) Strata break in split spoon at 1.0' and 44.8'

Other Samples:
ST-1 (18.0 - 20.0)

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. RPD_2125R	STATION 21+25	OFFSET 90 ft RT	ALIGNMENT -RPD-
COLLAR ELEV. 317.6 ft	TOTAL DEPTH 50.0 ft	NORTHING 439,604	EASTING 1,745,696
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/18/15	COMP. DATE 02/18/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
320														
315	317.6	0.0	1	2	1							M	GROUND SURFACE COASTAL PLAIN Brown and red, fine sandy CLAY (A-6)	0.0
310	314.1	3.5	6	10	12							M	RESIDUAL Orange and red, fine sandy silty CLAY (A-7-6)	2.0
305	309.1	8.5	4	6	8							M	Orange and red, fine sandy clayey SILT (A-5), saprolitic	8.7
300	304.1	13.5	3	4	4							M		
295	299.1	18.5	2	2	4							M	Yellow and orange, fine sandy SILT (A-4) with clay, saprolitic	17.0
290	294.1	23.5	2	2	3							M		
285	289.1	28.5	34	20	9							D	Tan and black, silty fine to coarse SAND (A-2-4) with weathered rock fragments, saprolitic	27.0
280	284.1	33.5	4	5	7							M	Yellow, orange, tan and black mottled, fine sandy SILT (A-4), micaceous, saprolitic	32.0
275	279.1	38.5	8	10	13							M		
270	274.1	43.5	4	6	6							M		
	269.1	48.5	2	3	5							M		
												W		

Boring Terminated at Elevation 267.6 ft IN SILT (RESIDUAL)

Notes
1) 0.5' Topsoil
2) Strata break in split spoon at 8.7'

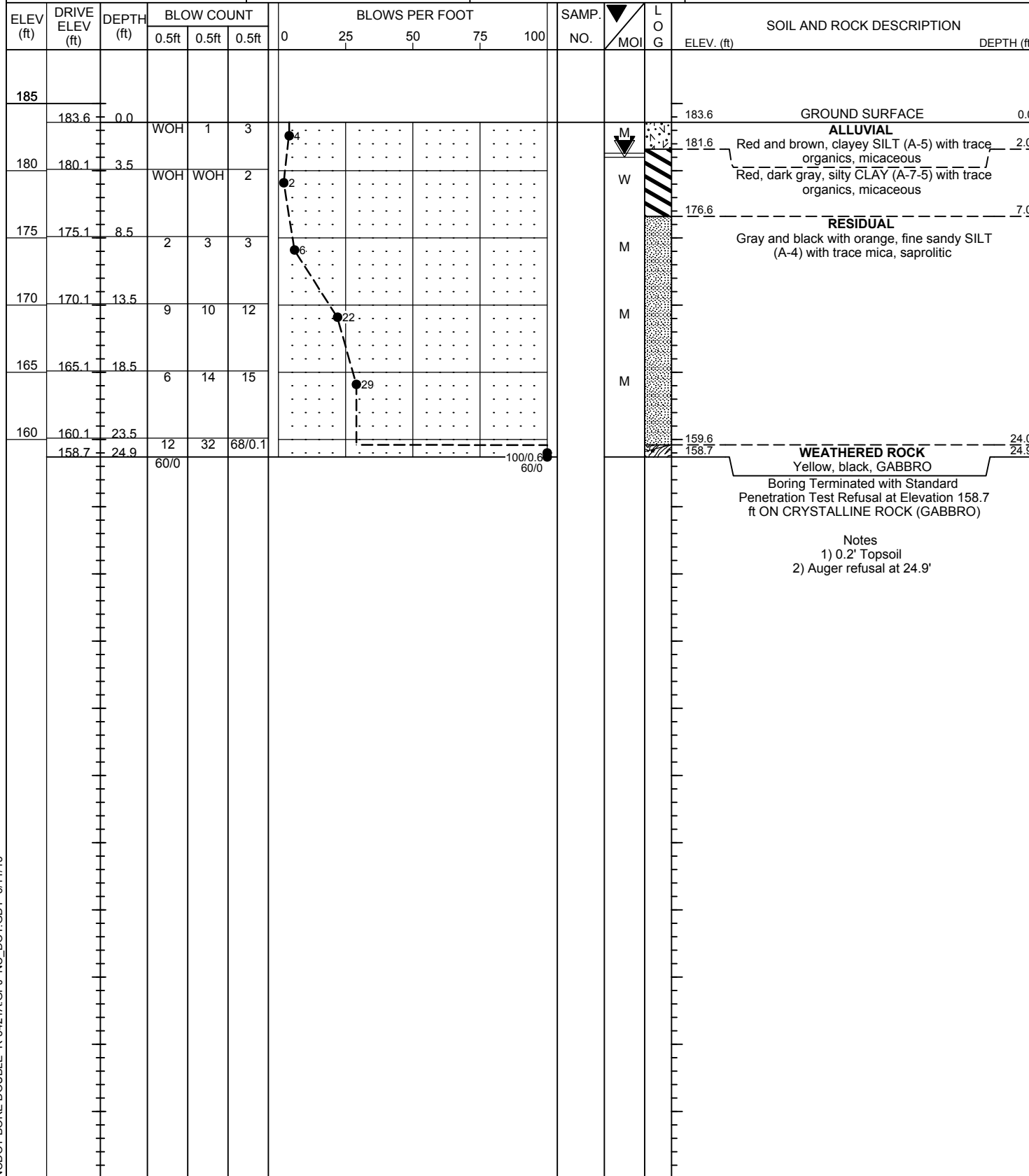
NCDOT BORE DOUBLE R-3421A.GPJ NC_DOT.GDT 6/11/15



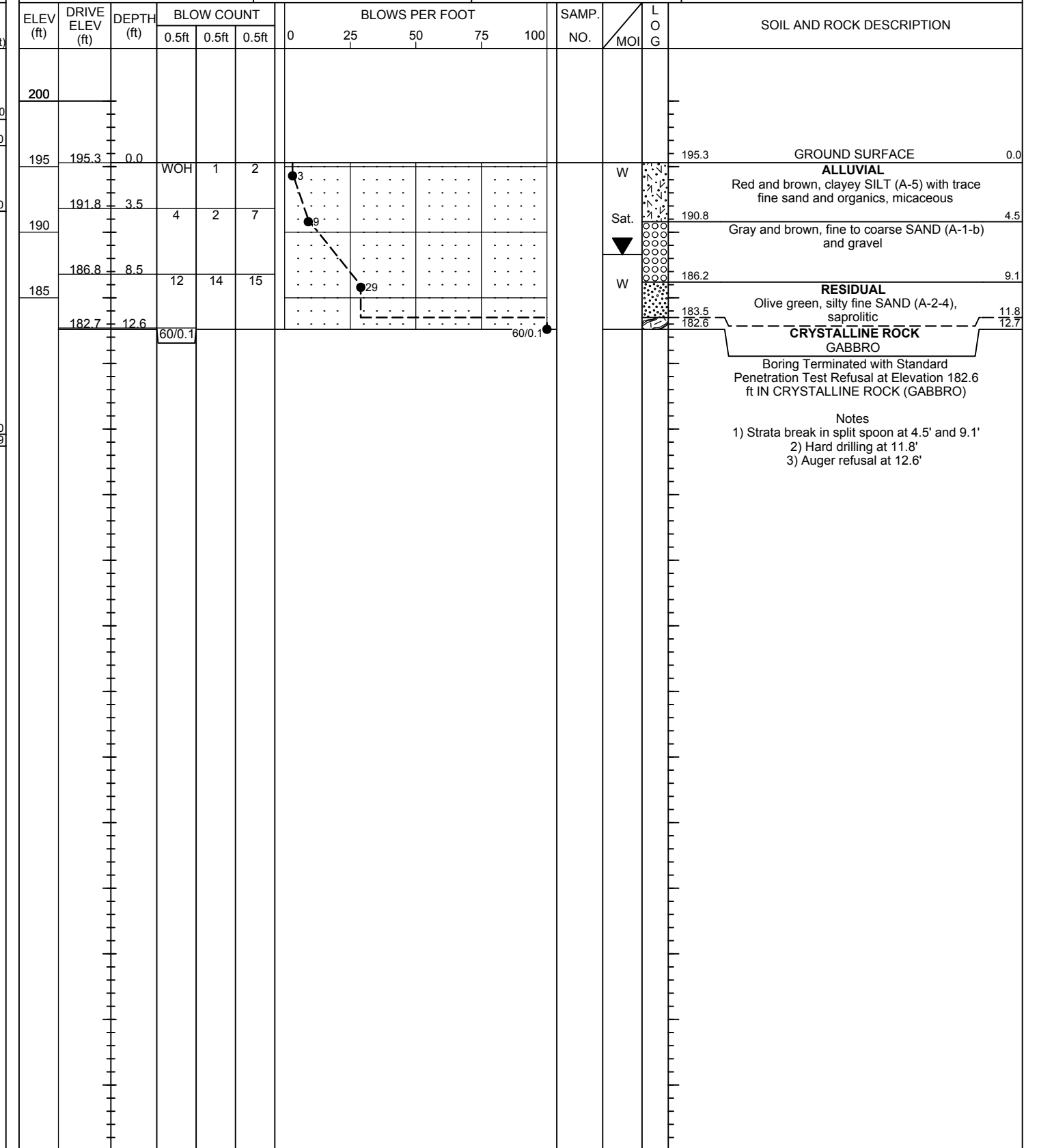
NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. LPB_868	STATION 8+68	OFFSET CL	ALIGNMENT -LPB-
COLLAR ELEV. 183.6 ft	TOTAL DEPTH 24.9 ft	NORTHING 436,978	EASTING 1,745,410
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 02/18/15	COMP. DATE 02/18/15	SURFACE WATER DEPTH N/A



WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft)
BORING NO. LPB_1176R	STATION 11+76	OFFSET 151 ft RT	ALIGNMENT -LPB-
COLLAR ELEV. 195.3 ft	TOTAL DEPTH 12.7 ft	NORTHING 437,169	EASTING 1,745,548
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 02/16/15	COMP. DATE 02/17/15	SURFACE WATER DEPTH N/A





NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft) 0 HR. 2.0
BORING NO. LPC_332L	STATION 3+32	OFFSET 95 ft LT	ALIGNMENT -LPC-
COLLAR ELEV. 196.9 ft	TOTAL DEPTH 50.0 ft	NORTHING 437,564	EASTING 1,746,029
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 02/25/15	COMP. DATE 02/25/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
200														196.9	GROUND SURFACE	0.0
195	196.9	0.0											ALLUVIAL	194.9	Red and brown, fine sandy SILT (A-4) with trace organics, micaceous	2.0
	194.4	2.5												189.9	Gray, fine to coarse SAND (A-2-4) with some silt and clay, trace organics	7.0
190	191.9	5.0	1	2	1								RESIDUAL	189.9	Brown, orange and black, fine sandy SILT (A-4), saprolitic, micaceous	
	189.4	7.5	1	5	8											
	186.9	10.0	1	2	2											
185	184.4	12.5	1	1	2											
	181.9	15.0	1	2	3											
180	178.4	18.5	2	3	3											
	173.4	23.5	2	3	4											
170	168.4	28.5	3	6	8											
165	163.4	33.5	6	10	12											
160	158.4	38.5	21	56	44/0.3									157.9	WEATHERED ROCK	39.0
155	153.4	43.5	10	12	13									157.1	Brown and black, GABBRO	39.8
	148.4	48.5	100/0.3											148.4	RESIDUAL	
	146.9	50.0	100/0.3											146.9	Brown with orange and black, fine sandy SILT (A-4), saprolitic	
		60/0													WEATHERED ROCK	50.0
															Boring Terminated with Standard Penetration Test Refusal at Elevation 146.9 ft ON CRYSTALLINE ROCK (GABBRO)	
															Notes	
															1) 0.1' of Topsoil	
															2) Auger refusal at a depth of 50.0'	

NCDOT BORE DOUBLE R-3421A.GPJ NC_DOT_GDT 6/11/15

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST M. Johnson
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140			GROUND WTR (ft) 0 HR. Dry
BORING NO. LPC_875L	STATION 8+75	OFFSET 20 ft LT	ALIGNMENT -LPC-
COLLAR ELEV. 284.9 ft	TOTAL DEPTH 62.5 ft	NORTHING 437,577	EASTING 1,746,423
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 82% 01/17/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 02/03/15	COMP. DATE 02/04/15	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
285	284.9	0.0	3	3	7								GROUND SURFACE	0.0		
	281.4	3.5	13	9	10								RESIDUAL	280.4		
280													Orange and red, fine to coarse silty SAND (A-2-4) with rock fragments	4.5		
	276.4	8.5	10	24	45								Orange and red, silty CLAY (A-7-5/6) with sand	9.4		
275													Orange, yellow and black, silty SAND (A-2-4) with clay, micaceous	12.0		
	271.4	13.5	5	6	7								Orange and black, fine to coarse sandy CLAY (A-7-5/6)	17.5		
270	267.4	17.5											CRYSTALLINE ROCK	17.5		
265													Gray and black, GABBRO			
260																
255																
250																
245																
240																
235																
230																
225																
														222.4	Boring Terminated at Elevation 222.4 ft IN CRYSTALLINE ROCK (GABBRO)	62.5
															Notes	
															1) 0.2' Topsoil	
															2) Strata break in split spoon at 4.5' and 9.4'	
															3) Auger refusal at 17.5'	



NCDOT GEOTECHNICAL ENGINEERING UNIT

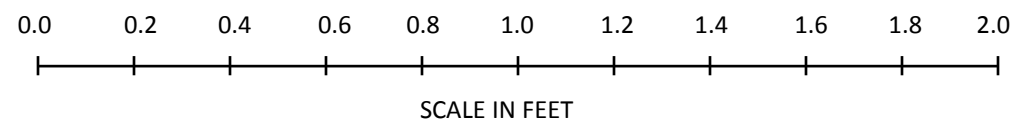
CORE BORING REPORT

WBS 34542.1.FR4		TIP R-3421A		COUNTY RICHMOND		GEOLOGIST M. Johnson					
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140							GROUND WTR (ft)				
BORING NO. LPC_875L		STATION 8+75		OFFSET 20 ft LT		ALIGNMENT -LPC-					
COLLAR ELEV. 284.9 ft		TOTAL DEPTH 62.5 ft		NORTHING 437,577		EASTING 1,746,423					
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 82% 01/17/2014				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic					
DRILLER D. Tignor		START DATE 02/03/15		COMP. DATE 02/04/15		SURFACE WATER DEPTH N/A					
CORE SIZE NQ3		TOTAL RUN 45.0 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	LOG	DESCRIPTION AND REMARKS
267.4	267.4	17.5	5.0	2:08/1.0	(4.8)	(4.8)		(44.7)	(43.8)		Continued from previous page
265	262.4	22.5	5.0	2:26/1.0 2:03/1.0 2:01/1.0 2:09/1.0	96%	96%	RS-1	99%	97%		CRYSTALLINE ROCK Gray and black, fresh to very slightly weathered, very hard, GABBRO, moderately close to wide fracture spacing, no apparent bedding RS-1 = 18.0' to 18.5', UCS = 18,902 psi
260	257.4	27.5	5.0	2:02/1.0 2:08/1.0 1:56/1.0 1:51/1.0 2:06/1.0	100%	94%					
255	252.4	32.5	5.0	2:00/1.0 2:18/1.0 2:24/1.0 2:04/1.0 2:11/1.0	100%	94%					
250	247.4	37.5	5.0	2:01/1.0 2:03/1.0 2:02/1.0 1:56/1.0 2:14/1.0	(4.9)	(4.9)	RS-2				RS-2 = 35.2' to 35.7', UCS = 15,792 psi
245	242.4	42.5	5.0	1:58/1.0 2:04/1.0 2:19/1.0 2:03/1.0 2:11/1.0	(5.0)	(5.0)					R1 = 12, R2 = 20, R3 = 25, R4 = 20, R5 = 7, RMR = 84, Rock type E
240	237.4	47.5	5.0	2:11/1.0 2:07/1.0 1:54/1.0 1:55/1.0 2:17/1.0	(5.0)	(4.8)					
235	232.4	52.5	5.0	2:20/1.0 2:22/1.0 2:08/1.0 1:59/1.0 2:22/1.0	100%	98%					
230	227.4	57.5	5.0	2:26/1.0 2:31/1.0 2:04/1.0 2:05/1.0 2:23/1.0	(5.0)	(5.0)					
225	222.4	62.5	5.0	1:57/1.0 2:20/1.0 2:26/1.0 2:00/1.0 2:18/1.0	100%	100%					Boring Terminated at Elevation 222.4 ft IN CRYSTALLINE ROCK (GABBRO)
<p style="text-align: center;">Notes</p> <p style="text-align: center;">1) 0.2' Topsoil</p> <p style="text-align: center;">2) Strata break in split spoon at 4.5' and 9.4'</p> <p style="text-align: center;">3) Auger refusal at 17.5'</p>											

