

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT



**SUBSURFACE INVESTIGATION**

STATE JOB NO. 050249

FEDERAL AID PROJECT NO. STP-0073(56)

HWY. 36-HWY. 16 (S)

STATE HIGHWAY 13 SECTION ---

IN WHITE COUNTY

LETTING OF AUGUST 10, 2016

The information contained herein was obtained by the Department for design and estimating purposes only. It is being furnished with the express understanding that said information does not constitute a part of the Proposal or Contract and represents only the best knowledge of the Department as to the location, character and depth of the materials encountered. The information is only included and made available so that bidders may have access to subsurface information obtained by the Department and is not intended to be a substitute for personal investigation, interpretation and judgment of the bidder. The bidder should be cognizant of the possibility that conditions affecting the cost and/or quantities of work to be performed may differ from those indicated herein.

**ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT**

May 23, 2014

**TO:** Mr. Trinity Smith, Engineer of Roadway Design

**SUBJECT:** Job No. 050249  
Hwy. 36 – Hwy. 16 (Gr. & Strs.) (S)  
Route 13  
White County

Transmitted herewith is the requested Soil Survey, Strength Data and Resilient Modulus test results for the above referenced job. The project consists of creating a two lane highway between Highway 36 and Highway 16. Samples were obtained along the new location. Locations were measured from centerline of construction and should be noted as such on the logs.

Based on laboratory results of samples obtained, the subgrade soils consist primarily of sandy clay with varying amounts of sandstone fragments. Isolated locations of highly plastic clay were encountered. The subgrade soils are expected to provide a stable working platform with conventional processing if the weather is favorable during construction. Rock was encountered within the project limits; station, location and depth to rock are listed in Table 1 below.

Table 1

Station	Location from Centerline	Depth (ft.)
154+70	C.L.	3.5
174+00	C.L.	2.0
190+00	C.L.	4.5
278+00	C.L.	2.5
286+00	C.L.	4.0

Three ponds were encountered within the project limits, at stations 146+00 centerline of construction, 180+00 at centerline of construction, and 241+00 at centerline of construction. These ponds should be drained and all soft unstable organic material should be undercut to a depth of stable material (anticipated to be no more than two feet). The undercut areas should be back filled with material meeting the minimum requirements of Selected Material Class SM-1, in the Standard Specifications for Highway Construction, 2014 edition.

Between stations 104+00 to 114+00, 123+00 to 124+00, 137+00 to 142+00, 161+00 to 163+00, 278+00 to 281+00, and 286+00 to 289+00 the grade line closely matches that of the natural ground. These areas primarily traverse open pasture land and wooded areas, it is recommended these areas be undercut a minimum depth of two feet to remove all soft unstable organic material prior to embankment construction. The undercut may be backfilled with locally available unspecified material. An alternative to undercutting is to raise the grade line three to five feet to bridge across the unstable organic material.

Between stations 164+00 to 181+00 and 213+80 to 237+00 are proposed cuts depths of approximately 65 feet and 37 feet respectively. Cut slope recommendations will be provided in a separate report after the subsurface investigation is complete.

The remaining cuts within the project limits are less than 15 feet in depth. The proposed 3:1 cut slope configuration is acceptable as shown.

Based on currently available cross-sections between stations 182+00 to 192+00 is a proposed embankment approximately 34 feet in height, 199+00 to 213+00 is an approximate 25 feet embankment, 238+00 to 274+00 is an embankment 34 feet in height, and 275+00 to 277+15 is an approximate 30 feet high embankment. It is anticipated that the rock from the cuts will be used in embankment construction. Slope configuration and undercut requirements will be made when the subsurface investigation is complete.

Embankments less than 15 feet in height may be constructed with locally available material utilizing the 3:1 slope configuration shown in the currently available cross-sections.

Listed below is the additional information requested for use in developing the plans:

1. The Qualified Products List (QPL) indicates that Aggregate Base Course (Class CL-7) is available from commercial producers in the vicinity of Judsonia.

2. Asphalt Concrete Hot Mix

<u>Type</u>	<u>Asphalt Cement %</u>	<u>Mineral Aggregate %</u>
Surface Course	5.3	94.7
Binder Course	4.4	95.6
Base Course	4.0	96.0

  
Michael C. Benson  
Materials Engineer

MCB:pt:bjj  
Attachment

cc: State Constr. Eng. – Master File Copy  
District 5 Engineer  
Transportation Planning and Policy Div.  
G. C. File

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS  
MATERIALS DIVISION  
MICHAEL BENSON, MATERIALS ENGINEER  
\*\*\* SOIL SURVEY STRENGTH TEST REPORT \*\*\*

DATE - 05/02/2014  
JOB NUMBER - 050249

SEQUENCE NO. - 1  
MATERIAL CODE - SSRV  
SPEC. YEAR - 2003  
SUPPLIER ID. - 1  
COUNTY/STATE - 73  
DISTRICT NO. - 05

JOB NAME - HWY.36-HWY.16 (GR.&STRS.) (S)

\*\*\*\*\*  
\* STATION LIMITS R-VALUE AT 240 psi \*  
\*\*\*\*\*

BEGIN JOB - END JOB 11

RESILIENT MODULUS  
STA.102+50 6989  
STA.181+50 9936  
STA.299+50 7472

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REMARKS -

AASHTO TESTS : T190

**ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT  
MATERIALS DIVISION**

**AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS  
RECOMPACTED SAMPLES**

<b>Job No.</b>	050249	<b>Material Code</b>	SSRVPS
<b>Date Sampled:</b>	04/30/14	<b>Station No.:</b>	102+50
<b>Date Tested:</b>	April 30, 2014	<b>Location:</b>	20'LT
<b>Name of Project:</b>	HWY.36-HWY.16 (GR & STRS.)(S)		
<b>County:</b>	<b>Code:</b> 73	<b>Name:</b> WHITE	
<b>Sampled By:</b>	FAULKNER	<b>Depth:</b>	0-5
<b>Lab No.:</b>	20141075	<b>AASHTO Class:</b>	A-4(3)
<b>Sample ID:</b>	RV348	<b>Material Type (1 or 2):</b>	2
<b>LATITUDE:</b>		<b>LONGITUDE:</b>	

**1. Testing Information:**

Preconditioning - Permanent Strain > 5% (Y=Yes or N= No)	N
Testing - Permanent Strain > 5% (Y=Yes or N=No)	N
Number of Load Sequences Completed (0-15)	15

**2. Specimen Information:**

Specimen Diameter (in):	
Top	3.96
Middle	3.86
Bottom	3.92
Average	3.91
Membrane Thickness (in):	0.01
Height of Specimen, Cap and Base (in):	8.03
Height of Cap and Base (in):	0.00
Initial Length, Lo (in):	8.03
Initial Area, Ao (sq. in):	11.95
Initial Volume, AoLo (cu. in):	95.99

**3. Soil Specimen Weight:**

Weight of Wet Soil Used (g):	3237.10
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**4. Soil Properties:**

Optimum Moisture Content (%):	14.3
Maximum Dry Density (pcf):	115.2
95% of MDD (pcf):	109.4
In-Situ Moisture Content (%):	N/A

**5. Specimen Properties:**

Wet Weight (g):	3237.10
Compaction Moisture content (%):	14.3
Compaction Wet Density (pcf):	128.49
Compaction Dry Density (pcf):	112.42
Moisture Content After Mr Test (%):	14.3

**6. Quick Shear Test (Y=Yes, N=No, N/A=Not Applicable):**

#VALUE!

**7. Resilient Modulus, Mr:**

$9515(S_c)^{-0.27774}(S_3)^{0.37900}$

**8. Comments**

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**9. Tested By:**     MW/DT    

**Date:**     April 30, 2014

**ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT  
MATERIALS DIVISION**

**AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS  
RECOMPACTED SAMPLES**

Job No. 050249      Material Code SSRVPS  
 Date Sampled: 04/30/14      Station No.: 102+50  
 Date Tested: April 30, 2014      Location: 20'LT  
 Name of Project: HWY.36-HWY.16 (GR & STRS.)  
 County: Code: 73      Name: WHITE  
 Sampled By: FAULKNER      Depth: 0-5  
 Lab No.: 20141075      AASHTO Class: A-4(3)  
 Sample ID: RV348      Material Type (1 or 2): 2  
 LATITUDE:      LONGITUDE:

PARAMETER	Chamber Confining Pressure		Nominal Maximum Axial Stress		Actual Applied Max. Axial Load		Actual Applied Cyclic Load		Actual Applied Contact Load		Actual Applied Max. Axial Stress		Actual Applied Cyclic Stress		Actual Applied Contact Stress		Average Recov Def. LVDT 1 and 2		Resilient Strain		Resilient Modulus	
	S <sub>3</sub>	psi	S <sub>cyclic</sub>	psi	P <sub>max</sub>	lbs	P <sub>cyclic</sub>	lbs	P <sub>contact</sub>	lbs	S <sub>max</sub>	psi	S <sub>cyclic</sub>	psi	S <sub>contact</sub>	psi	H <sub>avg</sub>	in	ε <sub>r</sub>	in/in	M <sub>r</sub>	psi
Sequence 1	6.0	2.0	2.0	24.7	46.3	22.0	43.7	2.7	2.1	1.8	0.2	0.00094	0.00012	15,702								
Sequence 2	6.0	4.0	4.0	68.3	64.9	43.7	64.9	2.7	3.9	3.7	0.2	0.00209	0.00026	14,015								
Sequence 3	6.0	6.0	6.0	90.3	84.5	64.9	84.5	3.4	5.7	5.4	0.3	0.00344	0.00043	12,687								
Sequence 4	6.0	8.0	8.0	111.8	103.6	84.5	103.6	5.8	7.6	7.1	0.5	0.00531	0.00066	10,697								
Sequence 5	6.0	10.0	10.0	24.7	22.0	22.0	22.0	8.3	9.4	8.7	0.7	0.00722	0.00090	9,631								
Sequence 6	4.0	2.0	2.0	45.6	42.9	42.9	42.9	2.7	2.1	1.8	0.2	0.00115	0.00014	12,912								
Sequence 7	4.0	4.0	4.0	66.0	63.3	63.3	63.3	2.7	3.8	3.6	0.2	0.00248	0.00031	11,604								
Sequence 8	4.0	6.0	6.0	87.6	82.7	82.7	82.7	5.0	5.5	5.3	0.2	0.00416	0.00052	10,226								
Sequence 9	4.0	8.0	8.0	109.6	102.2	102.2	102.2	7.4	7.3	6.9	0.4	0.00603	0.00075	9,204								
Sequence 10	4.0	10.0	10.0	24.3	21.6	21.6	21.6	2.7	9.2	8.5	0.6	0.00811	0.00101	8,458								
Sequence 11	2.0	2.0	2.0	44.8	42.0	42.0	42.0	2.8	2.0	1.8	0.2	0.00142	0.00018	10,210								
Sequence 12	2.0	4.0	4.0	64.3	61.4	61.4	61.4	2.8	3.8	3.5	0.2	0.00322	0.00040	8,778								
Sequence 13	2.0	6.0	6.0	84.7	80.5	80.5	80.5	4.2	5.4	5.1	0.2	0.00514	0.00064	8,034								
Sequence 14	2.0	8.0	8.0	105.9	99.2	99.2	99.2	6.7	7.1	6.7	0.3	0.00732	0.00091	7,385								
Sequence 15	2.0	10.0	10.0	24.7	22.0	22.0	22.0	6.7	8.9	8.3	0.6	0.00954	0.00119	6,989								