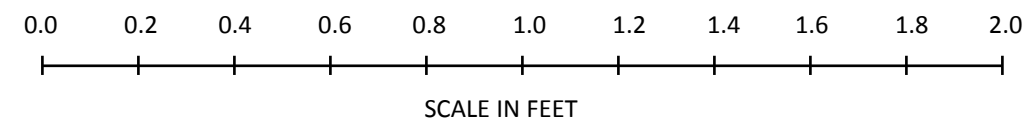
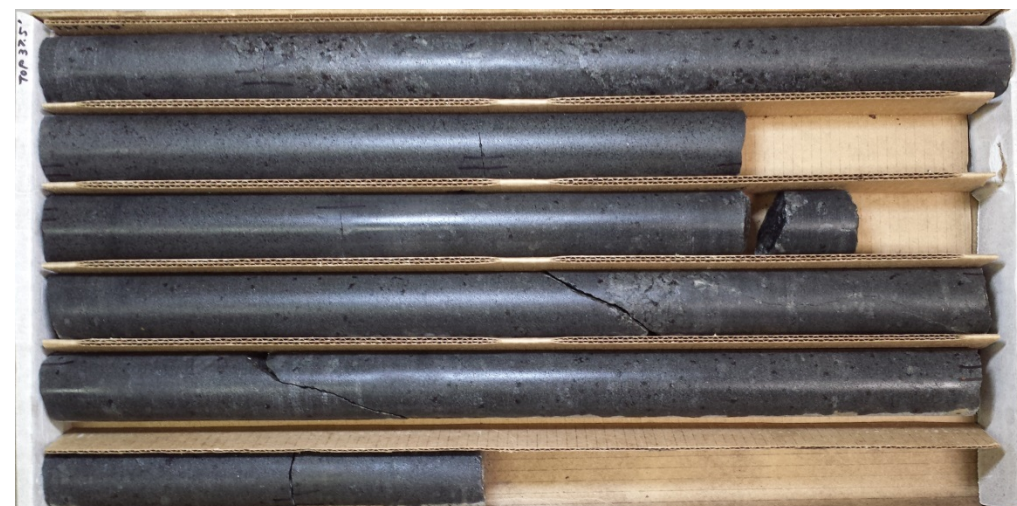
NCDOT CORE DOUBLE R-3421A.GPJ NC_DOT.GDT 6/9/15



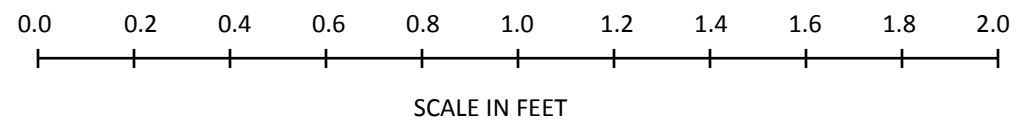
CORE PHOTOGRAPHS: Boring LPC_875L -LPC- Station 8+75, 20 feet Left



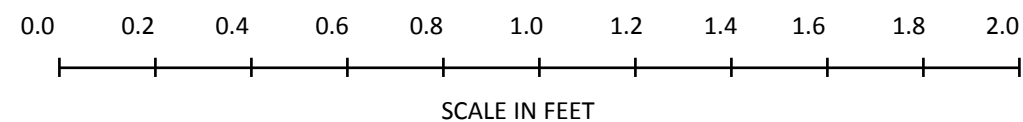
Begin Run 5
37.5 feet



Begin Run 3
27.5 feet



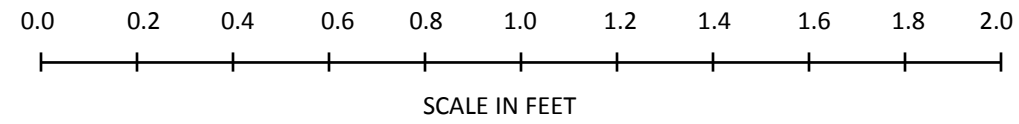
Begin Run 7
47.5 feet





CORE PHOTOGRAPHS: Boring LPC_875L -LPC- Station 8+75, 20 feet Left

Begin Run 9
57.5 feet





NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang	
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140				GROUND WTR (ft)
BORING NO. LPC_1299R	STATION 12+99	OFFSET 96 ft RT	ALIGNMENT -LPC-	0 HR. 4.0
COLLAR ELEV. 203.1 ft	TOTAL DEPTH 15.8 ft	NORTHING 438,004	EASTING 1,746,394	24 HR. 2.5
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER S. Davis	START DATE 02/25/15	COMP. DATE 02/25/15	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
205																
	203.1	0.0	1	5	4									203.1	GROUND SURFACE	0.0
	200.6	2.5	4	4	6										ALLUVIAL Red and brown, fine sandy SILT (A-4) with trace gravel	
	198.1	5.0	4	4	5									198.1	RESIDUAL Gray, brown, red and black, fine sandy SILT (A-4) with trace rock fragments, micaceous, saprolitic	5.0
	195.6	7.5	11	9	6											
	193.1	10.0	6	9	19											
	190.6	12.5	60	40/0.2										190.6	WEATHERED ROCK Gray, GABBRO	12.5
	187.4	15.0	100/0.3											187.4	CRYSTALLINE ROCK Gray and black, GABBRO	15.7
	187.3	15.7	60/0.1											187.3	Boring Terminated with Standard Penetration Test Refusal at Elevation 187.3 ft IN CRYSTALLINE ROCK (GABBRO)	15.8
															Notes 1) 0.1' Topsoil 2) Auger refusal at 15.7'	

WBS 34542.1.FR4	TIP R-3421A	COUNTY RICHMOND	GEOLOGIST C. Wang	
SITE DESCRIPTION US 220 Bypass from US 74 Bypass West of Rockingham at SR1109 to 0.3 miles south of SR1140				GROUND WTR (ft)
BORING NO. LPC_1345L	STATION 13+45	OFFSET 115 ft LT	ALIGNMENT -LPC-	0 HR. 9.5
COLLAR ELEV. 197.9 ft	TOTAL DEPTH 17.8 ft	NORTHING 437,844	EASTING 1,746,250	24 HR. 3.3
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 76% 02/05/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER S. Davis	START DATE 02/25/15	COMP. DATE 02/25/15	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
200																
	197.9	0.0												197.9	GROUND SURFACE	0.0
	195.4	2.5	WOH	WOH	WOH									195.4	ALLUVIAL Red, brown, sandy SILT (A-4) with trace organics	2.0
	192.9	5.0	3	2	3									192.9	RESIDUAL Red, brown and gray, silty CLAY (A-7-5/6) with trace organics	5.0
	190.4	7.5	2	6	5									190.4	RESIDUAL Gray and black, fine sandy SILT (A-4), micaceous, saprolitic	7.0
	187.9	10.0	12	16	15											
	185.4	12.5	8	8	13											
	182.9	15.0	15	12	18											
	180.1	17.8	60/0											180.1	Brown and black, fine sandy SILT (A-4), micaceous, saprolitic	16.1
															Boring Terminated with Standard Penetration Test Refusal at Elevation 180.1 ft ON CRYSTALLINE ROCK (GABBRO)	17.8
															Notes 1) 0.2' Topsoil 2) Strata break in split spoon at 16.1' 3) Auger refusal at 17.8'	

**North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory**

T.I.P. ID NO.: R-3421A
DESCRIPTION: US 220 Bypass from US 4 Bypass west of Rockingham at SR 1109 intersection to 0.3 miles south of SR 1140

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT:	<u>34542.1.FR4</u>	COUNTY:	<u>Richmond</u>
DATE SAMPLED:	<u>2/15 & 3/15</u>	RECEIVED:	<u>2/15 & 3/15</u>
SAMPLED FROM:	<u>RPC, US74, FLY</u>	REPORTED:	<u>2/15 & 3/15</u>
SUBMITTED BY:	<u>B. Howey, P.E.</u>	BY:	<u>D. Jenks</u> Cert No. 101-02-0603

TEST RESULTS

TEST RESULTS

PROJ. SAMPLE NO.	ST-1	SS-5	SS-9	SS-11	SS-12	SS-19	SS-5	SS-7	SS-12	SS-13	SS-14	SS-1	SS-4	SS-5
BORING NO.	RPC_2100R	US74_6500R_340	US74_6500R_340	US74_6500R_340	US74_6500R_340	US74_6500R_340	FLY_825R	FLY_825R	FLY_825R	FLY_825R	FLY_825R	FLY_1825	FLY_1825	FLY_1825
Retained #4 Sieve %	0.0	24.9	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Passing #10 Sieve %	100.0	61.4	100.0	98.2	100.0	100.0	98.0	99.9	97.8	100.0	100.0	98.9	100.0	100.0
Passing #40 Sieve %	98.6	33.2	86.7	71.9	99.3	92.8	65.4	82.6	58.9	99.6	86.5	56.4	98.8	99.4
Passing #200 Sieve %	88.6	11.2	54.6	40.9	63.5	57.3	29.6	36.3	19.6	94.4	69.8	17.5	87.2	72.7

SOIL MORTAR - 100%														
Coarse Sand Ret - #60 %	2.7	61.5	20.1	42.0	4.1	17.2	48.0	37.4	57.7	0.7	20.4	66.2	3.0	6.0
Fine Sand Ret - #270 %	16.2	23.5	31.2	18.8	37.3	32.1	22.7	30.6	23.8	6.5	13.0	17.9	13.0	26.0
Silt 0.053 - 0.010 mm %	25.9	6.5	6.7	4.7	12.1	37.1	0.3	8.6	2.4	19.7	22.6	6.4	18.9	21.9
Clay < 0.010 mm %	55.2	8.5	42.0	34.5	46.5	13.6	29.0	23.4	16.1	73.1	44.0	9.5	65.1	46.1
L.L.	51	26	57	47	41	54	49	22	29	106	73	14	80	54
P.L.	27	NP	25	23	24	46	23	17	23	38	41	NP	67	NP
P.I.	24	NP	32	24	17	9	26	5	6	68	32	NP	13	NP
AASHTO Classification	A-7-6 (24)	A-1-b (0)	A-7-6 (14)	A-7-6 (5)	A-7-6 (10)	A-5 (6)	A-2-7 (1)	A-4 (0)	A-2-4 (0)	A-7-5 (78)	A-7-5 (25)	A-2-4 (0)	A-7-5 (23)	A-5 (4)
Station	-RPC- 21+00	-US74- 65+00	-US74- 65+00	-US74- 65+00	-US74- 65+00	-US74- 65+00	-FLY- 8+25	-FLY- 8+25	-FLY- 8+25	-FLY- 8+25	-FLY- 8+25	-FLY- 18+25	-FLY- 18+25	-FLY- 18+25
Offset	240' Rt	340' Rt	340' Rt	340' Rt	340' Rt	340' Rt	40' Rt	40' Rt	40' Rt	40' Rt	40' Rt	CL	CL	CL
Depth (ft)	33.0	18.5	38.5	48.5	53.5	88.5	18.5	28.5	53.5	58.5	63.5	0.0	13.5	18.5
to	35.0	20.0	40.0	50.0	55.0	90.0	20.0	30.0	55.0	60.0	65.0	1.5	15.0	20.0
Moisture Content (%)	26.8	3.9	17.3	15.5	27.9	37.6	22.0	13.6	27.8	60.0	32.4	6.4	52.0	49.3
Organic Content (%)	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

NP=Not plastic
NT=Not tested
ND = Not Determined
CL = Centerline

W.P. Alton, PE
Soils Engineer

**North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory**

T.I.P. ID NO.: R-3421A
DESCRIPTION: US 220 Bypass from US 4 Bypass west of Rockingham at SR 1109 intersection to 0.3 miles south of SR 1140

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT:	<u>34542.1.FR4</u>	COUNTY:	<u>Richmond</u>
DATE SAMPLED:	<u>2/15 & 3/15</u>	RECEIVED:	<u>2/15 & 3/15</u>
SAMPLED FROM:	<u>I73</u>	REPORTED:	<u>2/15 & 3/15</u>
SUBMITTED BY:	<u>B. Howey, P.E.</u>	BY:	<u>D. Jenks</u> Cert No. 101-02-0603

TEST RESULTS

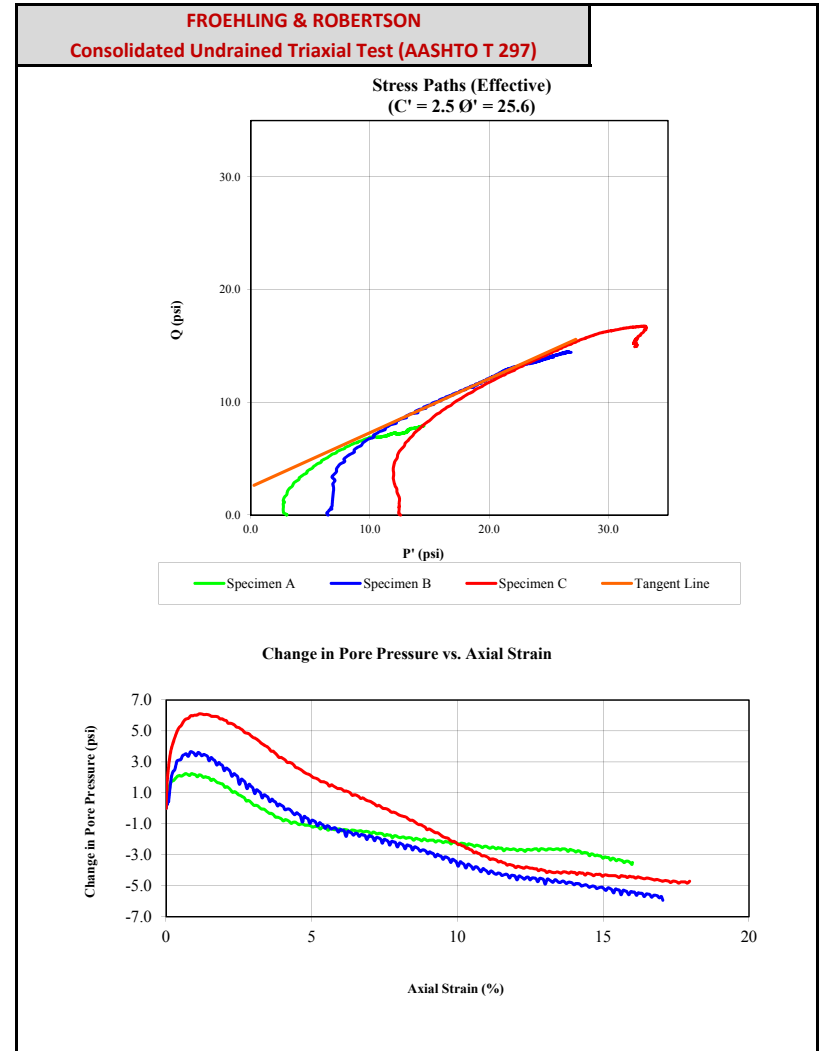
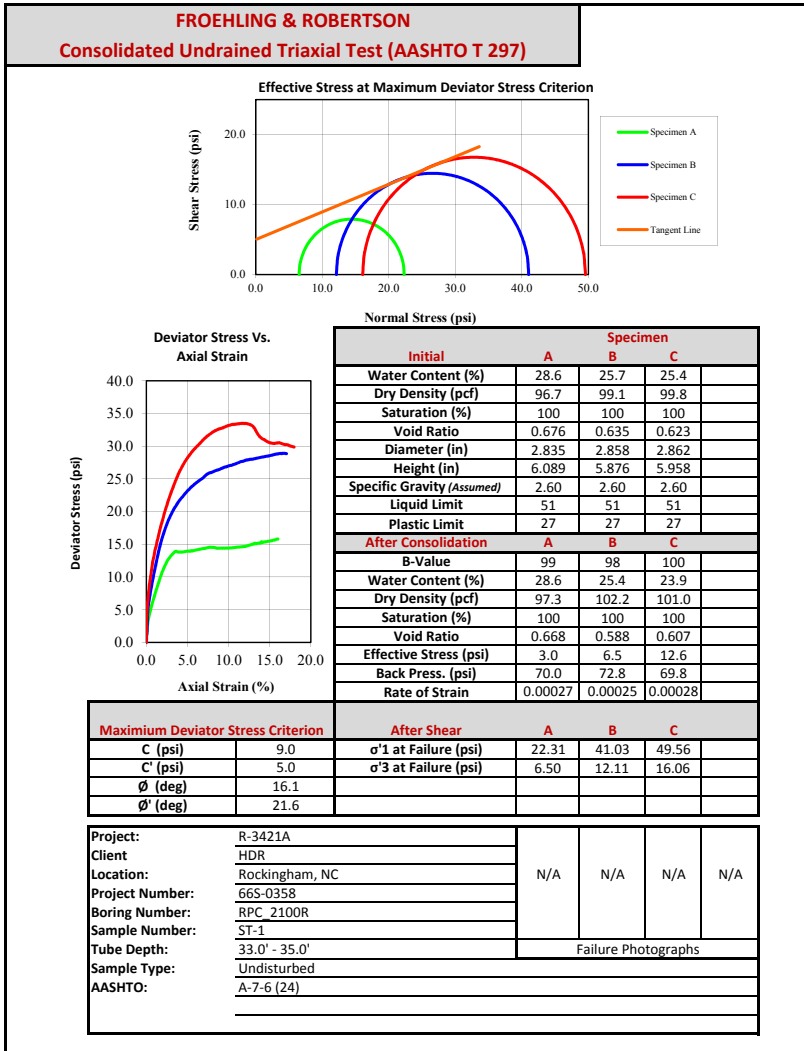
TEST RESULTS

PROJ. SAMPLE NO.	SS-2	SS-3	SS-5	SS-8	SS-11	SS-9	SS-10						
BORING NO.	I73_12200L	I73_12200L	I73_12200L	I73_12200L	I73_12200L	I73_12500L_160	I73_12500L_160						
Retained #4 Sieve %	0.0	0.0	0.3	0.0	0.0	0.0	0.0						
Passing #10 Sieve %	100.0	99.5	97.7	100.0	99.6	100.0	100.0						
Passing #40 Sieve %	91.8	68.2	44.5	98.8	87.4	98.0	96.0						
Passing #200 Sieve %	67.4	33.4	27.8	86.6	41.0	79.1	49.2						