TESTED BY \_\_\_\_\_      MW/DT \_\_\_\_\_      DATE April 30, 2014  
 REVIEWED BY \_\_\_\_\_      DATE \_\_\_\_\_

**ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT  
MATERIALS DIVISION**

**AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS  
RECOMPACTED / THINWALL TUBE SAMPLES**

Job No.	050249	Material Code	SSRVPS
Date Sampled:	04/30/14	Station No.:	102+50
Date Tested:	April 30, 2014	Location:	20'LT
Name of Project:	HWY.36-HWY.16 (GR & STRS.)(S)		
County:	Code: 73	Name:	WHITE
Sampled By:	FAULKNER	Depth:	0-5
Lab No.:	20141075	AASHTO Class:	A-4(3)
Sample ID:	RV348	Material Type (1 or 2):	2
LATITUDE:		LONGITUDE:	

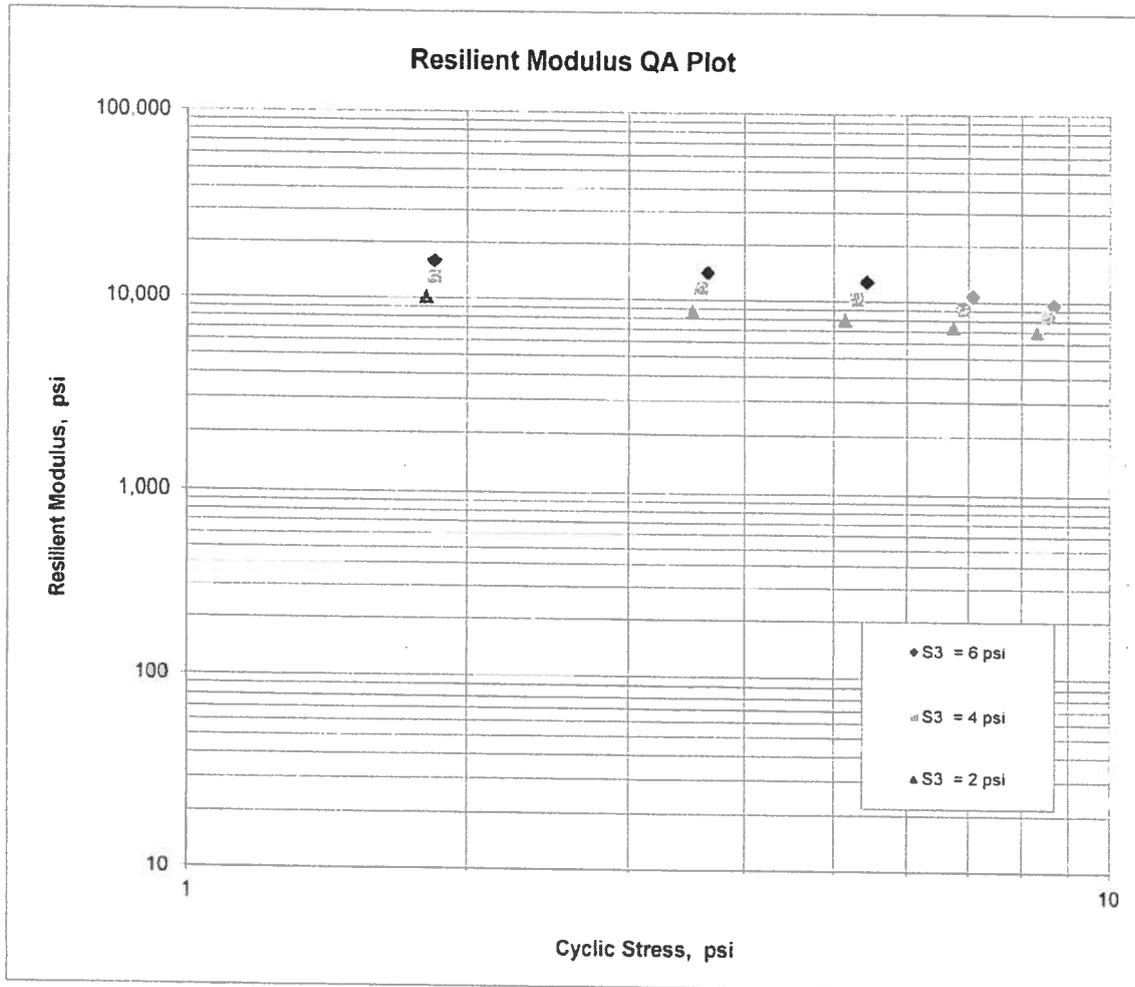
$$M_R = K_1 (S_C)^{K_2} (S_3)^{K_5}$$

$$K_1 = 9,515$$

$$K_2 = -0.27774$$

$$K_5 = 0.37900$$

$$R^2 = 0.97$$



**ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT  
MATERIALS DIVISION**

**AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS  
RECOMPACTED SAMPLES**

<b>Job No.:</b>	050249	<b>Material Code:</b>	SSRVPS
<b>Date Sampled:</b>	04/29/2014	<b>Station No.:</b>	181+50
<b>Date Tested:</b>	April 29, 2014	<b>Location:</b>	CL
<b>Name of Project:</b>	HWY.36 (GR & STRS.)(S)		
<b>County:</b>	<b>Code: 1</b>	<b>Name:</b>	ARKANSAS
<b>Sampled By:</b>	FAULKNER	<b>Depth:</b>	0-5
<b>Lab No.:</b>	20141076	<b>AASHTO Class:</b>	A-6(11)
<b>Sample ID:</b>	RV349	<b>Material Type (1 or 2):</b>	2
<b>LATITUDE:</b>		<b>LONGITUDE:</b>	

**1. Testing Information:**

Preconditioning - Permanent Strain > 5% (Y=Yes or N= No)	N
Testing - Permanent Strain > 5% (Y=Yes or N=No)	N
Number of Load Sequences Completed (0-15)	15

**2. Specimen Information:**

Specimen Diameter (in):	
Top	3.86
Middle	3.90
Bottom	3.90
Average	3.89
Membrane Thickness (in):	0.01
Height of Specimen, Cap and Base (in):	8
Height of Cap and Base (in):	0.00
Initial Length, Lo (in):	8
Initial Area, Ao (sq. in):	11.79
Initial Volume, AoLo (cu. in):	94.33

**3. Soil Specimen Weight:**

Weight of Wet Soil Used (g):	3104.60
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**4. Soil Properties:**

Optimum Moisture Content (%):	18.5
Maximum Dry Density (pcf):	107.5
95% of MDD (pcf):	102.1
In-Situ Moisture Content (%):	N/A

**5. Specimen Properties:**

Wet Weight (g):	3104.60
Compaction Moisture content (%):	18.3
Compaction Wet Density (pcf):	125.40
Compaction Dry Density (pcf):	106.00
Moisture Content After Mr Test (%):	17.9

**6. Quick Shear Test (Y=Yes, N=No, N/A=Not Applicable):**

#VALUE!

**7. Resilient Modulus, Mr:**

10376(Sc)<sup>-0.12389</sup>(S3)<sup>0.29220</sup>

**8. Comments**

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**9. Tested By:**

MW/DT

**Date:** April 29, 2014

**ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT  
MATERIALS DIVISION**

**AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS  
RECOMPACTED SAMPLES**

<b>Job No.</b>	050249	<b>Material Code</b>	SSRVPS
<b>Date Sampled:</b>	04/29/2014	<b>Station No.:</b>	181+50
<b>Date Tested:</b>	April 29, 2014	<b>Location:</b>	CL
<b>Name of Project:</b>	HWY 36 (GR & STRS.)(S)	<b>Depth:</b>	0-5
<b>County:</b>	Code: 1	<b>AASHTO Class:</b>	A-6(11)
<b>Sampled By:</b>	FAULKNER	<b>Material Type (1 or 2):</b>	2
<b>Lab No.:</b>	20141076	<b>LONGITUDE:</b>	
<b>Sample ID:</b>	RV349		
<b>LATITUDE:</b>			

PARAMETER	DESIGNATION	UNIT	Chamber	Nominal	Actual	Actual	Actual	Actual	Actual	Actual	Average	Resilient	Resilient
			Confining Pressure	Maximum Axial Stress	Applied Max. Axial Load	Applied Cyclic Load	Applied Contact Load	Applied Max. Axial Stress	Applied Cyclic Stress	Applied Contact Stress	Recov Def. LVDT 1 and 2	Strain	Modulus
			S <sub>3</sub>	S <sub>cyclic</sub>	P <sub>max</sub>	P <sub>cyclic</sub>	P <sub>contact</sub>	S <sub>max</sub>	S <sub>cyclic</sub>	S <sub>contact</sub>	H <sub>avg</sub>	ε <sub>r</sub>	M <sub>r</sub>
			psi	psi	lbs	lbs	lbs	psi	psi	psi	in	in/in	psi
Sequence 1			6.0	2.0	24.5	21.8	2.7	2.1	1.9	0.2	0.00090	0.00011	16,519
Sequence 2			6.0	4.0	45.7	43.0	2.7	3.9	3.6	0.2	0.00184	0.00023	15,843
Sequence 3			6.0	6.0	67.2	63.8	3.4	5.7	5.4	0.3	0.00290	0.00036	14,920
Sequence 4			6.0	8.0	89.5	83.8	5.7	7.6	7.1	0.5	0.00427	0.00053	13,306
Sequence 5			6.0	10.0	111.0	103.0	8.0	9.4	8.7	0.7	0.00579	0.00072	12,072
Sequence 6			4.0	2.0	24.4	21.7	2.6	2.1	1.8	0.2	0.00105	0.00013	14,059
Sequence 7			4.0	4.0	45.3	42.6	2.7	3.8	3.6	0.2	0.00213	0.00027	13,603
Sequence 8			4.0	6.0	66.2	63.6	2.7	5.6	5.4	0.2	0.00331	0.00041	13,021
Sequence 9			4.0	8.0	88.1	83.4	4.8	7.5	7.1	0.4	0.00456	0.00057	12,401
Sequence 10			4.0	10.0	109.9	102.7	7.2	9.3	8.7	0.6	0.00604	0.00076	11,537
Sequence 11			2.0	2.0	23.9	21.3	2.7	2.0	1.8	0.2	0.00130	0.00016	11,097
Sequence 12			2.0	4.0	44.8	42.0	2.7	3.8	3.6	0.2	0.00268	0.00034	10,635
Sequence 13			2.0	6.0	65.5	62.7	2.8	5.6	5.3	0.2	0.00402	0.00050	10,588
Sequence 14			2.0	8.0	86.3	82.3	4.0	7.3	7.0	0.3	0.00541	0.00068	10,315
Sequence 15			2.0	10.0	107.7	101.2	6.4	9.1	8.6	0.5	0.00691	0.00086	9,936

TESTED BY	_____	MW/DT	_____	DATE	_____
REVIEWED BY	_____			DATE	April 29, 2014

**ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT  
MATERIALS DIVISION**

**AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS  
RECOMPACTED / THINWALL TUBE SAMPLES**

<b>Job No.</b>	050249	<b>Material Code</b>	SSRVPS
<b>Date Sampled:</b>	04/29/2014	<b>Station No.:</b>	181+50
<b>Date Tested:</b>	April 29, 2014	<b>Location:</b>	CL
<b>Name of Project:</b>	HWY.36 (GR & STRS.)(S)		
<b>County:</b>	<b>Code:</b> 1	<b>Name:</b>	ARKANSAS
<b>Sampled By:</b>	FAULKNER	<b>Depth:</b>	0-5
<b>Lab No.:</b>	20141076	<b>AASHTO Class:</b>	A-6(11)
<b>Sample ID:</b>	RV349	<b>Material Type (1 or 2):</b>	2
<b>LATITUDE:</b>		<b>LONGITUDE:</b>	

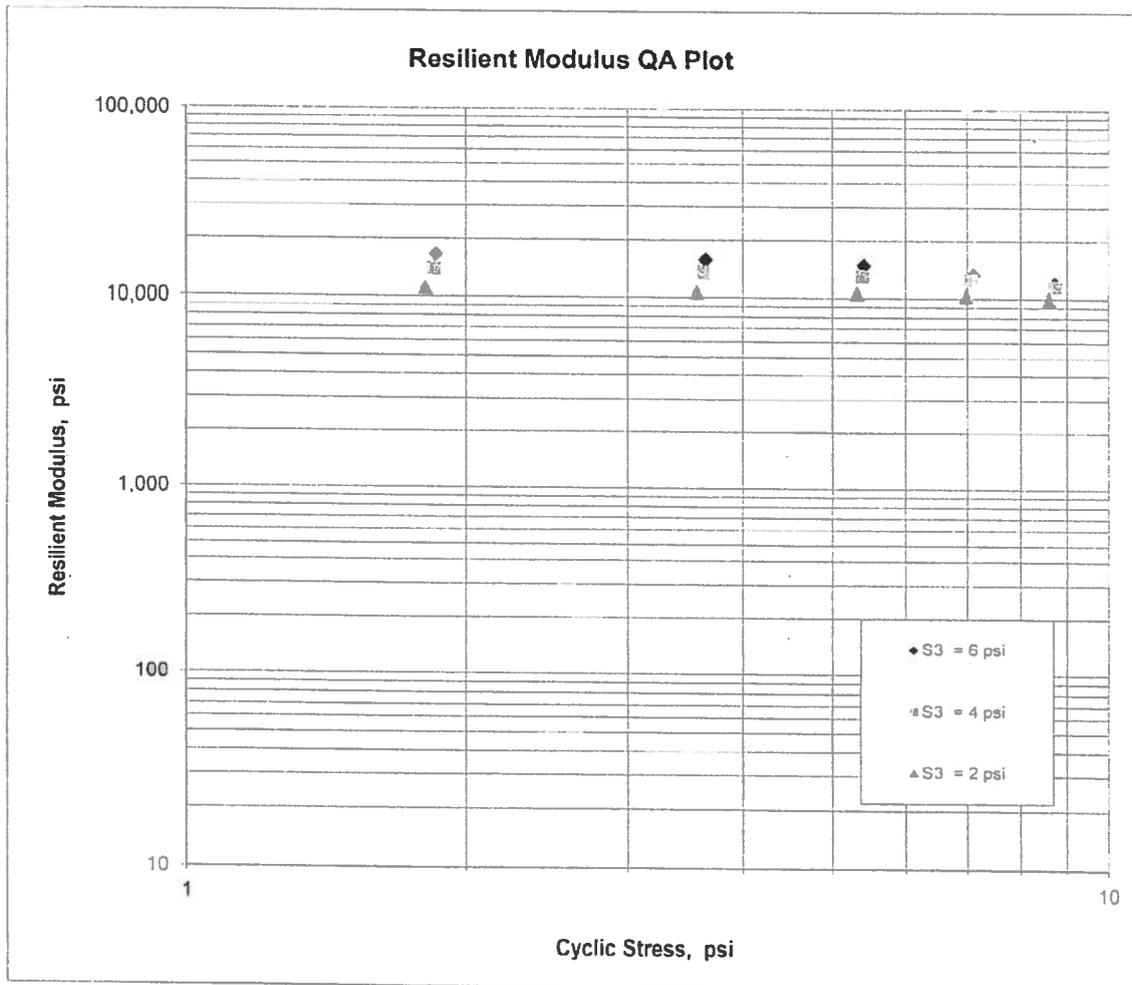
$$M_R = K_1 (S_c)^{K_2} (S_3)^{K_5}$$

$$K_1 = 10,376$$

$$K_2 = -0.12389$$

$$K_5 = 0.29220$$

$$R^2 = 0.92$$



**ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT  
MATERIALS DIVISION**

**AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS  
RECOMPACTED SAMPLES**

<b>Job No.</b>	050249	<b>Material Code</b>	SSRVPS
<b>Date Sampled:</b>	04/29/2014	<b>Station No.:</b>	299+50
<b>Date Tested:</b>	April 29, 2014	<b>Location:</b>	CL
<b>Name of Project:</b>	HWY.36 (GR & STRS.)(S)		
<b>County:</b>	<b>Code:</b> 73	<b>Name:</b> WHITE	
<b>Sampled By:</b>	FAULKNER	<b>Depth:</b>	0-5
<b>Lab No.:</b>	20141077	<b>AASHTO Class:</b>	A-4(0)
<b>Sample ID:</b>	RV350	<b>Material Type (1 or 2):</b>	2
<b>LATITUDE:</b>		<b>LONGITUDE:</b>	

**1. Testing Information:**

Preconditioning - Permanent Strain > 5% (Y=Yes or N= No)	N
Testing - Permanent Strain > 5% (Y=Yes or N=No)	N
Number of Load Sequences Completed (0-15)	15

**2. Specimen Information:**

Specimen Diameter (in):	
Top	3.95
Middle	3.94
Bottom	3.95
Average	3.95
Membrane Thickness (in):	0.01
Height of Specimen, Cap and Base (in):	8.03
Height of Cap and Base (in):	0.00
Initial Length, Lo (in):	8.03
Initial Area, Ao (sq. in):	12.16
Initial Volume, AoLo (cu. in):	97.64

**3. Soil Specimen Weight:**

Weight of Wet Soil Used (g):	3339.60
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**4. Soil Properties:**

Optimum Moisture Content (%):	13.6
Maximum Dry Density (pcf):	116
95% of MDD (pcf):	110.2
In-Situ Moisture Content (%):	N/A

**5. Specimen Properties:**

Wet Weight (g):	3339.60
Compaction Moisture content (%):	13.6
Compaction Wet Density (pcf):	130.32
Compaction Dry Density (pcf):	114.72
Moisture Content After Mr Test (%):	13.7

**6. Quick Shear Test (Y=Yes, N=No, N/A=Not Applicable):**

#VALUE!