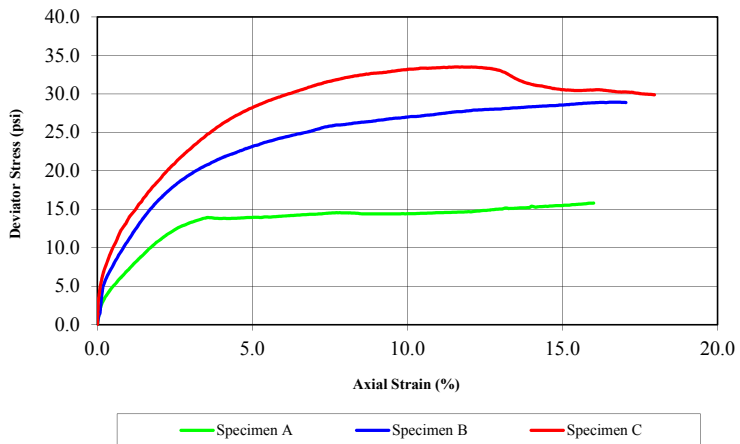
SOIL MORTAR - 100%													
Coarse Sand Ret - #60 %	13.7	56.8	66.4	4.1	26.3	7.0	16.4						
Fine Sand Ret - #270 %	22.8	10.6	5.9	12.8	40.7	17.1	42.3						
Silt 0.053 - 0.010 mm %	4.1	0.4	0.0	16.3	25.3	20.8	29.3						
Clay < 0.010 mm %	59.4	32.2	27.7	66.8	7.7	55.1	12.0						
L.L.	69	50	69	98	42	79	62						
P.L.	33	24	30	61	NP	41	43						
P.I.	36	26	39	37	NP	38	19						
AASHTO Classification	A-7-5 (22)	A-2-7 (3)	A-2-7 (1)	A-7-5 (44)	A-5 (0)	A-7-5 (35)	A-7-5 (8)						
Station	-I73- 122+00	-I73- 122+00	-I73- 122+00	-I73- 122+00	-I73- 122+00	-I73- 125+00	-I73- 125+00						
Offset	150' Lt	150' Lt	150' Lt	150' Lt	150' Lt	160' Lt	160' Lt						
Depth (ft)	3.5	8.5	18.5	33.5	48.5	38.5	43.5						
to	5.0	10.0	20.0	35.0	50.0	40.0	45.0						
Moisture Content (%)	22.4	13.0	15.3	51.5	34.6	43.2	30.5						
Organic Content (%)	NT	NT	NT	NT	NT	NT	NT						

NP=Not plastic
NT=Not tested
ND = Not Determined
CL = Centerline

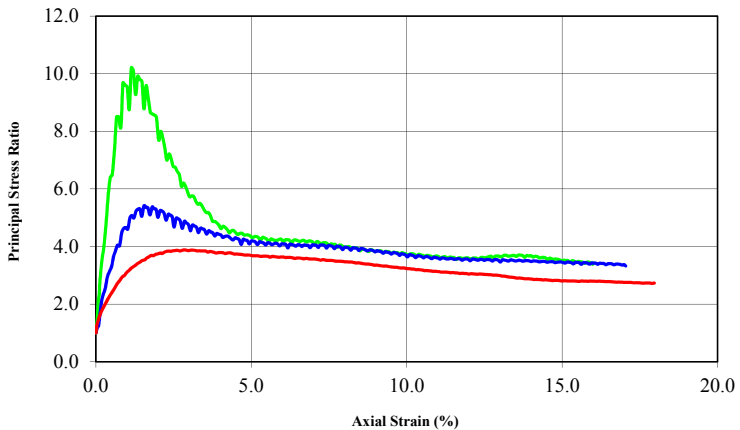
W.P. Alton, PE
Soils Engineer



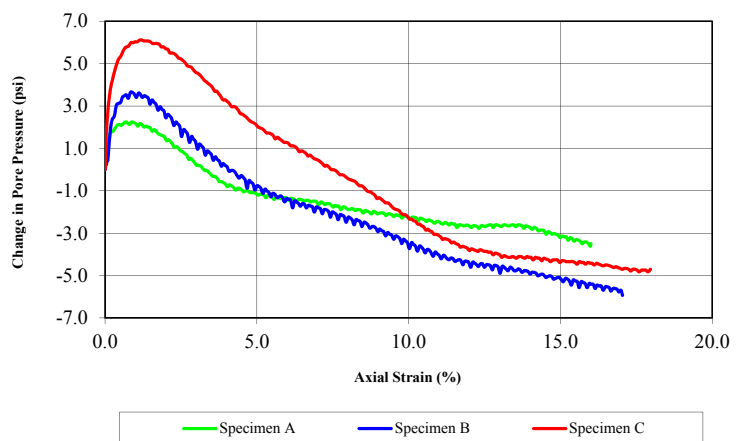
Deviator Stress vs. Axial Strain



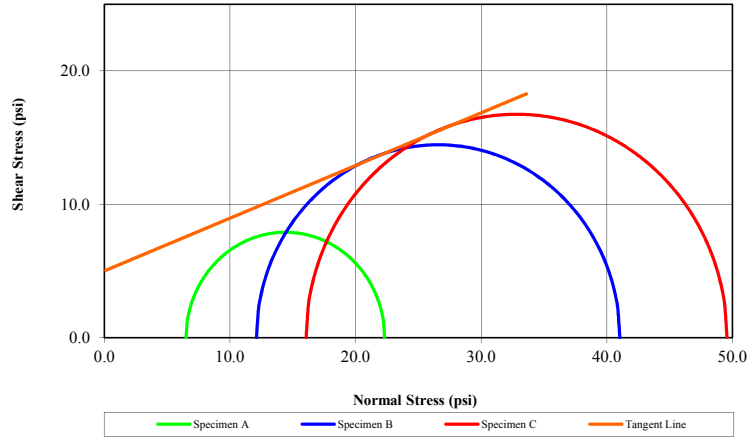
Principal Stress Ratio vs. Axial Strain



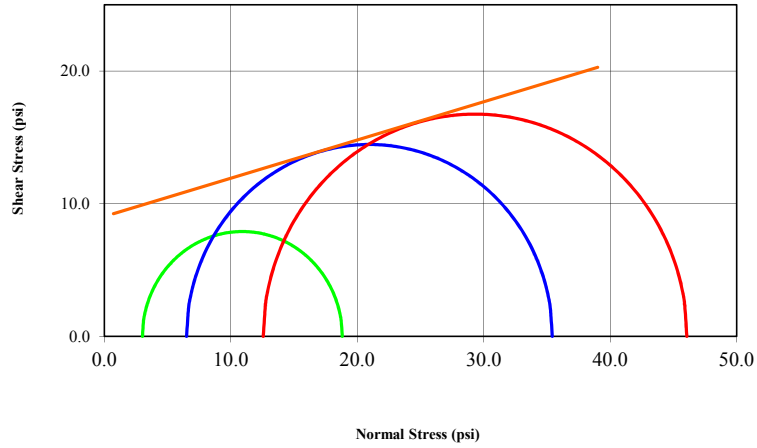
Change in Pore Pressure vs. Axial Strain



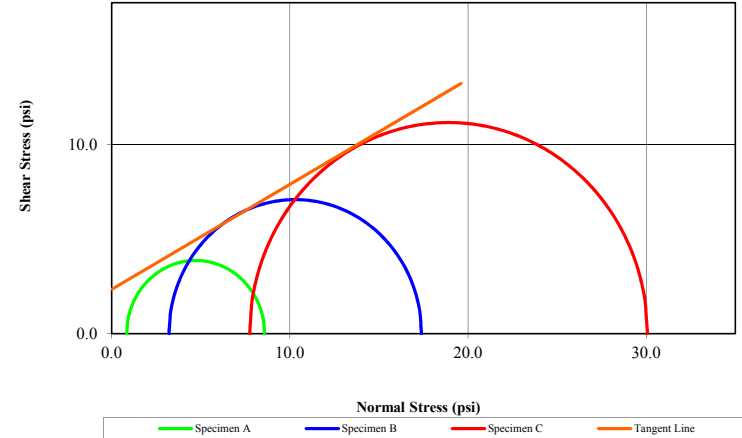
Mohr Stress Circles at Maximum Deviator Stress Criterion
Effective Stress
($C' = 5.0$ $\phi' = 21.6$)



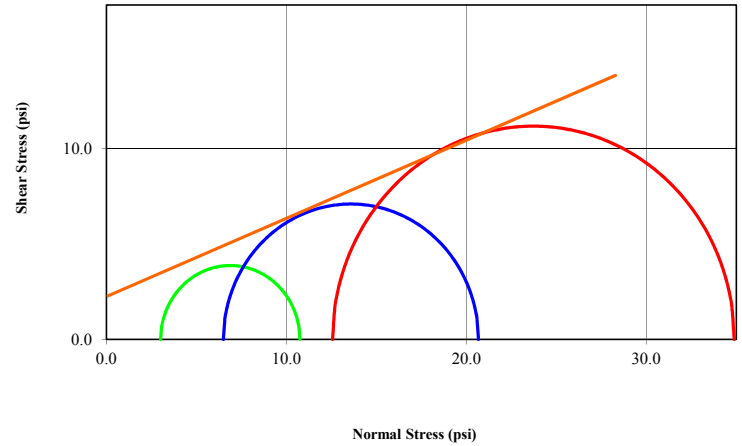
Total Stress
($C = 9.0$ $\phi = 16.1$)



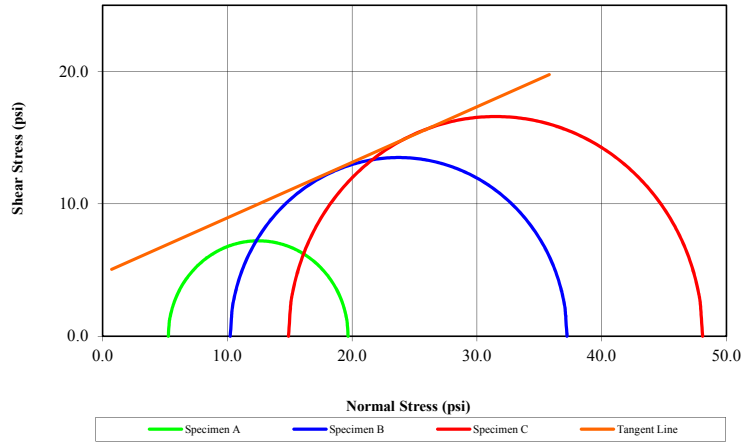
Mohr Stress Circles at Maximum Principal Stress Ratio Criterion
Effective Stress
($C' = 2.3$ $\phi' = 29.0$)



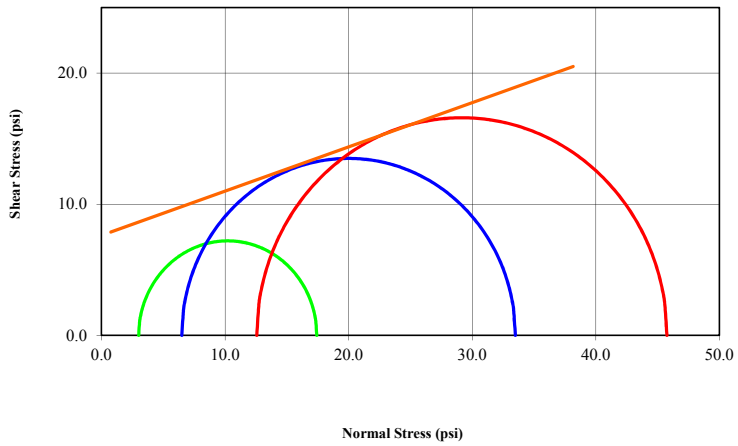
Total Stress
($C = 2.2$ $\phi = 22.2$)



Mohr Stress Circles at 10% Axial Strain Criterion
Effective Stress
($C' = 4.7$ $\phi' = 22.8$)



Total Stress
($C = 7.6$ $\phi = 18.7$)



LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

PROJECT NO.: 34542.1.1

TIP NO.: R-3421A

COUNTY: Richmond

DESCRIPTION: US 220 Bypass from US 74 Bypass West of Rockingham at SR 1109 Interchange to 0.3 miles South of SR 1140

Sample #	Boring #	Alignment	Station	Offset	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (in)	Diameter (in)	Unit Weight (pcf)	Unconfined Compressive Strength (psi)	RMR
RS-7	FLY_1825	-FLY-	18+25	0'	39.0' to 39.5'	Gabbro	Pgb	100%	4.02	1.77	191.7	15,964	74
RS-8	FLY_1825	-FLY-	18+25	0'	46.7' to 47.2'	Gabbro	Pgb	94%	4.02	1.77	178.3	13,970	74
RS-3	RPC_2100R	-RPC-	21+00	240' RT	67.0' to 67.5'	Gabbro	Pgb	98%	4.02	1.77	182.8	7,930	74
RS-4	RPC_2100R	-RPC-	21+00	240' RT	87.5' to 88.0'	Gabbro	Pgb	100%	4.05	1.77	189.2	12,539	74
RS-5	RPC_2750R	-RPC-	27+50	40' RT	59.0' to 59.5'	Gabbro	Pgb	44%	4.03	1.77	181.2	10,371	67
RS-6	RPD_720R	-RPD-	7+20	40' RT	42.0' to 42.5'	Gabbro	Pgb	100%	3.97	1.77	186.5	13,040	74
RS-1	LPC_875L	-LPC-	8+75	20' LT	18.0' to 18.5'	Gabbro	Pgb	97%	4.11	1.77	191.4	18,902	84
RS-2	LPC_875L	-LPC-	8+75	20' LT	35.2' to 35.7'	Gabbro	Pgb	98%	4.11	1.77	188.5	15,792	84



Unconfined Compression Test Test Data Sheet

Project: R-3421A Richmond County
TIP No. :



Boring No.: LPC_875L
Sample ID: RS-1
Depth, ft.: 18.0 - 18.5

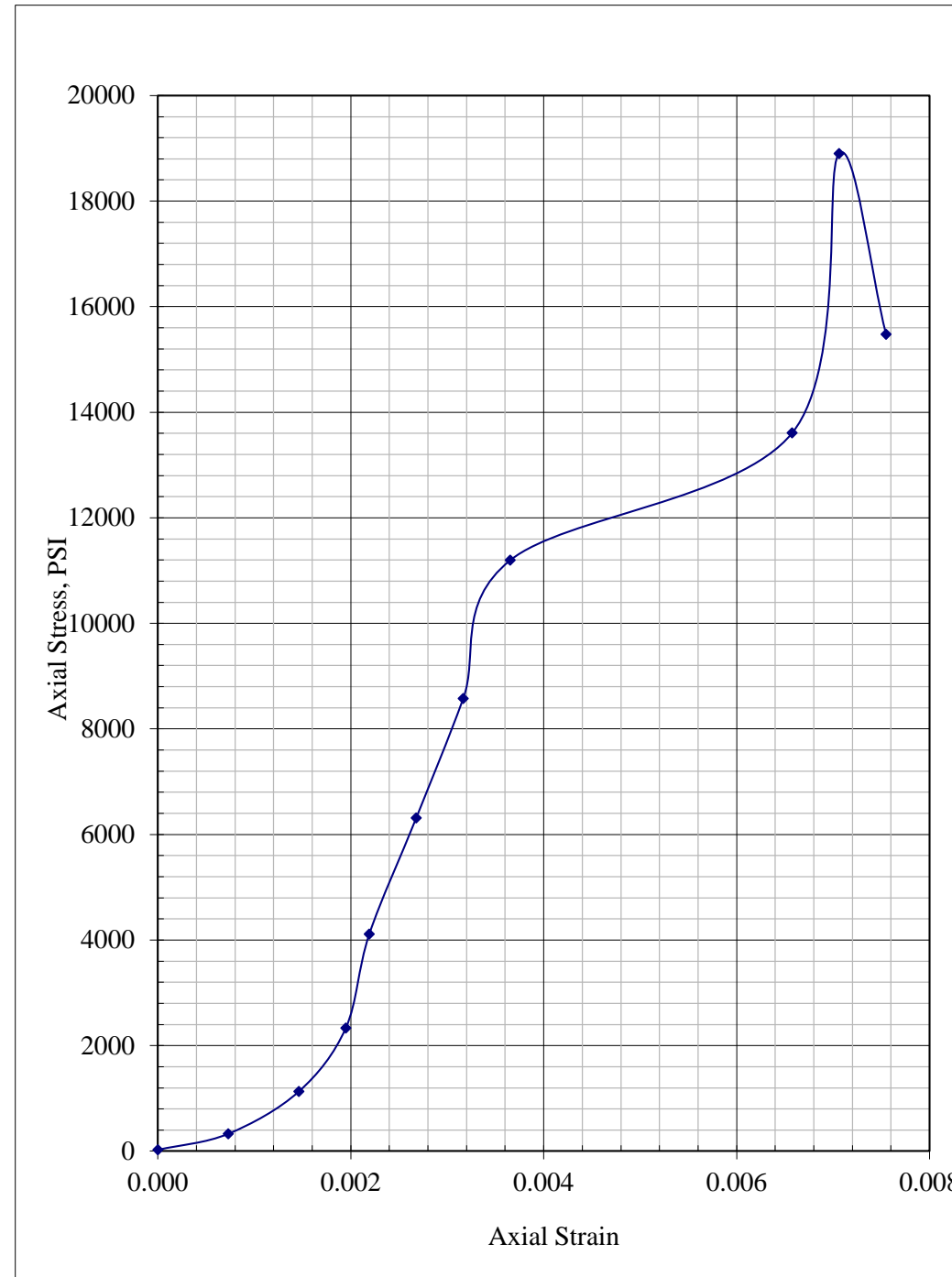
Specimen Description:

Specimen Conditions	
Diameter (in.)	1.77
Height (in.)	4.11
Area (in ²)	2.46
Unit Wt. (pcf)	191.4

Testing Conditions	
Loading Rate (%/min):	0.02 in/min.