**7. Resilient Modulus, Mr:**

7317(Sc)<sup>-0.15200(S3)<sup>0.45107</sup></sup>

**8. Comments**

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**9. Tested By:** MW/DT

**Date:** April 29, 2014

**ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT  
MATERIALS DIVISION**

**AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS  
RECOMPACTED SAMPLES**

Job No. 050249 Material Code SSRVPS  
 Date Sampled: 04/29/2014 Station No.: 299+50  
 Date Tested: April 29, 2014 Location: CL  
 Name of Project: HWY.36 (GR & STRS.)X(S)  
 County: Code: 73 Name: WHITE  
 Sampled By: FAULKNER Depth: 0-5  
 Lab No.: 20141077 AASHTO Class: A-4(0)  
 Sample ID: RV350 Material Type (1 or 2): 2  
 LATITUDE: LONGITUDE:

PARAMETER	DESIGNATION UNIT	Chamber	Nominal	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Average	Resilient	Resilient
		Confining Pressure	Maximum Axial Stress	Applied Max. Axial Load	Applied Cyclic Load	Applied Contact Load	Applied Max. Axial Stress	Applied Cyclic Stress	Applied Contact Stress	Recov Def. LVDT 1 and 2	Strain	Modulus	
		S <sub>3</sub> psi	S <sub>cyclic</sub> psi	P <sub>max</sub> lbs	P <sub>cyclic</sub> lbs	P <sub>contact</sub> lbs	S <sub>max</sub> psi	S <sub>cyclic</sub> psi	S <sub>contact</sub> psi	H <sub>avg</sub> in	ε <sub>r</sub> in/in	M <sub>r</sub> psi	
Sequence 1		6.0	2.0	25.0	22.4	2.6	2.1	1.8	0.2	0.00099	0.00012	14,983	
Sequence 2		6.0	4.0	47.0	44.4	2.6	3.9	3.7	0.2	0.00209	0.00026	14,017	
Sequence 3		6.0	6.0	69.7	66.2	3.5	5.7	5.4	0.3	0.00333	0.00041	13,130	
Sequence 4		6.0	8.0	93.2	87.2	6.0	7.7	7.2	0.5	0.00480	0.00060	12,000	
Sequence 5		6.0	10.0	116.7	108.1	8.6	9.6	8.9	0.7	0.00623	0.00078	11,466	
Sequence 6		4.0	2.0	25.0	22.3	2.7	2.1	1.8	0.2	0.00120	0.00015	12,270	
Sequence 7		4.0	4.0	46.4	43.6	2.8	3.8	3.6	0.2	0.00255	0.00032	11,314	
Sequence 8		4.0	6.0	67.7	64.8	2.9	5.6	5.3	0.2	0.00409	0.00051	10,465	
Sequence 9		4.0	8.0	91.0	85.7	5.3	7.5	7.0	0.4	0.00565	0.00070	10,025	
Sequence 10		4.0	10.0	114.6	106.8	7.7	9.4	8.8	0.6	0.00728	0.00091	9,693	
Sequence 11		2.0	2.0	24.4	21.6	2.8	2.0	1.8	0.2	0.00155	0.00019	9,194	
Sequence 12		2.0	4.0	45.0	42.2	2.8	3.7	3.5	0.2	0.00344	0.00043	8,084	
Sequence 13		2.0	6.0	65.2	62.4	2.9	5.4	5.1	0.2	0.00536	0.00067	7,684	
Sequence 14		2.0	8.0	87.3	83.0	4.3	7.2	6.8	0.4	0.00718	0.00089	7,639	
Sequence 15		2.0	10.0	110.0	103.1	6.9	9.0	8.5	0.6	0.00912	0.00114	7,472	

TESTED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 REVIEWED BY \_\_\_\_\_ DATE \_\_\_\_\_

**ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT  
MATERIALS DIVISION**

**AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS  
RECOMPACTED / THINWALL TUBE SAMPLES**

<b>Job No.</b>	050249	<b>Material Code</b>	SSRVPS
<b>Date Sampled:</b>	04/29/2014	<b>Station No.:</b>	299+50
<b>Date Tested:</b>	April 29, 2014	<b>Location:</b>	CL
<b>Name of Project:</b>	HWY.36 (GR & STRS.)(S)		
<b>County:</b>	<b>Code:</b> 73	<b>Name:</b>	WHITE
<b>Sampled By:</b>	FAULKNER	<b>Depth:</b>	0-5
<b>Lab No.:</b>	20141077	<b>AASHTO Class:</b>	A-4(0)
<b>Sample ID:</b>	RV350	<b>Material Type (1 or 2):</b>	2
<b>LATITUDE:</b>		<b>LONGITUDE:</b>	

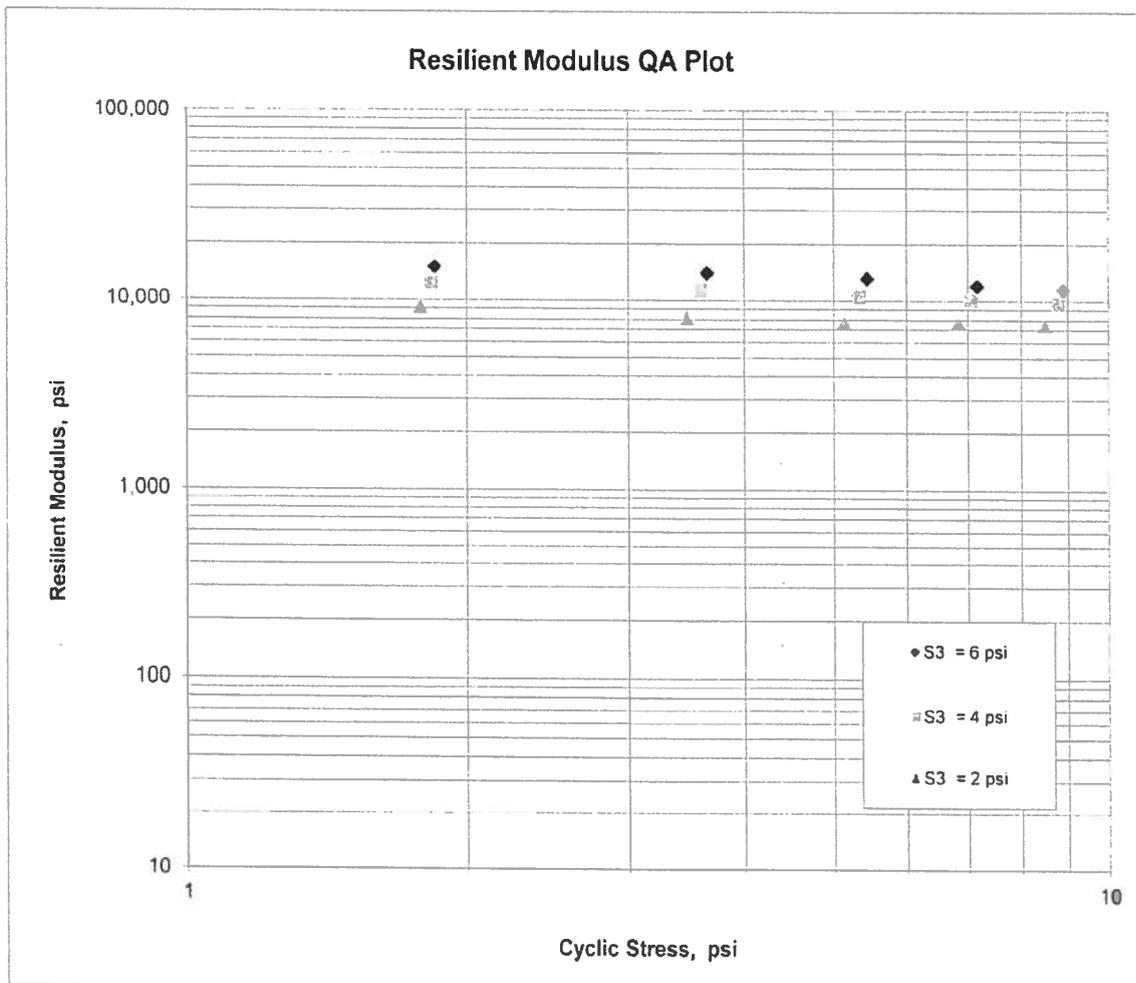
$$M_R = K_1 (S_c)^{K_2} (S_3)^{K_5}$$

$$K_1 = 7,317$$

$$K_2 = -0.15200$$

$$K_5 = 0.45107$$

$$R^2 = 0.99$$



JOB: 050249

Arkansas State Highway Transportation Department

JOB NAME: HWY.36-HWY.16 (GR.&STRS.) (S)

Materials Division

COUNTY NO. 73 DATE TESTED 4/22/2014

Michael Benson, Materials Engineer

STA.#	LOC.	DEPTH	COLOR	#					L.L.	P.I.	SOIL CLASS	LAB #:	%MOISTURE
				#4	#10	#40	#80	#200					
102+50	20'LT	0-5	BR/GR	83	70	61	58	54	28	10	A-4(3)	RV348	
181+50	CL	0-5	BR/GR	95	92	91	87	81	34	15	A-6(11)	RV349	
299+00	CL	0-5	BR/GR	88	82	80	78	56	21	02	A-4(0)	RV350	
102+50	20LT	0-5	BR/GR	89	77	66	63	60	34	15	A-6(7)	S335	20.6
154+70	CL	0-3.5Z	BR/GR	95	93	90	81	63	27	10	A-4(4)	S336	20.6
174+00	CL	0-2Z	BR/GR	92	85	79	68	45	ND	NP	A-4(0)	S337	14.1
181+50	CL	0-5	BR/GR	96	93	92	87	80	34	14	A-6(10)	S338	22.9
190+00	CL	0-4.5Z	BR/GR	95	93	91	90	88	79	52	A-7-6(52)	S339	33.2
214+35	CL	0-5	BR/GR	88	80	75	70	65	40	25	A-6(14)	S340	18.5
222+00	CL	0-5	BR/GR	95	86	79	72	53	26	11	A-6(3)	S341	20.2
254+00	CL	0-5	BR/GR	97	92	87	85	80	31	13	A-6(9)	S342	19.6
262+00	CL	0-5	BR/GR	97	85	75	73	67	30	11	A-6(5)	S343	19.2
278+00	CL	0-2.5Z	BR/GR	98	96	92	88	59	ND	NP	A-4(0)	S344	17.3
286+00	CL	0-4Z	BR/GR	100	98	96	94	87	25	08	A-4(5)	S345	9.6
294+00	CL	0-5	BR/GR	96	93	90	87	70	27	08	A-4(4)	S346	18.5
299+00	CL	0-5	BR/GR	86	81	78	75	61	23	05	A-4(1)	S347	14

comments: LOCATIONS MEASURED FROM C L OF CONSTRUCTION, Z=AUGER REFUSAL

Friday, May 02, 2014













# ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT

September 11, 2014

**TO:** Mr. Trinity Smith, Roadway Engineer

**SUBJECT:** Job No. 050249 (Slope Recommendations)  
Hwy 36 – Hwy 16 (Gr & Strs) (S)  
Route 13  
White County

Transmitted herewith are the logs of the borings conducted for the excavation of the cut slopes of the above referenced job. The samples obtained by the Standard Penetration Tests were brought to the laboratory and visually classified by experienced lab personnel to confirm the field identifications. The rock cores are available for inspection at the Materials Division.