Youngs Modulus (average, ksf):

Reading No.	Dial Guage Reading (in.)	Axial Load (lbs)*	Total Axial Deformation (in.)	Axial Strain	Corrected Area ¹ (in ²)	Axial Stress (psi)	Axial Stress (Kpa)
1	0.000	60	0.000	0.0000	2.46	24.37	168.06
2	0.003	810	0.003	0.0007	2.46	329.06	2268.77
3	0.006	2780	0.006	0.0015	2.46	1129.35	7786.57
4	0.008	5740	0.008	0.0019	2.46	2331.81	16077.24
5	0.009	10120	0.009	0.0022	2.46	4111.12	28345.16
6	0.011	15542	0.011	0.0027	2.46	6313.70	43531.46
7	0.013	21110	0.013	0.0032	2.46	8575.58	59126.54
8	0.015	27560	0.015	0.0037	2.46	11195.72	77191.83
9	0.027	33495	0.027	0.0066	2.46	13606.31	93812.22
10	0.029	46532	0.029	0.0071	2.46	18902.09	130325.39
11	0.031	38097	0.031	0.0075	2.46	15475.58	106700.38



Notes: 1. Right Cylinder Correction Method 2. *Specimen failed violently resulting in complete destruction of sample



Unconfined Compression Test

Test Data Sheet

Project: R-3421A Richmond County
 TIP No. :



Boring No.: LPC_875L
 Sample ID: RS-2
 Depth, ft.: 35.2 - 35.7

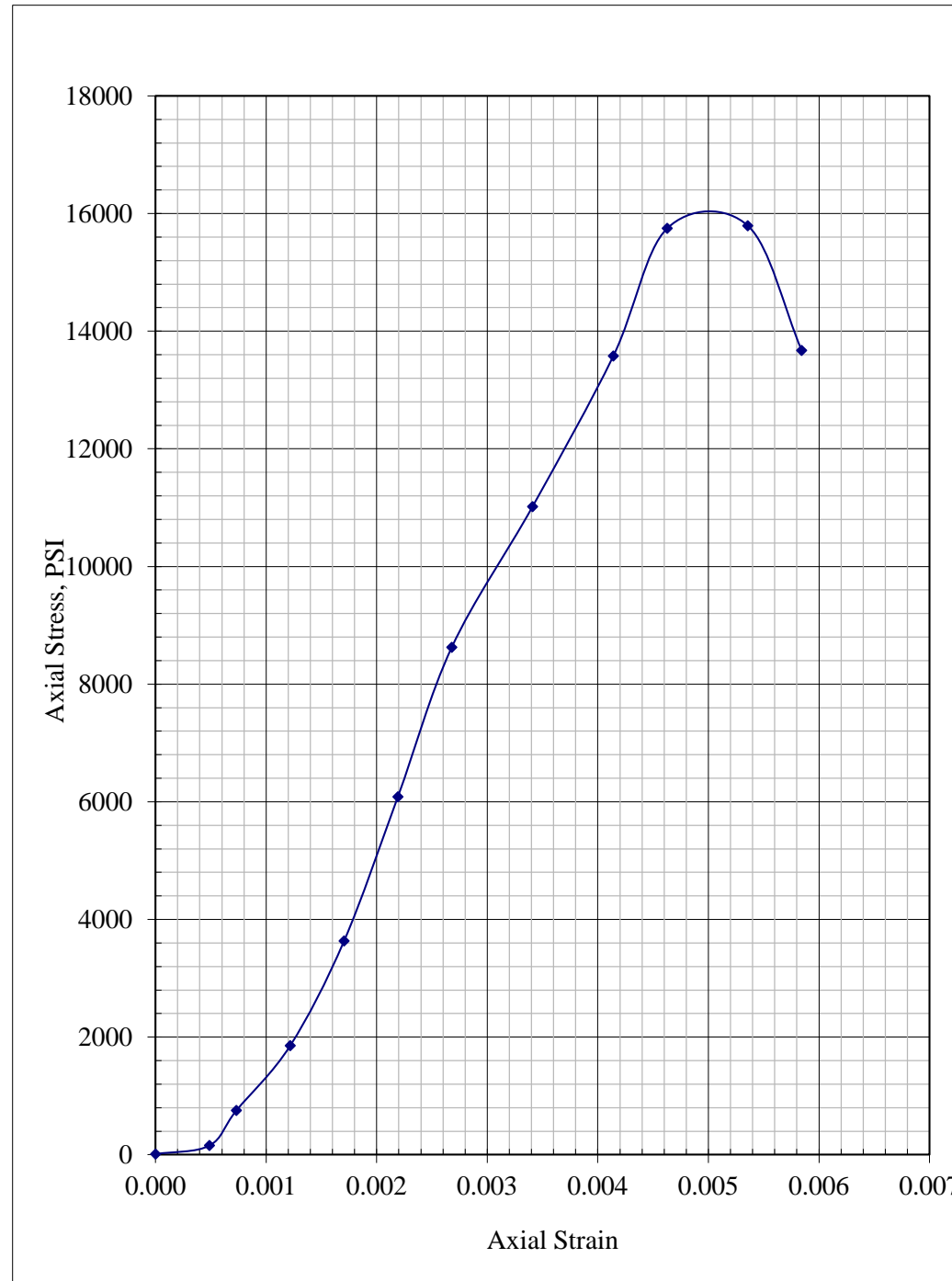
Specimen Description:

Specimen Conditions	
Diameter (in.)	1.77
Height (in.)	4.11
Area (in ²)	2.46
Unit Wt. (pcf)	188.5

Testing Conditions	
Loading Rate (%/min):	0.02 in/min.

Youngs Modulus (average, ksf):

Reading No.	Dial Guage Reading (in.)	Axial Load (lbs)*	Total Axial Deformation (in.)	Axial Strain	Corrected Area ¹ (in ²)	Axial Stress (psi)	Axial Stress (Kpa)
1	0.000	28	0.000	0.0000	2.46	11.37	78.43
2	0.002	384	0.002	0.0005	2.46	156.00	1075.57
3	0.003	1850	0.003	0.0007	2.46	751.55	5181.75
4	0.005	4562	0.005	0.0012	2.46	1853.27	12777.86
5	0.007	8940	0.007	0.0017	2.46	3631.77	25040.22
6	0.009	14980	0.009	0.0022	2.46	6085.43	41957.56
7	0.011	21232	0.011	0.0027	2.46	8625.18	59468.54
8	0.014	27120	0.014	0.0034	2.46	11017.01	75959.63
9	0.017	33420	0.017	0.0041	2.46	13576.17	93604.44
10	0.019	38762	0.019	0.0046	2.46	15746.17	108566.05
11	0.022	38874	0.022	0.0054	2.46	15791.55	108878.95
12	0.024	33652	0.024	0.0058	2.46	13670.18	94252.63



Notes: 1. Right Cylinder Correction Method 2. *Specimen failed violently resulting in complete destruction of sample



Unconfined Compression Test

Test Data Sheet

Project: R-3421A Richmond County
TIP No. :



Boring No.: RPC_2100R
Sample ID: RS-3
Depth, ft.: 67.0 - 67.5

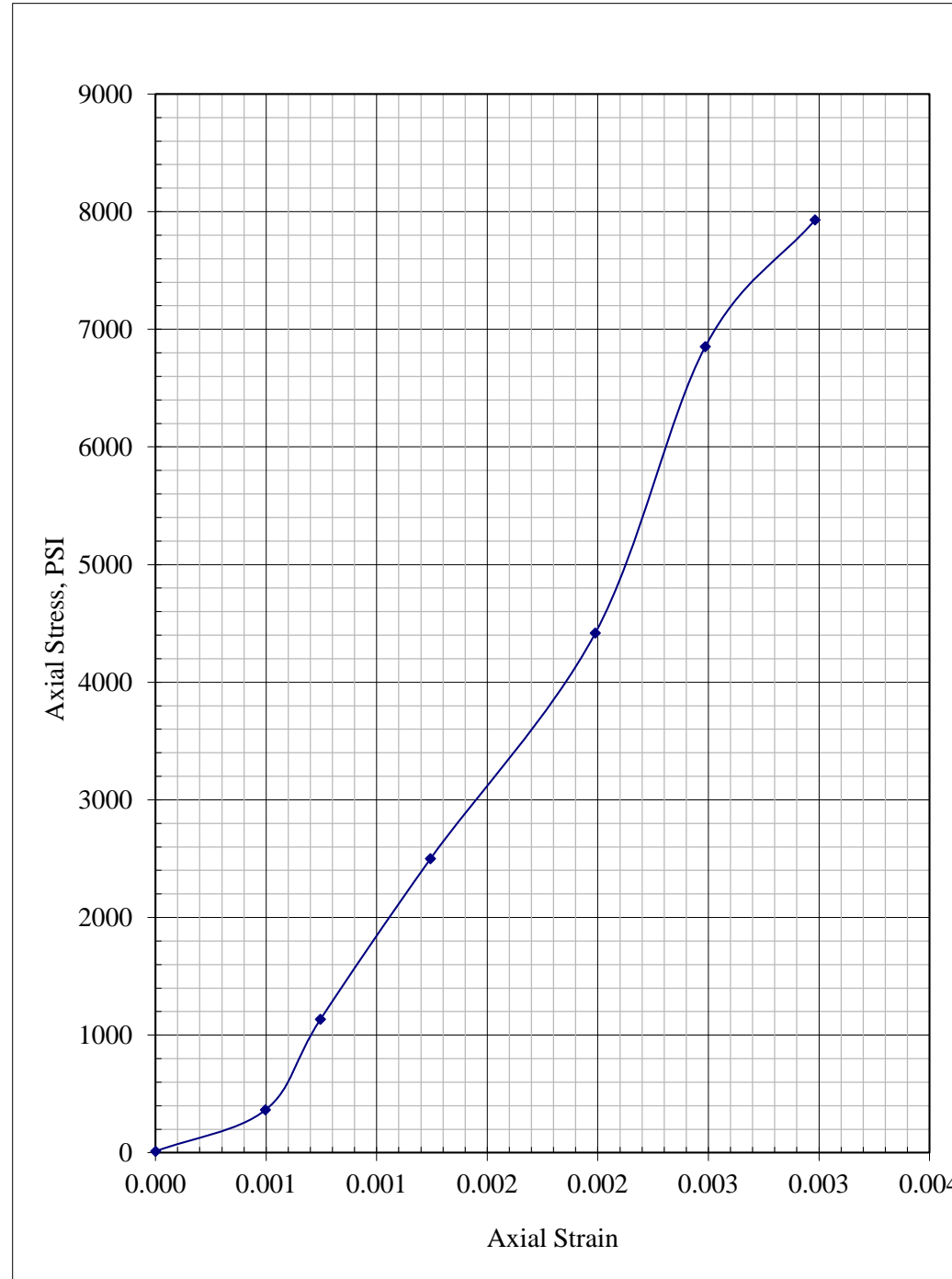
Specimen Description:

Specimen Conditions	
Diameter (in.)	1.77
Height (in.)	4.02
Area (in ²)	2.46
Unit Wt. (pcf)	182.8

Testing Conditions	
Loading Rate (%/min):	0.02 in/min.

Youngs Modulus (average, ksf):

Reading No.	Dial Guage Reading (in.)	Axial Load (lbs)*	Total Axial Deformation (in.)	Axial Strain	Corrected Area ¹ (in ²)	Axial Stress (psi)	Axial Stress (Kpa)
1	0.000	30	0.000	0.0000	2.46	12.19	84.03
2	0.002	897	0.002	0.0005	2.46	364.40	2512.45
3	0.003	2792	0.003	0.0007	2.46	1134.23	7820.24
4	0.005	6150	0.005	0.0012	2.46	2498.38	17225.73
5	0.008	10872	0.008	0.0020	2.46	4416.62	30451.51
6	0.010	16866	0.010	0.0025	2.46	6851.57	47239.93
7	0.012	19520	0.012	0.0030	2.46	7929.68	54673.24



Notes: 1. Right Cylinder Correction Method 2. *Specimen failed violently resulting in complete destruction of sample



Unconfined Compression Test

Test Data Sheet

Project: R-3421A Richmond County
 TIP No. :



Boring No.: RPC_2100R
 Sample ID: RS-4
 Depth, ft.: 87.5' - 88.0'

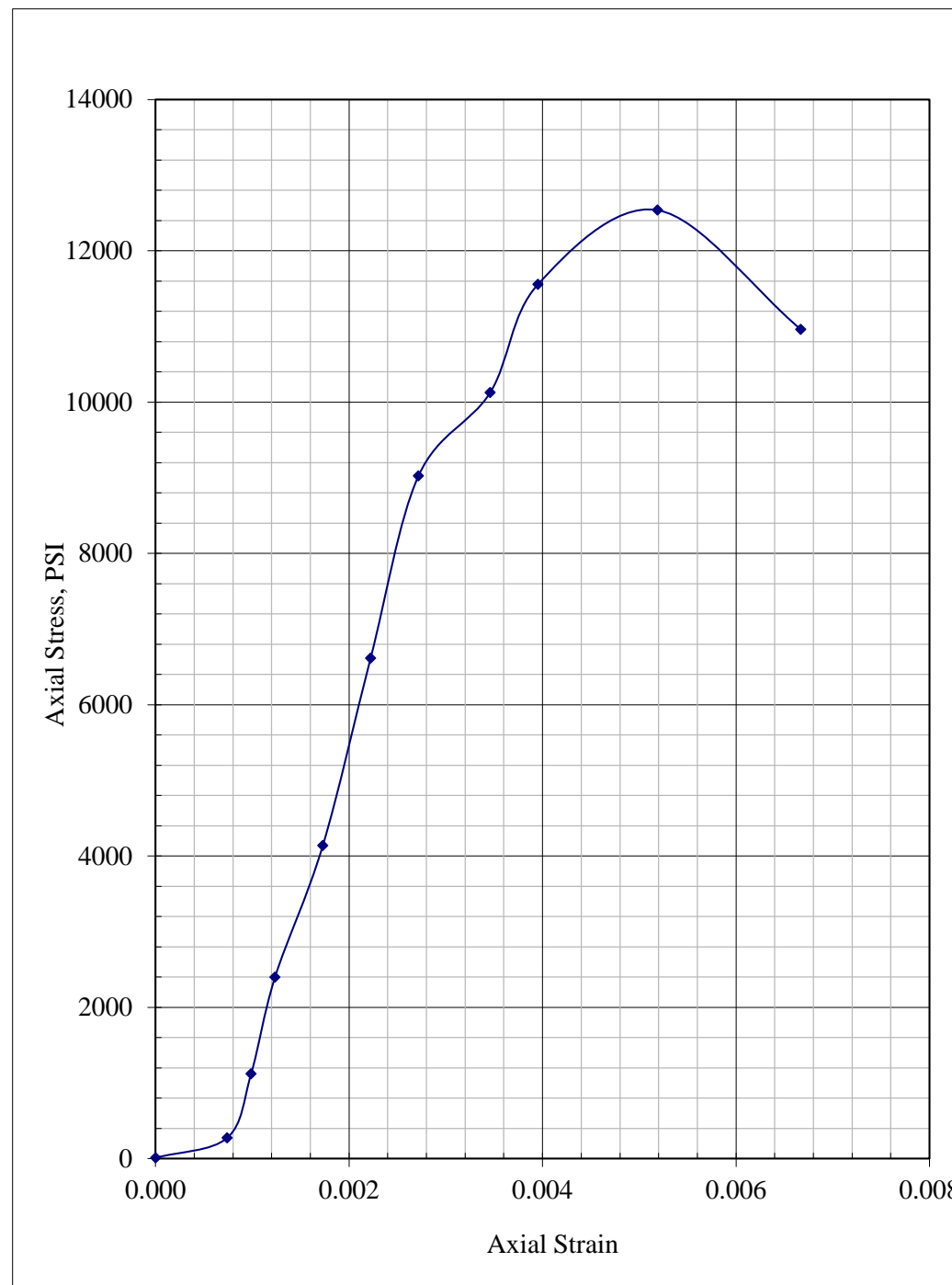
Specimen Conditions	
Diameter (in.)	1.77
Height (in.)	4.05
Area (in ²)	2.45
Unit Wt. (pcf)	189.2

Testing Conditions	
Loading Rate (%/min):	0.02 in/min.

Youngs Modulus (average, ksf):

Reading No.	Dial Guage Reading (in.)	Axial Load (lbs)*	Total Axial Deformation (in.)	Axial Strain	Corrected Area ¹ (in ²)	Axial Stress (psi)	Axial Stress (Kpa)
1	0.000	28	0.000	0.0000	2.45	11.41	78.69
2	0.003	679	0.003	0.0007	2.45	276.78	1908.31
3	0.004	2756	0.004	0.0010	2.45	1123.41	7745.62
4	0.005	5889	0.005	0.0012	2.45	2400.48	16550.75
5	0.007	10156	0.007	0.0017	2.45	4139.78	28542.80
6	0.009	16235	0.009	0.0022	2.45	6617.67	45627.22
7	0.011	22139	0.011	0.0027	2.45	9024.19	62219.66
8	0.014	24842	0.014	0.0035	2.45	10125.90	69815.68
9	0.016	28352	0.016	0.0040	2.45	11556.57	79679.75
10	0.021	30762	0.021	0.0052	2.45	12538.75	86451.68
11	0.027	26895	0.027	0.0067	2.45	10962.38	75582.98

Specimen Description:



Notes: 1. Right Cylinder Correction Method 2. *Specimen failed violently resulting in complete destruction of sample



Unconfined Compression Test Test Data Sheet

Project: R-3421A Richmond County
TIP No. :



Boring No.: RPC_2750R
Sample ID: RS-5
Depth, ft.: 59.0' - 59.5'

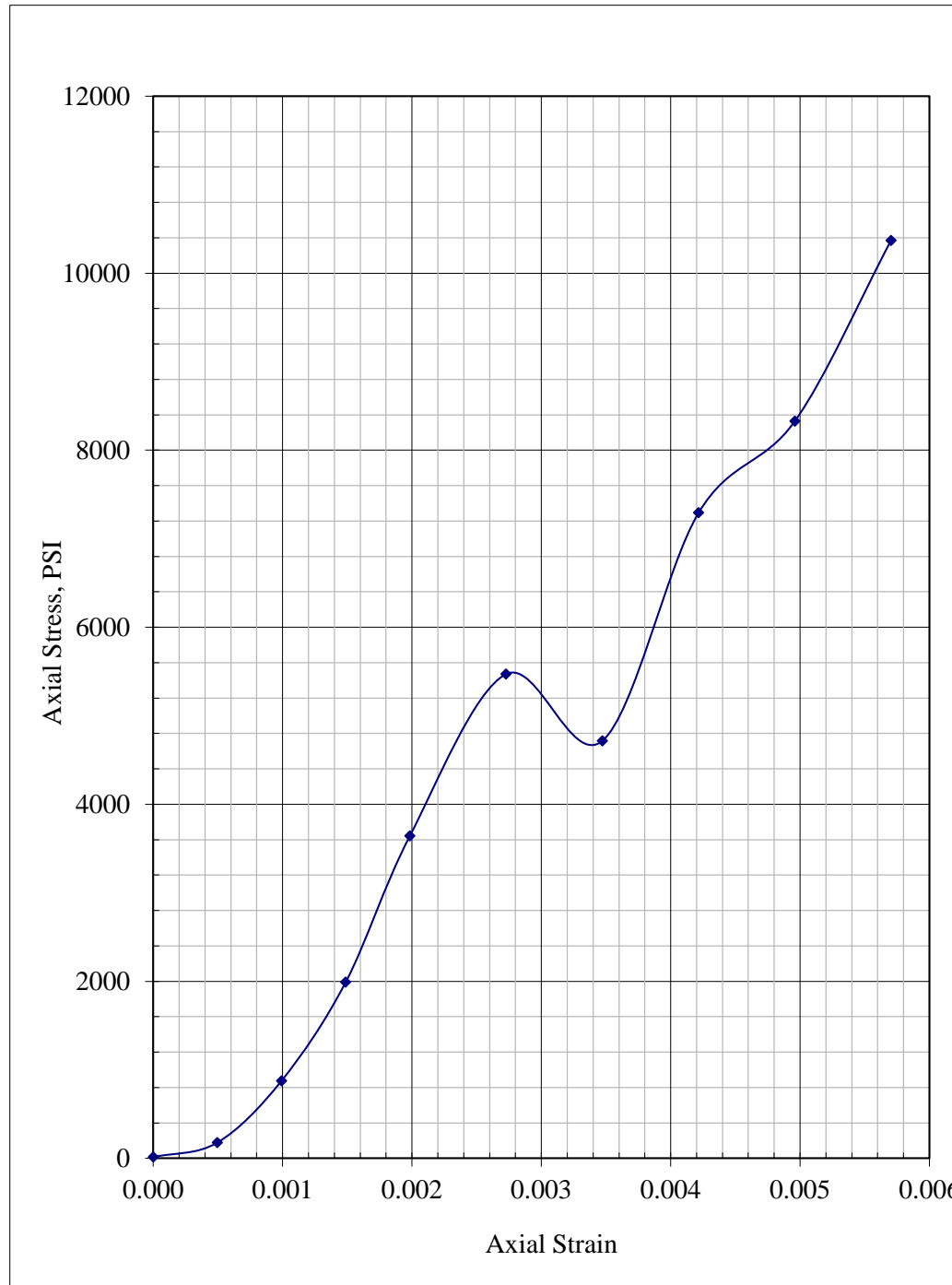
Specimen Conditions	
Diameter (in.)	1.77
Height (in.)	4.03
Area (in ²)	2.45
Unit Wt. (pcf)	181.2

Testing Conditions	
Loading Rate (%/min):	0.02 in/min.

Youngs Modulus (average, ksf):

Specimen Description:

Reading No.	Dial Guage Reading (in.)	Axial Load (lbs)*	Total Axial Deformation (in.)	Axial Strain	Corrected Area ¹ (in ²)	Axial Stress (psi)	Axial Stress (Kpa)
1	0.000	35	0.000	0.0000	2.45	14.27	98.37
2	0.002	438	0.002	0.0005	2.45	178.54	1230.99
3	0.004	2150	0.004	0.0010	2.45	876.39	6042.48
4	0.006	4883	0.006	0.0015	2.45	1990.41	13723.40
5	0.008	8936	0.008	0.0020	2.45	3642.48	25114.00
6	0.011	13422	0.011	0.0027	2.45	5471.01	37721.31
7	0.014	11572	0.014	0.0035	2.45	4716.89	32521.81
8	0.017	17893	0.017	0.0042	2.45	7293.35	50285.90
9	0.020	20432	0.020	0.0050	2.45	8328.21	57421.00
10	0.023	25443	0.023	0.0057	2.45	10370.65	71503.11



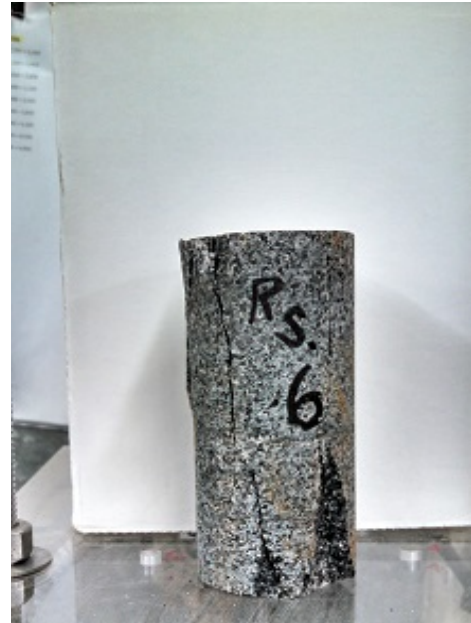
Notes: 1. Right Cylinder Correction Method 2. *Specimen failed violently resulting in complete destruction of sample



Unconfined Compression Test

Test Data Sheet

Project: R-3421A Richmond County
 TIP No. :



Boring No.: RPD_720R
 Sample ID: RS-6
 Depth, ft.: 42.0 - 45.0

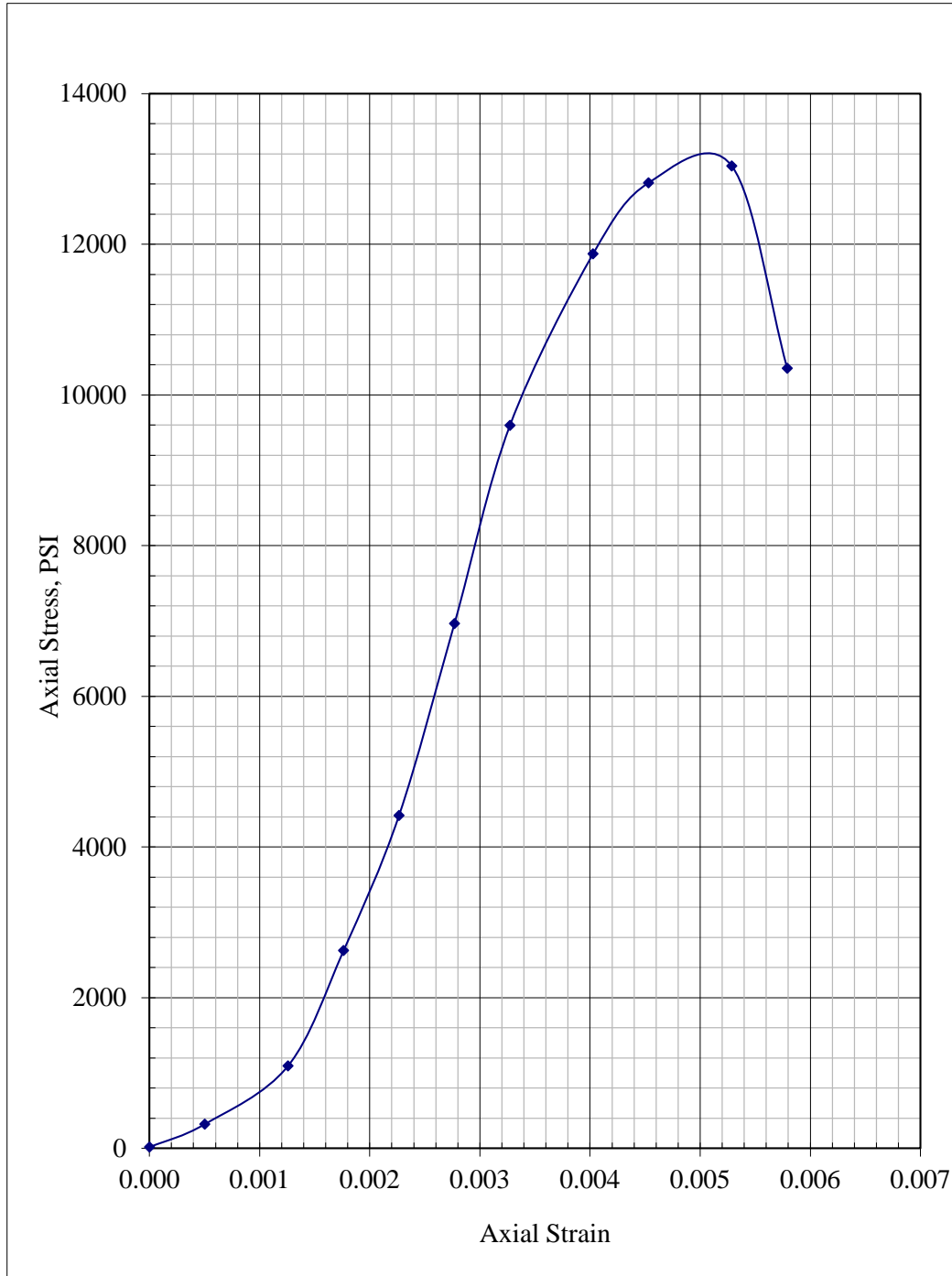
Specimen Description:

Specimen Conditions	
Diameter (in.)	1.77
Height (in.)	3.97
Area (in ²)	2.45
Unit Wt. (pcf)	186.5

Testing Conditions	
Loading Rate (%/min):	0.02 in/min.

Youngs Modulus (average, ksf):

Reading No.	Dial Guage Reading (in.)	Axial Load (lbs)*	Total Axial Deformation (in.)	Axial Strain	Corrected Area ¹ (in ²)	Axial Stress (psi)	Axial Stress (Kpa)
1	0.000	40	0.000	0.0000	2.45	16.31	112.42
2	0.002	792	0.002	0.0005	2.45	322.84	2225.89
3	0.005	2689	0.005	0.0013	2.45	1096.09	7557.30
4	0.007	6440	0.007	0.0018	2.45	2625.07	18099.21
5	0.009	10840	0.009	0.0023	2.45	4418.57	30464.98
6	0.011	17092	0.011	0.0028	2.45	6966.96	48035.49
7	0.013	23541	0.013	0.0033	2.45	9595.62	66159.48
8	0.016	29132	0.016	0.0040	2.45	11874.49	81871.78
9	0.018	31442	0.018	0.0045	2.45	12816.01	88363.29
10	0.021	31992	0.021	0.0053	2.45	13040.09	89908.31
11	0.023	25400	0.023	0.0058	2.45	10353.11	71382.21



Notes: 1. Right Cylinder Correction Method 2. *Specimen failed violently resulting in complete destruction of sample



Unconfined Compression Test Test Data Sheet

Project: R-3421A Richmond County
TIP No. :



Boring No.: FLY_1825
Sample ID: RS-7
Depth, ft.: 39.0' - 39.5'

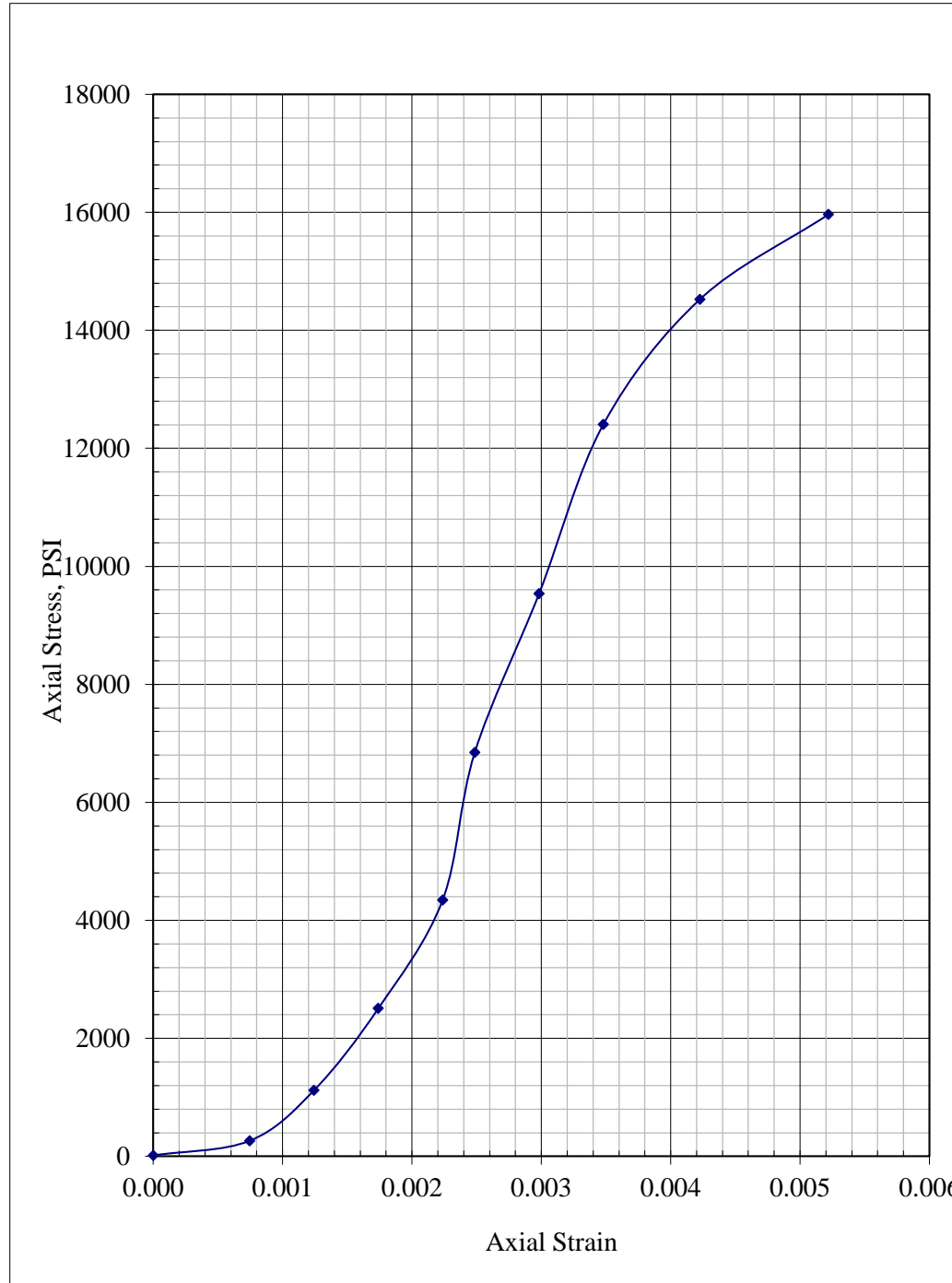
Specimen Conditions	
Diameter (in.)	1.77
Height (in.)	4.02
Area (in ²)	2.46
Unit Wt. (pcf)	191.7

Testing Conditions	
Loading Rate (%/min):	0.02 in/min.