The Materials Division has reviewed the proposed cut slopes at Stations 167+00 to 181+00 and 215+00 – 235+00 on the above referenced project. Table 1 indicates the location and elevation at which competent rock was encountered during drilling. At Stations 167+00 to 177+00, the excavation will require blasting in order to achieve the recommended slopes and should be excavated in accordance with Section 210 of the Standard Specifications. The rock cut should be excavated using a 1/4H:1V slope. The rock cut slopes should be benched at a maximum of 20 vertical feet, and the bench should be a minimum of 10 feet wide. Also, a 10 foot catchment should be established at the base of cuts to provide a cleanout area. Soil should be excavated on a 2H:1V slope with a 5' bench from its interface with rock continuing to the top of backslope. At Stations 215+00 to 235+00, highly weathered shale with sandstone layers and sandstone with clay seams was encountered. It is unlikely that this material would hold a near vertical face. Therefore, it is recommended that these slopes be constructed utilizing a 2:1 back slope with a 5 foot horizontal bench every 20 vertical feet. This configuration should also be utilized at Stations 177+00 to 181+00. Cross-sections have been attached to illustrate these recommendations.

Table 1: Competent Rock Location

Location	Centerline Offset	Elevation
167+00	48' LT	363.1
169+00	70' LT	402.1
171+00	39' LT	387.2
173+00	44' RT	407.3
175+00	32' LT	447.1
177+00	39' RT	435.3

If you have any questions concerning these recommendations, please contact the Geotechnical Section.



Michael C. Benson  
Materials Engineer

MCB:rpt:tgf  
Attachment

cc: State Construction Engineer - Master File Copy  
District 5 Engineer  
G.C. File

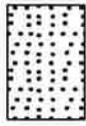
# LEGEND

## SOIL TYPES

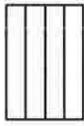
( SHOWN IN SYMBOL COLUMN )  
( PREDOMINANT TYPE SHOWN HEAVY )



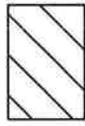
GRAVEL



SAND



SILT



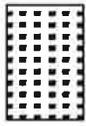
CLAY



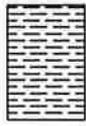
ORGANIC  
MATTER

## ROCK TYPES

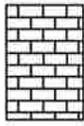
( SHOWN IN SYMBOL COLUMN )



SANDSTONE



SHALE  
or  
SILTSTONE



LIMESTONE  
or  
DOLOMITE



ALTERNATING  
LAYERS of  
SHALE and  
SANDSTONE



OTHER

## SAMPLER TYPES

( SHOWN IN SAMPLE COLUMN )

### SHELBY TUBE



UNDISTURBED  
SAMPLE  
RECOVERY



DISTURBED  
SAMPLE  
RECOVERY



NO  
RECOVERY

### SPLIT SPOON



SAMPLE  
RECOVERY



NO  
RECOVERY

### ROCK CORING



% RECOVERY  
INDICATED ON LOGS

## TERMS DESCRIBING CONSISTENCY OR CONDITION

GRANULAR SOIL		CLAY		CLAY-SHALE		SHALE	
*N' Value	Density	*N' Value	Consistency	*N' Value	Consistency	*N' Value	Consistency
0-4	Very Loose	0-1	Very Soft	0-1	Very Soft		
5-10	Loose	2-4	Soft	2-4	Soft	31-60	Soft
11-30	Medium Dense	5-8	Medium Stiff	5-8	Medium Stiff	Over 60	
31-50	Dense	9-15	Stiff	9-15	Stiff	More than 2'	
Over 50	Very Dense	16-30	Very Stiff	16-30	Very Stiff	Penetration	
		31-60	Hard	31-60	Hard	in 60 Blows	Medium Hard
		Over 60	Very Hard	Over 60	Very Hard	Less than 2'	
						Penetration	
						in 60 Blows	Hard

1. Ground water elevations indicated on boring logs represent ground water elevations at date or time shown on boring log. Absence of water surface implies that no ground water data is available but does not necessarily mean that ground water will not be encountered at locations or within the vertical reaches of these borings.
2. Borings represent subsurface conditions at their respective locations for their respective depths. Variations in conditions between or adjacent to boring locations may be encountered.
3. Terms used for describing soils according to their texture or grain size distribution are in accordance with the Unified Soil Classification System.

Standard Penetration Test – Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and performing the test are recorded for each 6 inches of penetration on the drill log. The field "N" Value ( $N_f$ ) can be obtained by

adding the bottom two numbers for example:  $\frac{6}{8-9} \Rightarrow 8+9 = 17 \text{ blows/ft}$ . The "N" Value corrected to 60% efficiency ( $N_{60}$ ) can be obtained by multiplying  $N_f$  by the hammer correction factor published on the boring log.

ARKANSAS HWY. & TRANS. DEPARTMENT MATERIALS DIVISION - GEOTECHNICAL SEC.					BORING NO. CUT-1 PAGE 1 OF 1							
JOB NO. 050249 White County					DATE: August 13, 2014							
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.) S.H. 13 Extension					TYPE OF DRILLING: Hollow Stem Auger & Diamond Coring							
STATION: 167+00					EQUIPMENT: CME 850 w/ CME Automatic Hammer							
LOCATION: 48' Left of Center Line of Construction					HAMMER CORRECTION FACTOR: 1.23							
LOGGED BY: Raymond Taylor												
COMPLETION DEPTH: 33.6												
DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R Q D
			SURFACE ELEVATION: 386.7									
5			Moist, Very Dense, Reddish Brown, Sand with clay and Gravel (Sandstone Fragments)							25 30-22		
10			SANDSTONE - Reddish Brown, Poorly-Cemented							60 (4")		
15			Moist, Stiff, Mottled Brown Clay with Poorly-Cemented Sandstone Layers								31	0
20			SHALE - Dark Gray, Laminated, Highly weathered, Soft, with Slight Dip								57	0
25			SANDSTONE - Gray and Reddish Brown, Thin Bedded, Cemented, with Slight Dip and Trace of Pyrite								30*	0
30			SANDSTONE WITH DARK GRAY WEATHERED SHALE LAYERS - Gray, Very Thin Bedded, Poorly-Cemented, with Slight Dip								88	0
35			Boring Terminated									

REMARKS: \* Poor core recovery due to inner core barrel not locking in.

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-2  
PAGE 1 OF 2

JOB NO. 050249 White County  
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
S.H. 13 Extension  
STATION: 169+00  
LOCATION: 70' Left of Center Line of Construction  
LOGGED BY: Raymond Taylor

DATE: August 6, 2014  
TYPE OF DRILLING: Hollow Stem Auger &  
Diamond Coring  
EQUIPMENT: CME 850 w/ CME  
Automatic Hammer  
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 48.1

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R O D
			SURFACE ELEVATION: 415.2									
5			SANDSTONE - Brown and Gray, Poorly-Cemented							60 (.01")	66	20
10											20	0
15			SANDSTONE WITH CLAY LAYERS - Mottled Brown and Gray, Thin Bedded, Weathered, Cemented, with Slight Dip, and Fractured Layers								80	0
20											88	18
25											54	0
30			WEATHERED SHALE WITH GRAY AND BROWN SANDSTONE LAYERS - Dark Gray, Laminated, Medium Hard, with Slight Dip								80	0
35												

REMARKS:

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-2  
PAGE 2 OF 2

JOB NO. 050249 White County  
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
S.H. 13 Extension  
STATION: 169+00  
LOCATION: 70' Left of Center Line of Construction  
LOGGED BY: Raymond Taylor

DATE: August 6, 2014  
TYPE OF DRILLING: Hollow Stem Auger &  
Diamond Coring  
EQUIPMENT: CME 850 w/ CME  
Automatic Hammer  
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 48.1

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R Q D
			SURFACE ELEVATION: 415.2									
40			SANDSTONE WITH DARK GRAY WEATHERED SHALE LAYERS - Gray, Thin to Medium Bedded, Cemented, with Slight Dip								80	14
45			WEATHERED SHALE WITH GRAY SANDSTONE SEAMS - Dark Gray, Laminated, Medium Hard, with Slight Dip								66	8
50			Boring Terminated								100	0
55												
60												
65												
70												

REMARKS:

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-3

PAGE 1 OF 2

JOB NO. 050249 White County  
 JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
 S.H. 13 Extension  
 STATION: 171+00  
 LOCATION: 39' Left of Center Line of Construction  
 LOGGED BY: Raymond Taylor

DATE: August 11, 2014  
 TYPE OF DRILLING: Hollow Stem Auger &  
 Diamond Coring  
 EQUIPMENT: CME 850 w/ CME  
 Automatic Hammer  
 HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 53

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R O D
			SURFACE ELEVATION: 425.2									
5		⊗	Moist, Very Stiff to Hard, Reddish Brown Clay							7 11-13		
10		⊗	Moist, Hard, Reddish Brown Clay with Gravel (Sandstone Fragments)							22 24-30		
			Moist, Stiff, Brown and Gray Clay with Gravel (Sandstone Fragments)								42	0
15			Moist, Stiff, Brown and Gray Clay with Poorly- Cemented Sandstone Layers								60	0
20											60	0
25			SHALE WITH BROWN AND GRAY SANDSTONE LAYERS - Gray and Brown, Laminated, Highly Weathered, Soft, with Slight Dip								88	0
30											62	0
			SHALE - Dark Gray, Laminated, Weathered, Medium Hard, with Slight Dip									
35												

REMARKS:

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-3  
PAGE 2 OF 2

JOB NO. 050249 White County  
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
S.H. 13 Extension  
STATION: 171+00  
LOCATION: 39' Left of Center Line of Construction  
LOGGED BY: Raymond Taylor

DATE: August 11, 2014  
TYPE OF DRILLING: Hollow Stem Auger &  
Diamond Coring  
EQUIPMENT: CME 850 w/ CME  
Automatic Hammer  
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 53

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R Q D
			SURFACE ELEVATION: 425.2									
40			SHALE - Dark Gray and Brown, Laminated, Highly Weathered, Medium Hard, with Moderate Dip								80	0
45			SHALE WITH WEATHERED SHALE LAYERS - Dark Gray and Brown, Laminated, Medium Hard, with Moderate Dip								40	0
50			SHALE WITH WEATHERED SHALE LAYERS - Dark Gray, Laminated, Medium Hard, with Moderate Dip and Slickensides								100	50
55			Boring Terminated								92	16
60												
65												
70												

REMARKS:

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-4

PAGE 1 OF 2

JOB NO. 050249 White County  
 JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
 S.H. 13 Extension  
 STATION: 173+00  
 LOCATION: 44' Right of Center Line of Construction  
 LOGGED BY: Raymond Taylor

DATE: August 12, 2014  
 TYPE OF DRILLING: Hollow Stem Auger &  
 Diamond Coring  
 EQUIPMENT: CME 850 w/ CME  
 Automatic Hammer  
 HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 53.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R Q D
5			Moist, Very Hard, Reddish Brown and Gray Clay with Gravel (Sandstone Fragments)							22 60 (2")		
10			Moist, Stiff, Reddish Brown and Gray Clay with Poorly-Cemented Sandstone Layers								42	0
15			Moist, Stiff, Reddish Brown and Gray Clay with Poorly-Cemented Sandstone Layers								8	0
20			SANDSTONE - Gray and Brown, Thin Bedded, Cemented, with Slight Dip								8	0
25			SHALE WITH GRAY SANDSTONE LAYERS - Dark Gray, Laminated, Weathered, Soft, with Slight Dip								22*	0
30			SHALE WITH WEATHERED SHALE LAYERS AND GRAY SANDSTONE SEAMS - Dark Gray, Laminated, Medium Hard, with Slight Dip								90	0
35			SHALE WITH WEATHERED SHALE LAYERS AND GRAY SANDSTONE SEAMS - Dark Gray, Laminated, Medium Hard, with Slight Dip								98	20

REMARKS: \* Poor core recovery due to inner core barrel not locking in.

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-4  
PAGE 2 OF 2

JOB NO. 050249 White County  
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
S.H. 13 Extension  
STATION: 173+00  
LOCATION: 44' Right of Center Line of Construction  
LOGGED BY: Raymond Taylor

DATE: August 12, 2014  
TYPE OF DRILLING: Hollow Stem Auger &  
Diamond Coring  
EQUIPMENT: CME 850 w/ CME  
Automatic Hammer  
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 53.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R O D
			SURFACE ELEVATION: 436.1									
40			SHALE WITH GRAY SANDSTONE SEAMS - Dark Gray, Laminated, Slightly Weathered, Medium Hard, with Slight Dip								96	22
45											100	20
50											100	66
55											98	60
60			Boring Terminated									
65												
70												

REMARKS: \* Poor core recovery due to inner core barrel not locking in.

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-5  
PAGE 1 OF 2

JOB NO. 050249 White County  
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
S.H. 13 Extension  
STATION: 175+00  
LOCATION: 32' Left of Center Line of Construction  
LOGGED BY: Raymond Taylor

DATE: August 5, 2014  
TYPE OF DRILLING: Hollow Stem Auger &  
Diamond Coring  
EQUIPMENT: CME 850 w/ CME  
Automatic Hammer  
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 58.1

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R Q D
			SURFACE ELEVATION: 450.2									
			SANDSTONE - Mottled Brown, Poorly-Cemented									
5			SANDSTONE WITH CLAY SEAMS - Mottled Brown, Thin Bedded, Slightly Weathered, Cemented, with Slight Dip and Fractured Layers								78	0
10			SANDSTONE WITH CLAY LAYERS - Mottled Brown and Gray, Medium Bedded, Slightly Weathered, Cemented, with Slight Dip								88	30
15											88	28
20			SHALE - Dark Gray, Laminated, Weathered, Medium Hard, with Slight Dip								88	38
25			SANDSTONE WITH DARK GRAY SHALE SEAMS - Gray, Medium Bedded, Weathered, Cemented, with Slight Dip and Fractured Layers								90	40
30			SANDSTONE WITH DARK GRAY SHALE SEAMS - Gray, Thin Bedded, Weathered, Cemented, with Slight Dip and Fractured Layers								100	0
35												

REMARKS:

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-5  
PAGE 2 OF 2

JOB NO. 050249 White County  
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
S.H. 13 Extension  
STATION: 175+00  
LOCATION: 32' Left of Center Line of Construction  
LOGGED BY: Raymond Taylor

DATE: August 5, 2014  
TYPE OF DRILLING: Hollow Stem Auger &  
Diamond Coring  
EQUIPMENT: CME 850 w/ CME  
Automatic Hammer  
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 58.1

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R O D
			SURFACE ELEVATION: 450.2									
40			SHALE WITH WEATHERED SHALE SEAMS - Dark Gray, Laminated, Medium Hard, with Slight Dip								100	0
45											88	0
50			SHALE WITH GRAY SANDSTONE SEAMS - Dark Gray, Laminated, Medium Hard, with Slight Dip								100	38
55											100	62
60			Boring Terminated									
65												
70												

REMARKS:

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-6

PAGE 1 OF 2

JOB NO. 050249 White County  
 JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
 S.H. 13 Extension  
 STATION: 177+00  
 LOCATION: 39' Right of Center Line of Construction  
 LOGGED BY: Raymond Taylor

DATE: August 5, 2014  
 TYPE OF DRILLING: Hollow Stem Auger &  
 Diamond Coring  
 EQUIPMENT: CME 850 w/ CME  
 Automatic Hammer  
 HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 42.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R Q D
			SURFACE ELEVATION: 441.8									
5		X	SANDSTONE - Mottled Brown, Poorly-Cemented							43 39-60 (4")		
			SANDSTONE - Mottled Brown, Cemented								89	0
10			SANDSTONE WITH CLAY SEAMS - Mottled Brown, Very Thin Bedded, Weathered, Cemented, with Slight Dip and Fractured Layers *							62	0	
15			SANDSTONE WITH CLAY LAYERS - Mottled Brown and Gray, Very Thin Bedded, Weathered, Cemented, with Slight Dip *							80	18	
20											62	0
25			WEATHERED SHALE WITH GRAY AND BROWN SANDSTONE LAYERS - Dark Gray, Laminated, Medium Hard, with Slight Dip *							90	11	
30											96	0
35												

REMARKS: \* Water loss was encountered from 7.4' to 42.4'.

<b>ARKANSAS HWY. &amp; TRANS. DEPARTMENT</b>		<b>BORING NO. CUT-6</b>	
<b>MATERIALS DIVISION - GEOTECHNICAL SEC.</b>		PAGE 2 OF 2	
JOB NO. 050249	White County	DATE:	August 5, 2014
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)	S.H. 13 Extension	TYPE OF DRILLING:	Hollow Stem Auger & Diamond Coring
STATION: 177+00		EQUIPMENT:	CME 850 w/ CME Automatic Hammer
LOCATION: 39' Right of Center Line of Construction		HAMMER CORRECTION FACTOR:	1.23
LOGGED BY: Raymond Taylor			

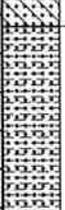
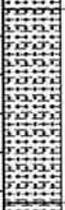
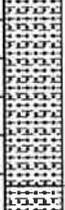
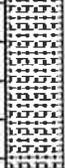
COMPLETION DEPTH: 42.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R Q D
			SURFACE ELEVATION: 441.8									
			SANDSTONE WITH DARK GRAY SHALE SEAMS - Gray and Brown, Medium Bedded, Weathered, Cemented, with Slight Dip and Fractured Layers *								78	38
40			SHALE WITH GRAY AND BROWN SANDSTONE LAYERS - Dark Gray, Laminated, Weathered, Medium Hard, with Slight Dip *								60	0
45			Boring Terminated									
50												
55												
60												
65												
70												

REMARKS: \* Water loss was encountered from 7.4' to 42.4'.