Youngs Modulus (average, ksf):

Specimen Description:

Reading No.	Dial Guage Reading (in.)	Axial Load (lbs)*	Total Axial Deformation (in.)	Axial Strain	Corrected Area ¹ (in ²)	Axial Stress (psi)	Axial Stress (Kpa)
1	0.000	40	0.000	0.0000	2.46	16.29	112.29
2	0.003	650	0.003	0.0007	2.46	264.66	1824.74
3	0.005	2750	0.005	0.0012	2.46	1119.69	7720.00
4	0.007	6158	0.007	0.0017	2.46	2507.28	17287.10
5	0.009	10668	0.009	0.0022	2.46	4343.54	29947.69
6	0.010	16814	0.010	0.0025	2.46	6845.91	47200.89
7	0.012	23422	0.012	0.0030	2.46	9536.34	65750.79
8	0.014	30472	0.014	0.0035	2.46	12406.71	85541.30
9	0.017	35673	0.017	0.0042	2.46	14524.20	100140.85
10	0.021	39210	0.021	0.0052	2.46	15964.12	110068.78



Notes: 1. Right Cylinder Correction Method 2. *Specimen failed violently resulting in complete destruction of sample



Unconfined Compression Test

Test Data Sheet

Project: R-3421A Richmond County
 TIP No. :



Boring No.: FLY_1825
 Sample ID: RS-8
 Depth, ft.: 46.7' - 47.2'

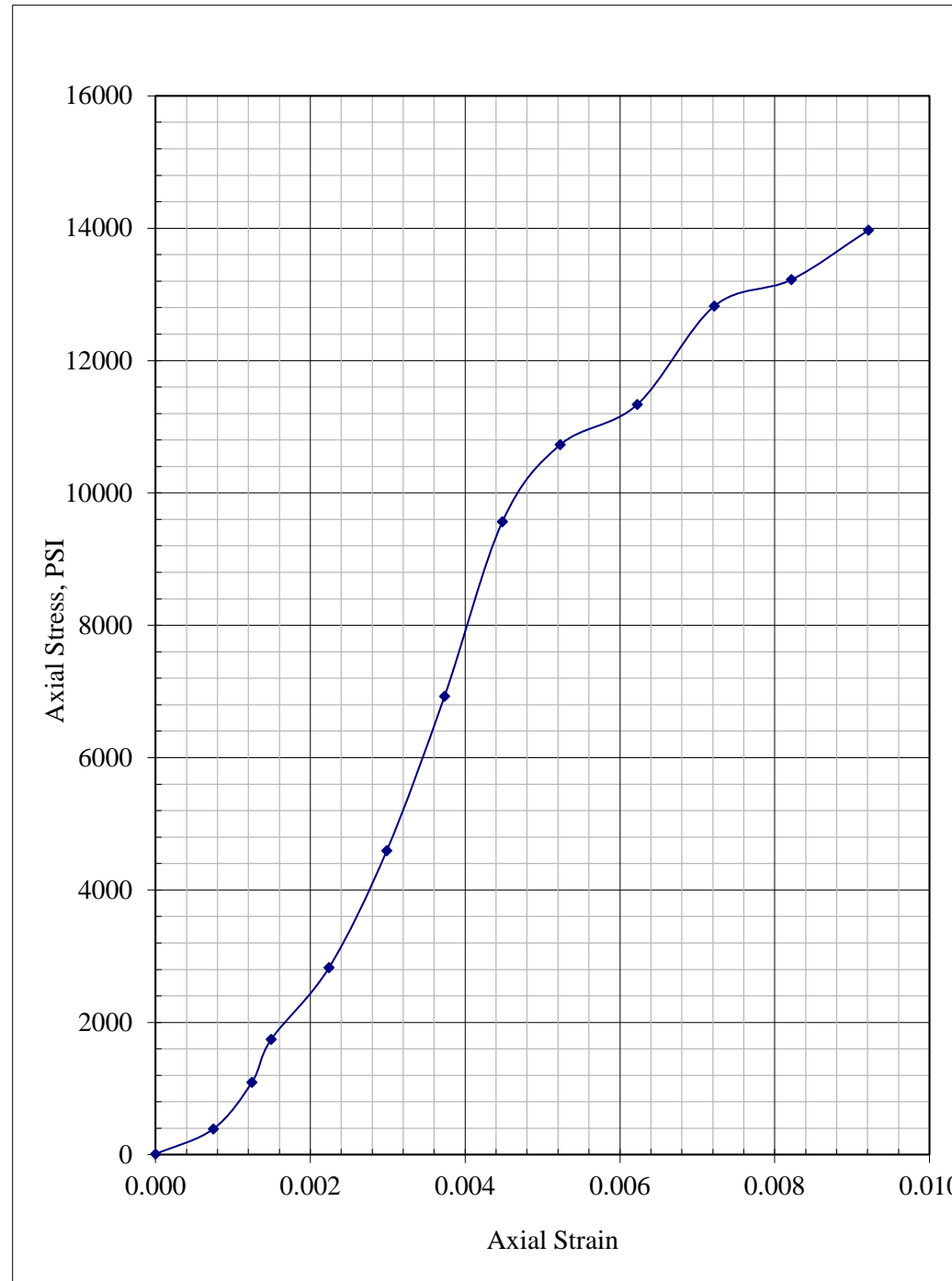
Specimen Description:

Specimen Conditions	
Diameter (in.)	1.77
Height (in.)	4.02
Area (in ²)	2.46
Unit Wt. (pcf)	178.3

Testing Conditions	
Loading Rate (%/min):	0.02 in/min.

Youngs Modulus (average, ksf):

Reading No.	Dial Guage Reading (in.)	Axial Load (lbs)*	Total Axial Deformation (in.)	Axial Strain	Corrected Area ¹ (in ²)	Axial Stress (psi)	Axial Stress (Kpa)
1	0.000	25	0.000	0.0000	2.46	10.18	70.18
2	0.003	958	0.003	0.0007	2.46	390.06	2689.38
3	0.005	2686	0.005	0.0012	2.46	1093.63	7540.33
4	0.006	4279	0.006	0.0015	2.46	1742.23	12012.29
5	0.009	6940	0.009	0.0022	2.46	2825.66	19482.28
6	0.012	11284	0.012	0.0030	2.46	4594.32	31676.71
7	0.015	17016	0.015	0.0037	2.46	6928.07	47767.36
8	0.018	23492	0.018	0.0045	2.46	9564.70	65946.31
9	0.021	26348	0.021	0.0052	2.46	10727.43	73963.07
10	0.025	27842	0.025	0.0062	2.46	11335.59	78156.19
11	0.029	31496	0.029	0.0072	2.46	12823.15	88412.57
12	0.033	32476	0.033	0.0082	2.46	13222.02	91162.63
13	0.037	34313	0.037	0.0092	2.46	13969.78	96318.27



Notes: 1. Right Cylinder Correction Method 2. *Specimen failed violently resulting in complete destruction of sample



Test Boring ID: I73_12500L_160

Date: 3/10/15
DMT Operator: M. DuBois
Rig Operator: D. Tigor
Rig Type: CME 55
GWT Depth: 34.0

ΔA avg.: 0.00
ΔB avg.: 0.60
Pre Drill Depth: 3.0

Notes: The boring was pre-augered to a depth of 3 feet. Testing was performed from a depth of 4 to 6 feet below existing grades. At a depth of 6.5-feet F&R encountered refusal of the DMT blade. F&R augered to a depth of 18 feet and resumed DMT sounding at 19-feet. The sounding continued to a termination depth of 35-feet.

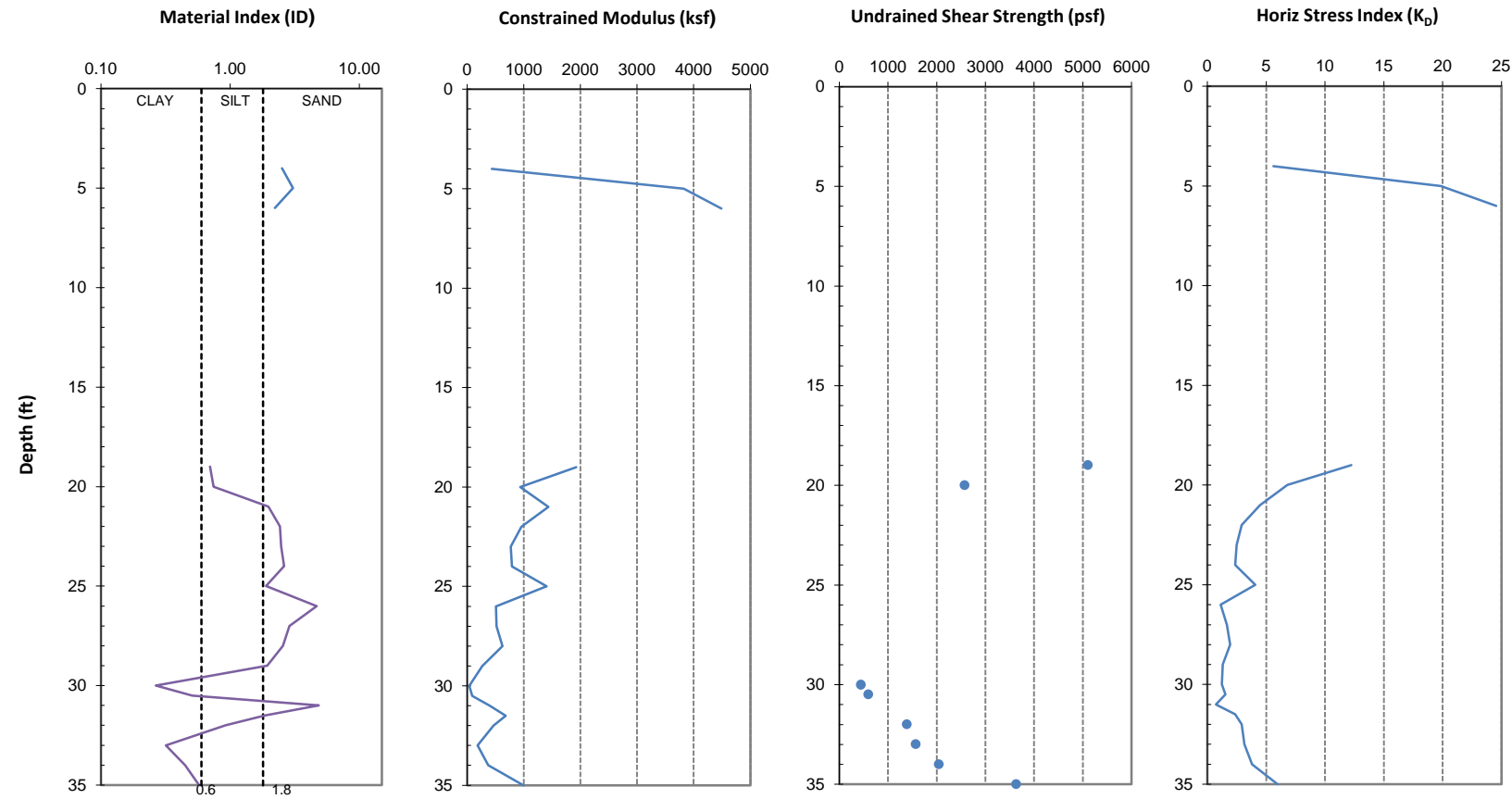
Depth (ft)	A (bars)	B (bars)	C (bars)	P ₀ bars	P ₁ bars	P ₂ bars	E _d (bars)	E _d (ksf)	I _D Material Index	γ (pcf)	u _o Pore Pressure (psf)	σ' _v (psf)	K _D Horizontal Stress Index	K _O In-Situ Earth Pressure Coeff.	R _M	R _{MO}	M Vertical Drained Constrained Modulus (bar)	M Vertical Drained Constrained Modulus (ksf)	OCR	c _u (psf)	φ	Description	Soil Type	E _s (psf)	E _s (ksf)
4	1.35	4.85		1.21	4.25		105.7	221	2.53	112.3	0.0	449.3	5.6		1.98	0.43	209.7	437			38	Low Rigidity	SILTY SAND	349556	350
5	6.25	22.80		5.45	22.20		581.1	1214	3.07	124.8	0.0	574.1	19.8		3.15	0.51	1835.3	3824			43	Rigid	SILTY SAND	3058835	3059
6	9.20	27.40	0.80	8.32	26.80	0.80	641.3	1340	2.22	134.2	0.0	708.2	24.5		3.35	0.38	2154.6	4489			44	Very Rigid	SILTY SAND	3590991	3591
19	14.60	24.60		14.13	24.00		342.5	716	0.70	131.0	0.0	2411.8	12.2	2.08	2.69	0.15	924.5	1926	16.88	5108		Very Dense	CLAYEY SILT	1540844	1541
20	8.55	15.00	1.05	8.26	14.40	1.05	213.1	445	0.74	121.7	0.0	2533.4	6.8	1.44	2.11	0.16	451.0	940	6.76	2578		Dense	CLAYEY SILT	751712	752
21	6.25	17.60		5.71	17.00		391.7	818	1.98	124.8	0.0	2658.2	4.5		1.75	0.35	687.9	1433			37	Rigid	SILTY SAND	1146463	1146
22	4.35	14.00	0.15	3.90	13.40	0.15	329.7	689	2.44	118.6	0.0	2776.8	2.9		1.39	0.42	459.6	957			34	Medium Rigidity	SILTY SAND	765932	766
23	3.85	12.60	0.15	3.44	12.00	0.15	296.9	620	2.49	118.6	0.0	2895.4	2.5		1.24	0.42	370.4	772			33	Medium Rigidity	SILTY SAND	617351	617
24	3.85	13.00	0.15	3.42	12.40	0.15	311.5	651	2.62	118.6	0.0	3013.9	2.4		1.22	0.44	379.7	791			33	Medium Rigidity	SILTY SAND	632759	633
25	6.70	18.40		6.15	17.80		404.4	845	1.90	124.8	0.0	3138.7	4.1		1.66	0.33	673.1	1402			36	Rigid	SILTY SAND	1121760	1122
26	2.15	10.60	0.10	1.76	10.00	0.10	286.0	598	4.69	118.6	0.0	3257.3	1.1		0.60	0.75	243.8	508			29	Medium Rigidity	SAND	406375	406
27	3.05	11.00	0.10	2.68	10.40	0.10	267.8	560	2.88	118.6	0.0	3375.8	1.7		0.93	0.48	248.7	518			31	Medium Rigidity	SILTY SAND	414506	415
28	3.65	12.20	0.10	3.25	11.60	0.10	289.7	605	2.57	118.6	0.0	3494.4	1.9		1.03	0.43	299.7	624			32	Medium Rigidity	SILTY SAND	499434	499
29	2.45	7.20	0.15	2.24	6.60	0.15	151.2	316	1.94	112.3	0.0	3606.7	1.3		0.59	0.34	128.9	269			30	Low Rigidity	SILTY SAND	214835	215
30	2.20	3.35	1.05	2.17	2.75	1.05	20.0	42	0.27	99.8	0.0	3706.6	1.2	0.31	0.35	0.09	17.1	36	0.47	442		Very Soft	CLAY	28472	28
30.5	2.85	4.80	0.95	2.78	4.20	0.95	49.2	103	0.51	106.1	0.0	3759.6	1.5	0.41	0.59	0.13	41.9	87	0.67	600		Soft	SILTY CLAY	69886	70
31	1.65	8.45	0.15	1.34	7.85	0.15	225.9	472	4.86	112.3	0.0	3815.8	0.7		0.23	0.78	192.6	401			26	Low Rigidity	SAND	320959	321
31.5	4.80	13.20	0.20	4.41	12.60	0.20	284.2	594	1.86	118.6	0.0	3875.0	2.4		1.15	0.33	326.5	680			33	Medium Rigidity	SILTY SAND	544137	544
32	5.75	11.20	0.65	5.51	10.60	0.65	176.7	369	0.92	112.3	0.0	3931.2	2.9	0.77	1.27	0.19	224.5	468	1.81	1392		Medium Dense	SILT	374194	374
33	6.20	8.65	4.20	6.11	8.05	4.20	67.4	141	0.32	112.3	0.0	4043.5	3.2	0.82	1.32	0.10	89.4	186	2.04	1573		Medium Stiff	CLAY	148945	149
34	7.75	11.60	4.85	7.59	11.00	4.85	118.4	247	0.45	118.6	0.0	4162.1	3.8	0.95	1.52	0.12	180.0	375	2.73	2049		Stiff	SILTY CLAY	299946	300
35	12.40	19.60	4.95	12.07	19.00	4.95	240.5	502	0.58	118.6	62.4	4218.2	6.0	1.31	1.98	0.14	476.7	993	5.50	3636		Stiff	SILTY CLAY	794455	794



FROEHLING & ROBERTSON, INC. Dilatometer Sounding Summary

Client: HDR Engineering
 Project: R3142A Richmond County
 Location: Richmond County, North Carolina
 Sounding: **Test Boring ID: I73_12500L_160**

Test Date: 3/10/2015
 Dilatometer Operator: M. DuBois
 Dilatometer: GB135
 F&R Project No.: 66S-0358



Notes: The boring was pre-augered to a depth of 3 feet. Testing was performed from a depth of 4 to 6 feet below existing grades. At a depth of 6.5-feet F&R encountered refusal of the DMT blade. F&R augered to a depth of 18 feet and resumed DMT sounding at 19-feet. The sounding continued to a termination depth of 35-feet.



Test Boring ID: FLY_825R

Date: 3/12/15
DMT Operator: M. DuBois
Rig Operator: D. Tigor
Rig Type: CME 55
GWT Depth: 50.5

ΔA avg.: 0.05
ΔB avg.: 0.50
Pre Drill Depth: 0.0

Notes: F&R attempted to push the dilatometer from the ground surface to a termination depth of 45 feet. At a depth of 3 feet F&R encountered refusal of the DMT blade. F&R augered to a depth of 14 feet and was able to perform testing to a depth of 16 feet before reaching refusal again. F&R augered to a depth of 18 feet and performed testing to a depth of 28 feet. At 28.5 feet F&R encountered refusal of the DMT blade. F&R augered to a depth of 33 feet and then continued DMT testing to the termination depth of 45 feet.