<b>ARKANSAS HWY. &amp; TRANS. DEPARTMENT MATERIALS DIVISION - GEOTECHNICAL SEC.</b>		BORING NO. CUT-7 PAGE 1 OF 1
JOB NO. 050249      White County	DATE: August 25, 2014	
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.) S.H. 13 Extension	TYPE OF DRILLING: Hollow Stem Auger & Diamond Coring	
STATION: 216+00	EQUIPMENT: CME 75 w/ CME Automatic Hammer	
LOCATION: 39' Left of Center Line of Construction	HAMMER CORRECTION FACTOR: 1.37	
LOGGED BY: Raymond Taylor		

COMPLETION DEPTH: 32.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R Q D
			SURFACE ELEVATION: 387.4									
5		X	Moist, Very Stiff, Brown Clay with Gravel (Sandstone Fragments)							5 8-13		
10		X	Moist, Very Hard, Mottled Brown and Gray Clay with Gravel (Sandstone and Shale Fragments)							19 13-60 (2")		
			SANDSTONE WITH CLAY AND HIGHLY WEATHERED SHALE LAYERS - Mottled Brown and Gray, Thin Bedded, Cemented, with Slight Dip								75	0
15			SHALE WITH SANDSTONE LAYERS - Dark Gray and Brown, Laminated, Highly Weathered, Medium Hard, with Slight Dip								80	0
20			SHALE WITH SANDSTONE LAYERS - Dark Gray and Brown, Laminated, Highly Weathered, Soft, with Slight Dip								58	0
25			SHALE WITH SANDSTONE LAYERS - Dark Gray and Brown, Laminated, Highly Weathered, Medium Hard, with Slight Dip								90	0
30			SHALE- Dark Gray and Brown, Laminated, Weathered, Medium Hard, with Slight Dip								100	0
			Boring Terminated									
35												

REMARKS:

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-8  
PAGE 1 OF 2

JOB NO. 050249 White County  
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
S.H. 13 Extension  
STATION: 218+00  
LOCATION: 39' Right of Center Line of Construction  
LOGGED BY: Raymond Taylor

DATE: August 27, 2014  
TYPE OF DRILLING: Hollow Stem Auger &  
Diamond Coring  
EQUIPMENT: CME 75 w/ CME Automatic  
Hammer  
HAMMER CORRECTION FACTOR: 1.37

COMPLETION DEPTH: 37.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R O D
			SURFACE ELEVATION: 392.9									
5		X	Moist, Very Stiff, Mottled Brown and Gray Clay with Gravel (Sandstone Fragments)							5 9-13		
10		X	Moist, Hard, Mottled Brown and Gray Clay							10 19-25		
15		X	Moist, Very Hard, Brown and Gray Clay with Sand and Gravel (Sandstone Fragments)							13 37-55	67	0
20			SANDSTONE WITH CLAY AND HIGHLY WEATHERED SHALE LAYERS - Mottled Brown and Gray, Very Thin Bedded, Poorly-Cemented, with Slight Dip								28	0
25			SANDSTONE WITH CLAY LAYERS - Mottled Brown and Gray, Thin Bedded, Cemented, with Slight Dip								56	0
30			SANDSTONE WITH CLAY LAYERS - Mottled Brown and Gray, Thin Bedded, Cemented, with Slight Dip								50	0
35			SHALE WITH SANDSTONE LAYERS - Dark									

REMARKS:

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-8  
PAGE 2 OF 2

JOB NO. 050249 White County  
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
S.H. 13 Extension  
STATION: 218+00  
LOCATION: 39' Right of Center Line of Construction  
LOGGED BY: Raymond Taylor

DATE: August 27, 2014  
TYPE OF DRILLING: Hollow Stem Auger &  
Diamond Coring  
EQUIPMENT: CME 75 w/ CME Automatic  
Hammer  
HAMMER CORRECTION FACTOR: 1.37

COMPLETION DEPTH: 37.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R O D
			SURFACE ELEVATION: 392.9									
			Gray and Brown, Laminated, Highly Weathered, Medium Hard, with Slight Dip								90	0
			Boring Terminated									
40												
45												
50												
55												
60												
65												
70												

REMARKS:

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-9

PAGE 1 OF 2

JOB NO. 050249 White County  
 JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
 S.H. 13 Extension  
 STATION: 220+00  
 LOCATION: 39' Right of Center Line of Construction  
 LOGGED BY: Raymond Taylor

DATE: August 26, 2014  
 TYPE OF DRILLING: Hollow Stem Auger &  
 Diamond Coring  
 EQUIPMENT: CME 75 w/ CME Automatic  
 Hammer  
 HAMMER CORRECTION FACTOR: 1.37

COMPLETION DEPTH: 38.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R O D
5			Moist, Very Stiff, Mottled Brown Clay							6 10-10		
10			Moist, Very Hard, Mottled Brown Clay with Gravel (Sandstone Fragments)							19 28-38		
15			SANDSTONE WITH CLAY AND HIGHLY WEATHERED SHALE LAYERS - Mottled Brown and Gray, Thin Bedded, Poorly-Cemented, with Slight Dip								52	0
20											84	0
25											68	0
30											84	0
35											84	0

REMARKS:

<b>ARKANSAS HWY. &amp; TRANS. DEPARTMENT MATERIALS DIVISION - GEOTECHNICAL SEC.</b>						BORING NO. CUT-9 PAGE 2 OF 2					
JOB NO. 050249 White County						DATE: August 26, 2014					
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.) S.H. 13 Extension						TYPE OF DRILLING: Hollow Stem Auger & Diamond Coring					
STATION: 220+00						EQUIPMENT: CME 75 w/ CME Automatic Hammer					
LOCATION: 39' Right of Center Line of Construction						HAMMER CORRECTION FACTOR: 1.37					
LOGGED BY: Raymond Taylor											
COMPLETION DEPTH: 38.4											
DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT. NO. OF BLOWS PER 6-IN.	% S C R	% R Q D
			SURFACE ELEVATION: 393.4								
			SHALE- Dark Gray and Brown, Laminated, Highly Weathered, Medium Hard, with Slight Dip							94	0
40			Boring Terminated								
45											
50											
55											
60											
65											
70											
REMARKS:											

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-10  
PAGE 1 OF 1

JOB NO. 050249 White County  
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
S.H. 13 Extension  
STATION: 222+00  
LOCATION: 37' Left of Center Line of Construction  
LOGGED BY: David Allen

DATE: August 18, 2014  
TYPE OF DRILLING: Hollow Stem Auger &  
Diamond Coring  
EQUIPMENT: CME 850 w/ CME  
Automatic Hammer  
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 31.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R O D
			SURFACE ELEVATION: 395.0									
5			Moist, Loose, Brown Sand with Clay							2 3-5		
10			Moist, Very Stiff, Brown and Gray Clay with Sand							4 7-9		
15			Moist, Hard, Brown and Gray Clay with Gravel (Sandstone and Quartz Fragments)							6 13-31		
20			CLAY WITH SANDSTONE AND SHALE FRAGMENTS - Moist, Hard, Brown and Gray								68	0
25											36	0
30			SANDSTONE WITH CLAY SEAMS - Brown, Thin Bedded, Weathered, Poorly-Cemented, with Slight Dip and Fractured Layers								74	0
											34	0
			Boring Terminated									
35												

REMARKS:

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-11  
PAGE 1 OF 1

JOB NO. 050249 White County  
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
S.H. 13 Extension  
STATION: 223+90  
LOCATION: 39' Left of Center Line of Construction  
LOGGED BY: David Allen

DATE: August 18, 2014  
TYPE OF DRILLING: Hollow Stem Auger &  
Diamond Coring  
EQUIPMENT: CME 850 w/ CME  
Automatic Hammer  
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 28.1

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R Q D
5		X	Moist, Hard, Brown to Brown and Gray Clay with Sand							9 14-22		
10		X								14 19-24		
15			CLAY WITH TRACE OF DARK GRAY SHALE - Moist, Hard, Brown and Gray								100	0
20											100	0
25			SHALE - Dark Gray and Brown, Laminated, Highly Weathered, Medium Hard, with Slight Dip								100	0
30			Boring Terminated									
35												

REMARKS:

JOB NO. 050249 White County JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.) S.H. 13 Extension STATION: 225+90 LOCATION: 24' Right of Center Line of Construction LOGGED BY: David Allen	DATE: August 19, 2014 TYPE OF DRILLING: Hollow Stem Auger & Diamond Coring EQUIPMENT: CME 850 w/ CME Automatic Hammer HAMMER CORRECTION FACTOR: 1.23
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COMPLETION DEPTH: 25.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R O D
			SURFACE ELEVATION: 396.0									
5	X		Moist, Stiff, Reddish Brown and Gray Clay							4 6-8		
10	X		Moist, Very Stiff, Brown and Gray Clay							6 9-18		
15	X		Moist, Very Stiff, Brown and Gray Clay with Gravel (Sandstone Fragments)							6 15-17		
20	X		Moist, Hard, Brown and Gray Clay with Gravel (Sandstone Fragments)							15 22-35		
25	X		SHALE - Brown and Gray, Highly Weathered, Medium Hard							11 17-42		
			Boring Terminated									
30												
35												

REMARKS:

**ARKANSAS HWY. & TRANS. DEPARTMENT  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. CUT-13  
PAGE 1 OF 1

JOB NO. 050249 White County  
JOB NAME: Hwy. 36 - Hwy. 16 (Gr. & Strs.)  
S.H. 13 Extension  
STATION: 228+00  
LOCATION: 39' Left of Center Line of Construction  
LOGGED BY: Tracy Henderson

DATE: August 19, 2014  
TYPE OF DRILLING: Hollow Stem Auger &  
Diamond Coring  
EQUIPMENT: CME 850 w/ CME  
Automatic Hammer  
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 19.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R O D
			SURFACE ELEVATION: 388.1									
5		X	Moist, Very Stiff, Reddish Brown Clay with Gravel (Sandstone Fragments)							12 13-14		
10		X	Moist, Very Stiff, Brown and Gray Clay with Trace of Gravel (Sandstone Fragments)							12 22-30		
15		X	SHALE - Brown and Dark Gray, Highly Weathered, Medium Hard							28 60 (3")		
20		X	Boring Terminated							32 60 (3")		
25												
30												
35												