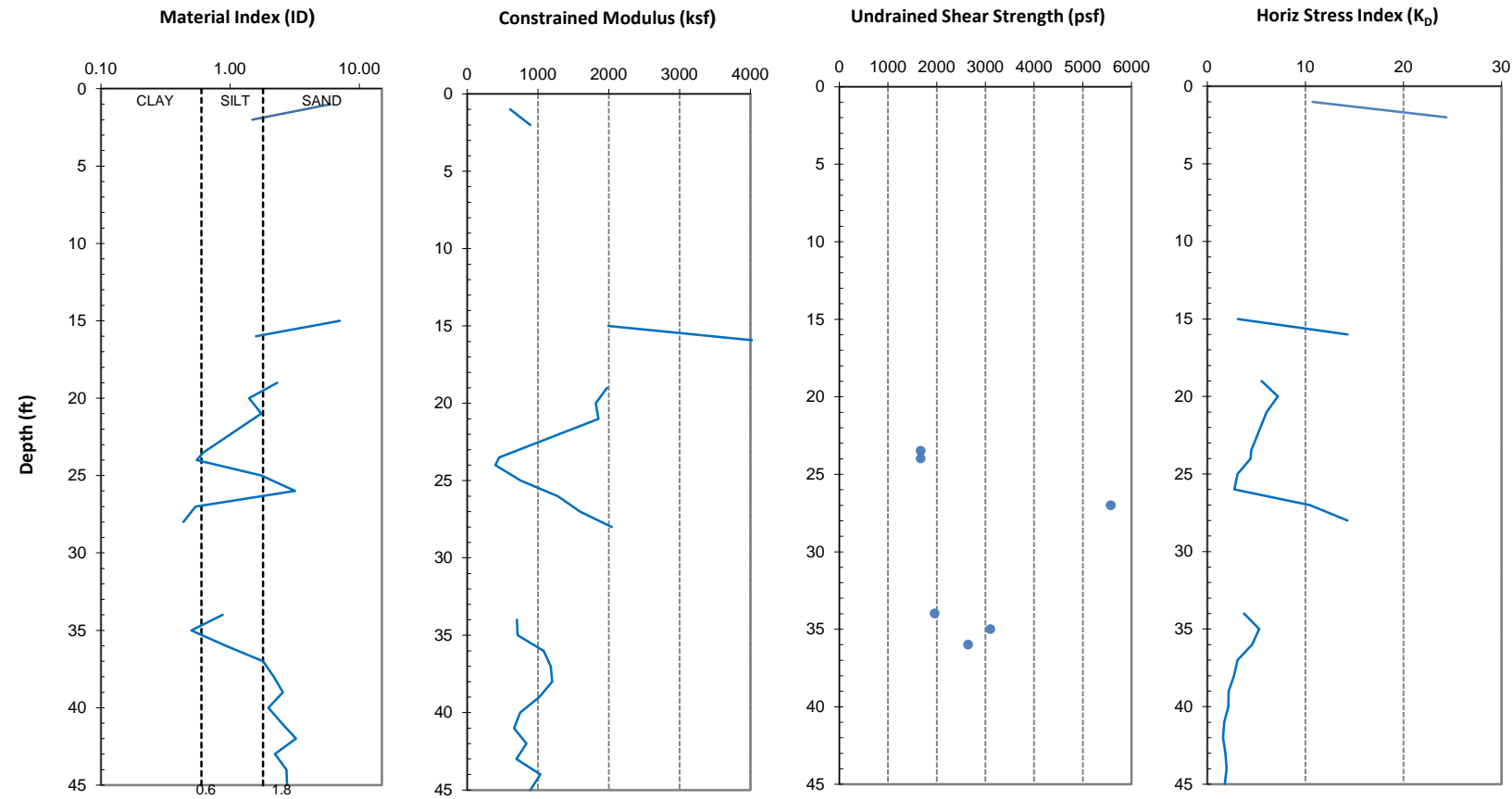
Depth (ft)	A (bars)	B (bars)	C (bars)	P ₀ bars	P ₁ bars	P ₂ bars	E _d (bars)	E _d (ksf)	I _D Material Index	γ (pcf)	u _o Pore Pressure (psf)	σ' _v (psf)	K _D Horizontal Stress Index	K _O In-Situ Earth Pressure Coeff.	R _M	R _{MO}	M Vertical Drained Constrained Modulus (bar)	M Vertical Drained Constrained Modulus (ksf)	OCR	c _u (psf)	φ	Description	Soil Type	E _s (psf)	E _s (ksf)
1	0.65	4.30		0.55	3.80		112.9	236	5.97	106.1	0.0	106.1	10.7		2.57	0.95	290.8	606			41	Loose	SAND	484672	485
2	2.60	6.65	0.60	2.48	6.15	0.65	127.5	266	1.48	106.1	0.0	212.2	24.4		3.34	0.27	427.6	891				Low Density	SANDY SILT	712709	713
15	3.45	21.60		2.62	21.10		641.3	1340	7.05	118.6	0.0	1753.4	3.1		1.49	1.11	957.6	1995			35	Medium Rigidity	SAND	1595920	1596
16	13.80	33.80	1.95	12.88	33.30	2.00	708.7	1481	1.59	131.0	0.0	1884.5	14.3		2.84	0.29	2016.5	4201				Very Dense	SANDY SILT	3360820	3361
19	6.60	20.40		5.99	19.90		482.8	1009	2.32	124.8	0.0	2258.9	5.5		1.96	0.40	949.3	1978			38	Rigid	SILTY SAND	1582238	1582
20	8.70	20.20		8.20	19.70		399.0	834	1.40	121.7	0.0	2380.6	7.2		2.18	0.26	872.4	1818				Dense	SANDY SILT	1454070	1454
21	7.80	20.40		7.25	19.90		439.0	917	1.75	121.7	0.0	2502.2	6.1		2.02	0.31	890.7	1856				Dense	SANDY SILT	1484454	1484
23.5	6.10	10.20	1.50	5.97	9.70	1.55	129.3	270	0.62	112.3	0.0	2783.0	4.5	1.07	1.68	0.14	217.8	454	3.52	1680		Medium Dense	CLAYEY SILT	363051	363
24	6.10	9.80	1.25	5.99	9.30	1.30	114.8	240	0.55	112.3	0.0	2839.2	4.4	1.06	1.67	0.13	191.8	400	3.43	1678		Medium Stiff	SILTY CLAY	319620	320
25	4.65	12.40		4.34	11.90		262.3	548	1.74	112.3	0.0	2951.5	3.1		1.38	0.31	362.6	755				Medium Dense	SANDY SILT	604356	604
26	4.60	17.40		4.04	16.90		446.3	933	3.19	124.8	0.0	3076.3	2.7		1.38	0.53	616.0	1283			34	Rigid	SILTY SAND	1026746	1027
27	16.40	25.20	8.75	16.04	24.70	8.80	300.6	628	0.54	127.9	0.0	3204.2	10.5	1.89	2.54	0.13	766.5	1597	13.20	5574		Hard	SILTY CLAY	1277419	1277
28	23.20	33.20	13.40	22.78	32.70	13.45	344.3	719	0.44	127.9	0.0	3332.2	14.3	2.28	2.84	0.12	979.8	2041	21.47	8558		Hard	SILTY CLAY	1633068	1633
34	7.55	14.20	2.25	7.30	13.70	2.30	222.3	464	0.88	121.7	0.0	4062.2	3.8	0.94	1.51	0.18	337.3	703	2.67	1962		Dense	CLAYEY SILT	562120	562
35	10.80	16.40	5.60	10.60	15.90	5.65	184.0	384	0.50	118.6	0.0	4180.8	5.3	1.21	1.85	0.13	342.2	713	4.57	3107		Stiff	SILTY CLAY	570330	570
36	9.75	18.60	2.50	9.39	18.10	2.55	302.4	632	0.93	121.7	0.0	4302.5	4.6	1.09	1.71	0.19	519.1	1081	3.61	2650		Dense	SILT	865134	865
37	7.05	18.80	0.15	6.54	18.30	0.20	408.1	853	1.80	121.7	0.0	4424.2	3.1		1.39	0.32	567.9	1183				Dense	SANDY SILT	946482	946
38	6.45	19.20	0.15	5.89	18.70	0.20	444.5	929	2.17	124.8	0.0	4549.0	2.7		1.29	0.38	577.0	1202			34	Rigid	SILTY SAND	961608	962
39	5.40	17.80	0.20	4.86	17.30	0.25	431.8	902	2.56	124.8	0.0	4673.8	2.2		1.13	0.43	489.3	1019			33	Rigid	SILTY SAND	815471	815
40	5.35	15.20	0.30	4.94	14.70	0.35	338.8	708	1.98	124.8	0.0	4798.6	2.1		1.06	0.35	360.9	752			33	Rigid	SILTY SAND	601578	602
41	4.45	14.60		4.02	14.10		349.8	731	2.51	118.6	0.0	4917.1	1.7		0.91	0.43	318.7	664			31	Medium Rigidity	SILTY SAND	531107	531
42	4.45	17.00		3.90	16.50		437.2	914	3.23	124.8	0.0	5041.9	1.6		0.92	0.53	402.1	838			31	Rigid	SILTY SAND	670174	670
43	5.00	15.20		4.57	14.70		351.6	735	2.22	124.8	0.0	5166.7	1.8		0.95	0.38	333.9	696			32	Rigid	SILTY SAND	556559	557
44	5.55	19.00		4.96	18.50		470.0	982	2.73	124.8	0.0	5291.5	2.0		1.05	0.46	497.2	1036			32	Rigid	SILTY SAND	828604	829
45	5.15	17.80		4.60	17.30		440.9	921	2.76	124.8	0.0	5416.3	1.8		0.97	0.46	429.2	894			31	Rigid	SILTY SAND	715358	715



FROEHLING & ROBERTSON, INC.
Dilatometer Sounding Summary

Client: HDR Engineering, Inc.
 Project: R3142A Richmond County
 Location: Richmond County, North Carolina
 Sounding: **Test Boring ID: FLY_825R**

Test Date: 3/12/2015
 Dilatometer Operator: M. DuBois
 Dilatometer: GB135
 F&R Project No.: 66S-0358



Notes: F&R attempted to push the dilatometer from the ground surface to a termination depth of 45 feet. At a depth of 3 feet F&R encountered refusal of the DMT blade. F&R augered to a depth of 14 feet and was able to perform testing to a depth of 16 feet before reaching refusal again. F&R augered to a depth of 18 feet and performed testing to a depth of 28 feet. At 28.5 feet F&R encountered refusal of the DMT blade. F&R augered to a depth of 33 feet and then continued DMT testing to the termination depth of 45 feet.



Froehling Robertson, Inc.
Dilatometer Data and Interpretation (ASTM D6635)

Test Boring ID: RPC_2100R

Date: 3/11/15
DMT Operator: M. DuBois
Rig Operator: D. Tigor
Rig Type: CME 55
GWT Depth: 27.0

ΔA avg.: 0.05
ΔB avg.: 0.45
Pre Drill Depth: 3.0

Notes: The boring was pre-augered to a depth of 3 feet.

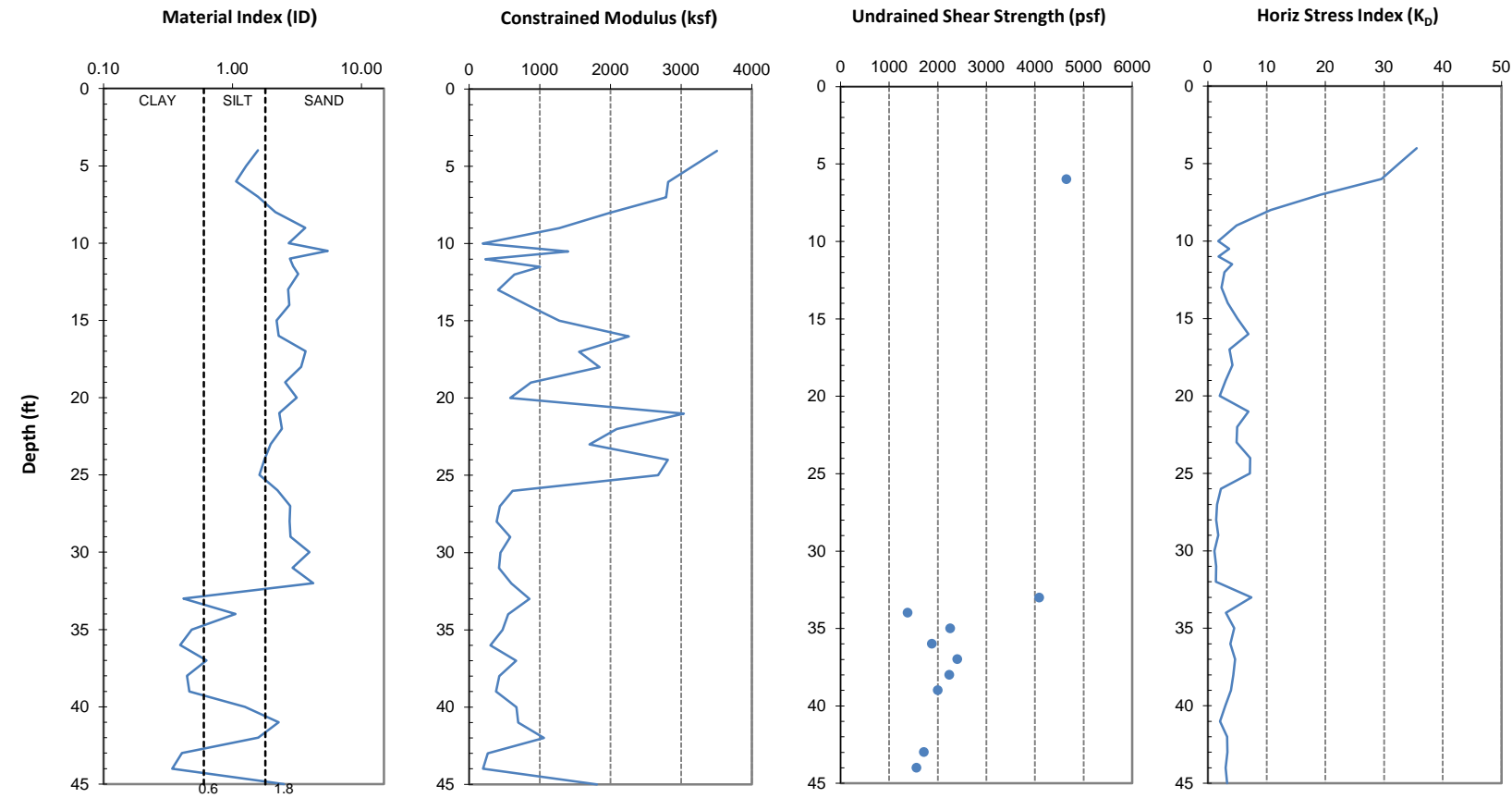
Depth (ft)	A (bars)	B (bars)	C (bars)	P ₀ bars	P ₁ bars	P ₂ bars	E _d (bars)	E _d (ksf)	I _b Material Index	γ (pcf)	u ₀ Pore Pressure (psf)	σ _v (psf)	K _D Horizontal Stress Index	K _O In-Situ Earth Pressure Coeff.	R _M	R _{MO}	M Vertical Drained Constrained Modulus (bar)	M Vertical Drained Constrained Modulus (ksf)	OCR	C _u (psf)	φ	Description	Soil Type	E _s (psf)	E _s (ksf)
4	8.85	21.80		8.28	21.35		453.6	948	1.58	121.7	0.0	486.7	35.5		3.70	0.29	1683.5	3507				Dense	SANDY SILT	2805813	2806
5	10.00	22.00	2.05	9.48	21.55	2.10	419.0	875	1.27	121.7	0.0	608.4	32.5		3.62	0.24	1520.0	3167				Dense	SANDY SILT	2533343	2533
6	10.80	21.80	1.45	10.33	21.35	1.50	382.6	799	1.07	121.7	0.0	730.1	29.5	3.46	3.53	0.21	1352.8	2818	66.75	4653		Dense	SILT	2254682	2255
7	8.35	20.60	0.85	7.81	20.15	0.90	428.1	895	1.58	121.7	0.0	851.8	19.2		3.12	0.29	1337.8	2787				Dense	SANDY SILT	2229738	2230
8	5.45	16.20		4.99	15.75		373.5	780	2.16	124.8	0.0	976.6	10.7		2.56	0.37	959.4	1999			41	Rigid	SILTY SAND	1599035	1599
9	2.95	12.40		2.55	11.95		326.1	681	3.68	118.6	0.0	1095.1	4.9		1.88	0.60	613.2	1278			37	Medium Rigidity	SAND	1022065	1022
10	1.10	4.25		1.02	3.80		96.6	202	2.73	106.1	0.0	1201.2	1.8		0.97	0.46	93.5	195			31	Loose	SILTY SAND	155900	156
10.5	2.70	14.60		2.18	14.15		415.4	868	5.49	118.6	0.0	1260.5	3.6		1.62	0.87	673.1	1402			35	Medium Rigidity	SAND	1121911	1122
11	1.25	4.80		1.15	4.35		111.1	232	2.79	112.3	0.0	1316.6	1.8		1.00	0.47	111.2	232			32	Low Rigidity	SILTY SAND	185276	185
11.5	3.05	11.20		2.72	10.75		278.7	582	2.96	118.6	0.0	1375.9	4.1		1.73	0.49	483.2	1007			36	Medium Rigidity	SILTY SAND	805399	805
12	2.20	8.70		1.95	8.25		218.6	457	3.23	118.6	0.0	1435.2	2.8		1.41	0.53	308.3	642			34	Medium Rigidity	SILTY SAND	513889	514
13	1.90	6.85		1.73	6.40		162.1	339	2.70	112.3	0.0	1547.5	2.3		1.21	0.46	196.4	409			33	Low Rigidity	SILTY SAND	327289	327
14	3.00	10.60		2.70	10.15		258.7	541	2.77	118.6	0.0	1666.1	3.4		1.54	0.46	399.9	833			35	Medium Rigidity	SILTY SAND	666461	666
15	4.70	14.20		4.30	13.75		327.9	685	2.20	124.8	0.0	1790.9	5.0		1.86	0.38	613.3	1278			37	Rigid	SILTY SAND	1022153	1022
16	6.95	21.20		6.31	20.75		501.0	1047	2.29	124.8	0.0	1915.7	6.9		2.16	0.39	1084.5	2259			39	Rigid	SILTY SAND	1807550	1808
17	4.15	17.20		3.57	16.75		457.3	955	3.69	118.6	0.0	2034.2	3.7		1.63	0.60	747.2	1557			36	Medium Rigidity	SAND	1245251	1245
18	4.95	19.40		4.30	18.95		508.3	1062	3.40	124.8	0.0	2159.0	4.2		1.74	0.56	886.5	1847			36	Rigid	SAND	1477432	1477
19	3.65	12.20		3.30	11.75		293.3	613	2.56	118.6	0.0	2277.6	3.0		1.43	0.43	419.9	875			35	Medium Rigidity	SILTY SAND	699840	700
20	2.60	10.00		2.31	9.55		251.4	525	3.14	118.6	0.0	2396.2	2.0		1.11	0.52	279.0	581			32	Medium Rigidity	SILTY SAND	464931	465
21	9.25	28.20		8.38	27.75		672.2	1405	2.31	134.2	0.0	2530.3	6.9		2.16	0.40	1458.6	3039			39	Very Rigid	SILTY SAND	2430964	2431
22	7.05	22.20		6.37	21.75		533.8	1115	2.42	124.8	0.0	2655.1	5.0		1.87	0.41	1003.0	2090			37	Rigid	SILTY SAND	1671620	1672
23	7.05	19.80	0.15	6.49	19.35	0.20	446.3	933	1.98	124.8	0.0	2779.9	4.9		1.83	0.35	818.5	1705			37	Rigid	SILTY SAND	1364211	1364
24	10.80	28.20		10.01	27.75		615.8	1287	1.77	131.0	0.0	2911.0	7.2		2.19	0.32	1350.0	2812				Very Dense	SANDY SILT	2249933	2250
25	11.20	27.80	1.65	10.45	27.35	1.70	586.6	1226	1.62	131.0	0.0	3042.0	7.2		2.18	0.29	1283.5	2674				Very Dense	SANDY SILT	2139212	2139
26	3.70	11.40		3.39	10.95		262.3	548	2.23	118.6	0.0	3160.6	2.2		1.13	0.38	296.2	617			33	Medium Rigidity	SILTY SAND	493717	494
27	2.75	9.85		2.47	9.40		240.5	502	2.81	118.6	0.0	3279.1	1.6		0.87	0.47	210.0	437			31	Medium Rigidity	SILTY SAND	349918	350
28	2.55	9.05		2.30	8.60		218.6	457	2.78	118.6	62.4	3335.3	1.4		0.78	0.47	186.4	388			30	Medium Rigidity	SILTY SAND	310605	311
29	3.30	11.60		2.96	11.15		284.2	594	2.82	118.6	124.8	3391.4	1.8		0.98	0.47	280.6	585			32	Medium Rigidity	SILTY SAND	467637	468
30	2.20	9.55		1.91	9.10		249.6	521	3.96	118.6	187.2	3447.6	1.1		0.58	0.64	212.8	443			29	Medium Rigidity	SAND	354608	355
31	2.75	9.80		2.47	9.35		238.6	499	2.92	118.6	249.6	3503.8	1.4		0.78	0.49	203.4	424			30	Medium Rigidity	SILTY SAND	339077	339
32	2.85	12.60		2.44	12.15		337.0	704	4.24	118.6	312.0	3559.9	1.3		0.76	0.69	287.3	599			30	Medium Rigidity	SAND	478850	479
33	13.20	18.80	5.15	13.00	18.35	5.20	185.8	388	0.42	118.6	374.4	3616.1	7.4	1.52	2.20	0.11	409.8	854	7.71	4086		Stiff	SILTY CLAY	683042	683
34	5.85	11.80		5.63	11.35		198.6	415	1.06	112.3	436.8	3666.0	3.1	0.80	1.33	0.21	265.0	552	1.97	1388		Medium Dense	SILT	441666	442
35	8.40	12.60	4.35	8.27	12.15	4.40	134.8	282	0.48	118.6	499.2	3722.2	4.5	1.08	1.69	0.12	228.2	475	3.55	2260		Stiff	SILTY CLAY	380388	380
36	7.30	10.40	3.80	7.22	9.95	3.85	94.7	198	0.39	112.3	561.6	3772.1	3.9	0.96	1.53	0.11	145.0	302	2.78	1882		Medium Stiff	SILTY CLAY	241716	242
37	9.00	14.60	4.00	8.80	14.15	4.05	185.8	388	0.63	121.7	624.0	3831.4	4.6	1.10	1.71	0.14	319.3	665	3.71	2409		Dense	CLAYEY SILT	532087	532
38	8.50	12.40	4.40	8.38	11.95	4.45	123.9	259	0.44	118.6	686.4	3887.5	4.3	1.05	1.65	0.12	204.6	426	3.33	2244		Stiff	SILTY CLAY	340962	341
39	7.85	11.60	4.10	7.74	11.15	4.15	118.4	247	0.46	118.6	748.8	3943.7	3.9	0.97	1.54	0.12	183.1	382	2.85	2005		Stiff	SILTY CLAY	305249	305
40	6.35	13.60	0.65	6.06	13.15	0.70	245.9	514	1.25	121.7	811.2	4003.0	3.0		1.30	0.24	321.7	670				Dense	SANDY SILT	536202	536
41	4.80	14.00		4.42	13.55		317.0	662	2.29	118.6	873.6	4059.1	2.1		1.05	0.39	334.8	697			32	Medium Rigidity	SILTY SAND	557965	558
42	7.35	17.60		6.91	17.15		355.2	742	1.58	121.7	936.0	4118.4	3.3		1.43	0.29	509.1	1061				Dense	SANDY SILT	848436	848
43	7.15	10.20	4.30	7.07	9.75	4.35	92.9	194	0.41	112.3	998.4	4168.3	3.3	0.85	1.37	0.11	127.6	266	2.19	1719		Medium Stiff	SILTY CLAY	212704	213
44	6.70	9.20	4.30	6.65	8.75	4.35	72.9	152	0.34	112.3	1060.8	4218.2	3.0	0.79	1.28	0.10	93.9	196	1.92	1568		Medium Stiff	CLAY	156434	156
45	7.95	24.40		7.20	23.95		581.1	1214	2.51	124.8	1123.2	4280.6	3.3		1.49	0.43	867.8	1808			35	Rigid	SILTY SAND	1446412	1446



FROEHLING & ROBERTSON, INC.
Dilatometer Sounding Summary

Client: HDR Engineering
 Project: R3142A Richmond County
 Location: Richmond County, North Carolina
 Sounding: **Test Boring ID: RPC_2100R**

Test Date: 3/11/2015
 Dilatometer Operator: M. DuBois
 Dilatometer: GB135
 F&R Project No.: 66S-0358



Notes: The boring was pre-augered to a depth of 3 feet.



Froehling Robertson, Inc.
 Dilatometer Data and Interpretation (ASTM D6635)

Test Boring ID: RPD_2125R

Date: 3/10/15
 DMT Operator: M. DuBois
 Rig Operator: D. Tigor
 Rig Type: CME 55
 GWT Depth: Unknown

ΔA avg.: 0.05
 ΔB avg.: 0.50
 Pre Drill Depth: 3.0

Notes: The boring was pre-augered to a depth of 3 feet. At a depth of 22.2 feet F&R encountered refusal of the DMT blade. F&R discussed the sounding with HDR and the sounding was terminated at that depth.

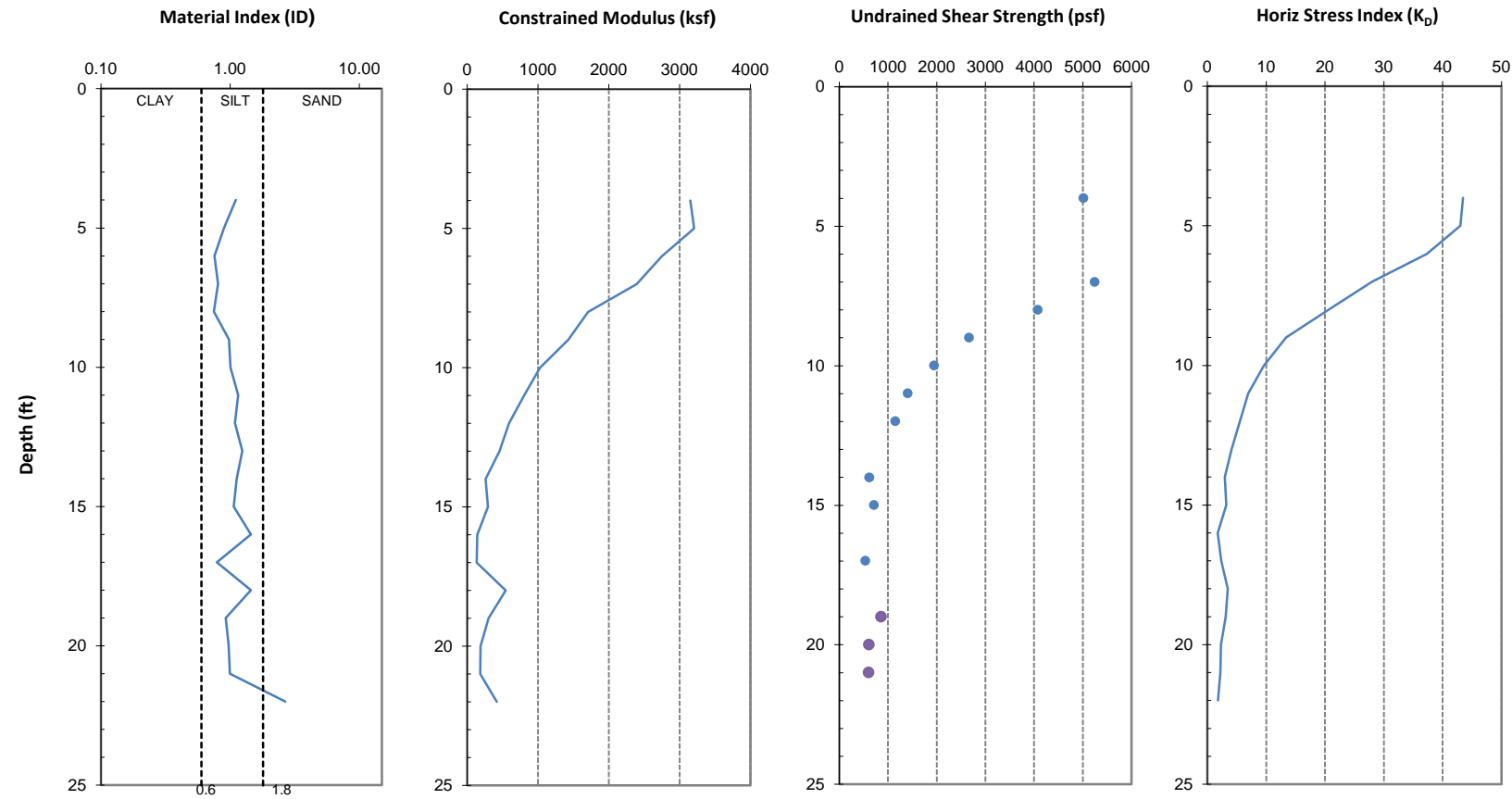
Depth (ft)	A (bars)	B (bars)	C (bars)	P ₀ bars	P ₁ bars	P ₂ bars	E _d (bars)	E _d (ksf)	I _D Material Index	γ (pcf)	u _o Pore Pressure (psf)	σ' _v (psf)	K _D Horizontal Stress Index	K _O In-Situ Earth Pressure Coeff.	R _M	R _{MO}	M Vertical Drained Constrained Modulus (bar)	M Vertical Drained Constrained Modulus (ksf)	OCR	c _u (psf)	φ	Description	Soil Type	E _s (psf)	E _s (ksf)
4	10.60	21.80		10.12	21.30		388.0	811	1.11	121.7	0.0	486.7	43.4	4.26	3.89	0.22	1514.0	3154	121.73	5020		Dense	SILT	2523416	2523
5	13.20	24.60	0.90	12.71	24.10	0.95	395.3	826	0.90	131.0	0.0	617.8	43.0	4.24	3.88	0.18	1538.5	3205	119.76	6288		Very Dense	CLAYEY SILT	2564244	2564
6	13.80	24.00	2.20	13.37	23.50	2.25	351.6	735	0.76	131.0	0.0	748.8	37.3	3.93	3.75	0.16	1321.1	2752	96.00	6385		Very Dense	CLAYEY SILT	2201774	2202
7	12.20	21.80	1.95	11.80	21.30	2.00	329.7	689	0.81	131.0	0.0	879.8	28.0	3.36	3.48	0.17	1149.3	2394	61.43	5246		Very Dense	CLAYEY SILT	1915526	1916
8	10.20	17.80	1.85	9.90	17.30	1.90	256.9	537	0.75	121.7	0.0	1001.5	20.6	2.83	3.19	0.16	820.9	1710	38.16	4078		Dense	CLAYEY SILT	1368164	1368
9	7.50	14.80	1.10	7.21	14.30	1.15	245.9	514	0.98	121.7	0.0	1123.2	13.4	2.20	2.78	0.20	685.3	1428	19.48	2668		Dense	SILT	1142144	1142
10	5.95	12.00	0.20	5.73	11.50	0.25	200.4	419	1.01	121.7	0.0	1244.9	9.6	1.79	2.46	0.20	494.4	1030	11.57	1948		Dense	SILT	824078	824
11	4.70	10.20		4.50	9.70		180.4	377	1.15	112.3	0.0	1357.2	6.9	1.45	2.14	0.22	386.7	806	6.95	1412		Medium Dense	SILT	644427	644
12	4.05	8.65		3.90	8.15		147.6	308	1.09	112.3	0.0	1469.5	5.5	1.25	1.91	0.21	283.2	590	4.90	1156		Medium Dense	SILT	472071	472
13	3.25	7.50		3.12	7.00		134.8	282	1.25	112.3	0.0	1581.8	4.1		1.63	0.24	220.0	458				Medium Dense	SANDY SILT	366686	367
14	2.50	5.65		2.42	5.15		94.7	198	1.13	106.1	0.0	1687.9	3.0	0.78	1.31	0.22	124.1	259	1.88	615		Low Density	SILT	206801	207
15	2.85	6.20		2.76	5.70		102.0	213	1.07	106.1	0.0	1794.0	3.2	0.83	1.37	0.21	140.3	292	2.10	714		Low Density	SILT	233827	234
16	1.65	4.40		1.59	3.90		80.2	167	1.45	106.1	0.0	1900.1	1.7		0.81	0.27	68.3	142				Low Density	SANDY SILT	113889	114
17	2.30	4.55		2.27	4.05		61.9	129	0.79	106.1	0.0	2006.2	2.4	0.64	1.04	0.17	64.4	134	1.29	543		Low Density	CLAYEY SILT	107402	107
18	3.70	9.10		3.51	8.60		176.7	369	1.45	112.3	0.0	2118.5	3.5		1.47	0.27	260.7	543				Medium Dense	SANDY SILT	434490	434
19	3.45	6.95		3.35	6.45		107.5	225	0.92	112.3	0.0	2230.8	3.1	0.82	1.34	0.19	144.1	300	2.02	863		Medium Dense	SILT	240250	240
20	2.65	5.60		2.58	5.10		87.4	183	0.98	106.1	0.0	2336.9	2.3	0.62	1.03	0.20	90.6	189	1.25	615		Low Density	SILT	150948	151
21	2.65	5.65		2.58	5.15		89.3	187	1.00	106.1	0.0	2443.0	2.2	0.60	0.99	0.20	88.6	185	1.16	607		Low Density	SILT	147635	148
22	2.45	8.65		2.22	8.15		205.9	430	2.68	118.6	0.0	2561.5	1.8		0.98	0.45	202.0	421			32	Medium Rigidity	SILTY SAND	336746	337



FROEHLING & ROBERTSON, INC.
Dilatometer Sounding Summary

Client: HDR Engineering
 Project: R3142A Richmond County
 Location: Richmond County, North Carolina
 Sounding: **Test Boring ID: RPD_2125R**

Test Date: 3/10/2015
 Dilatometer Operator: M. DuBois
 Dilatometer: GB135
 F&R Project No.: 66S-0358



Notes: The boring was pre-augered to a depth of 3 feet. At a depth of 22.2 feet F&R encountered refusal of the DMT blade. F&R discussed the sounding with HDR and the sounding was terminated at that depth.