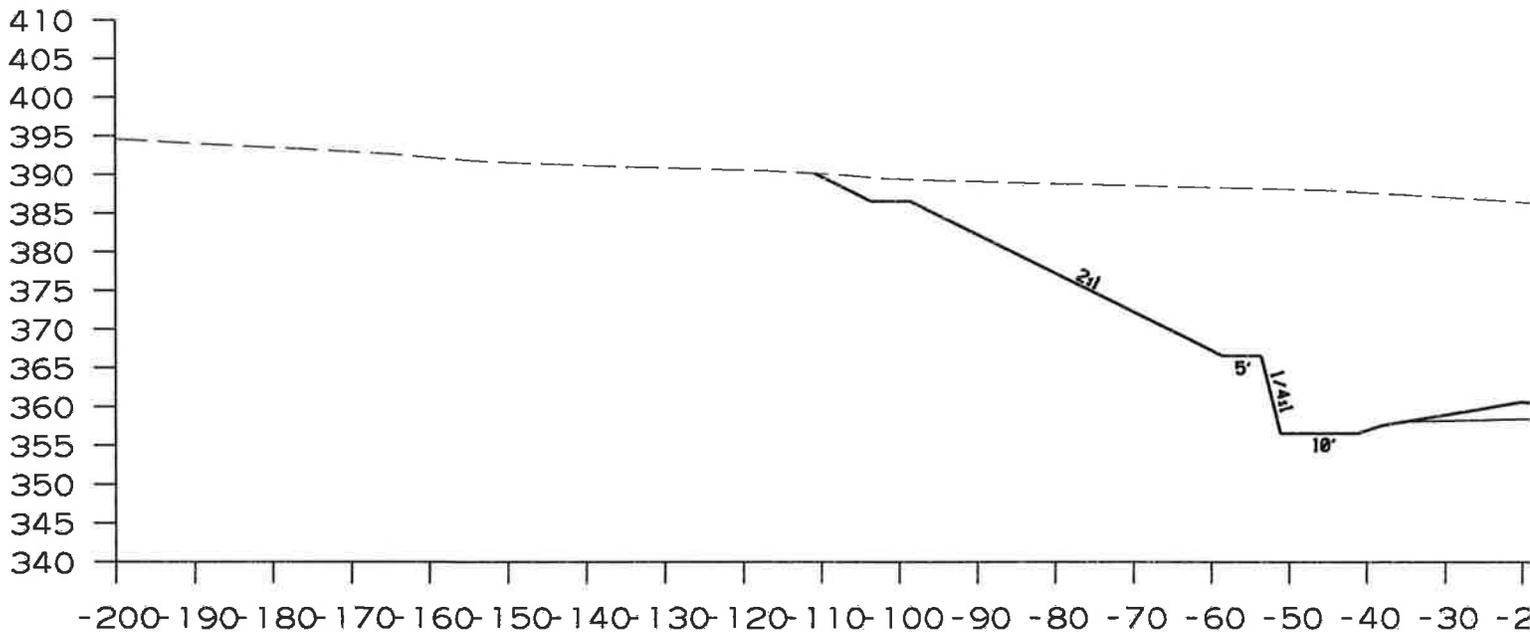
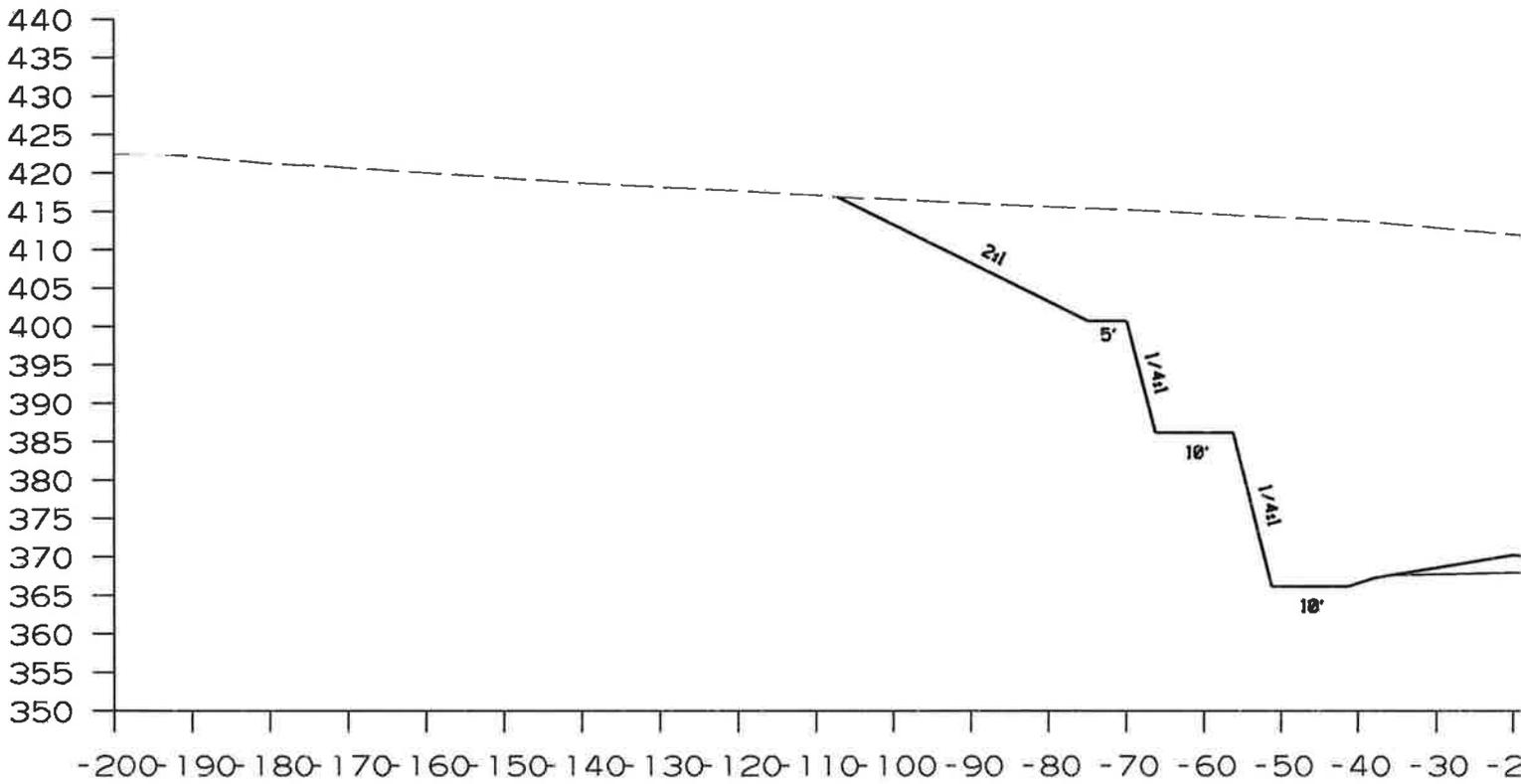
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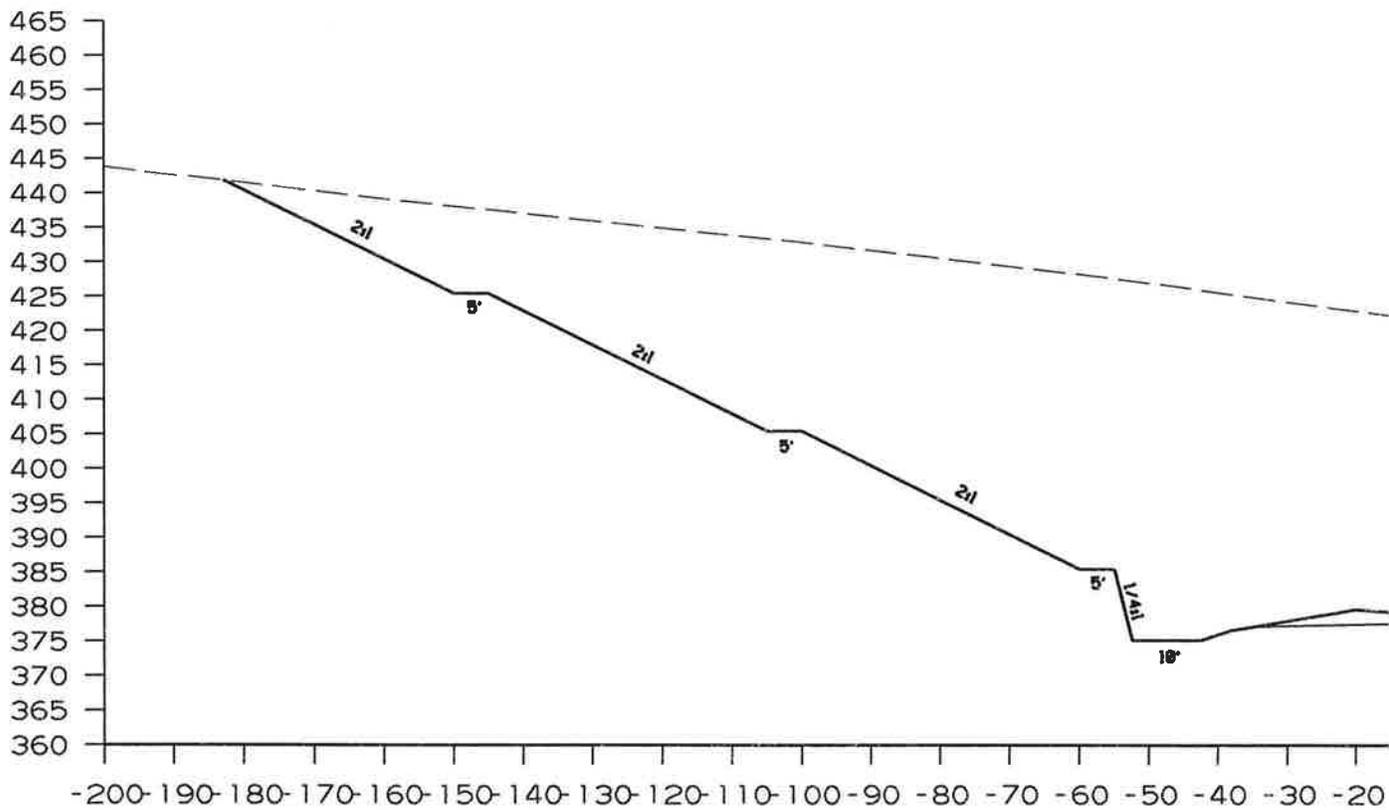
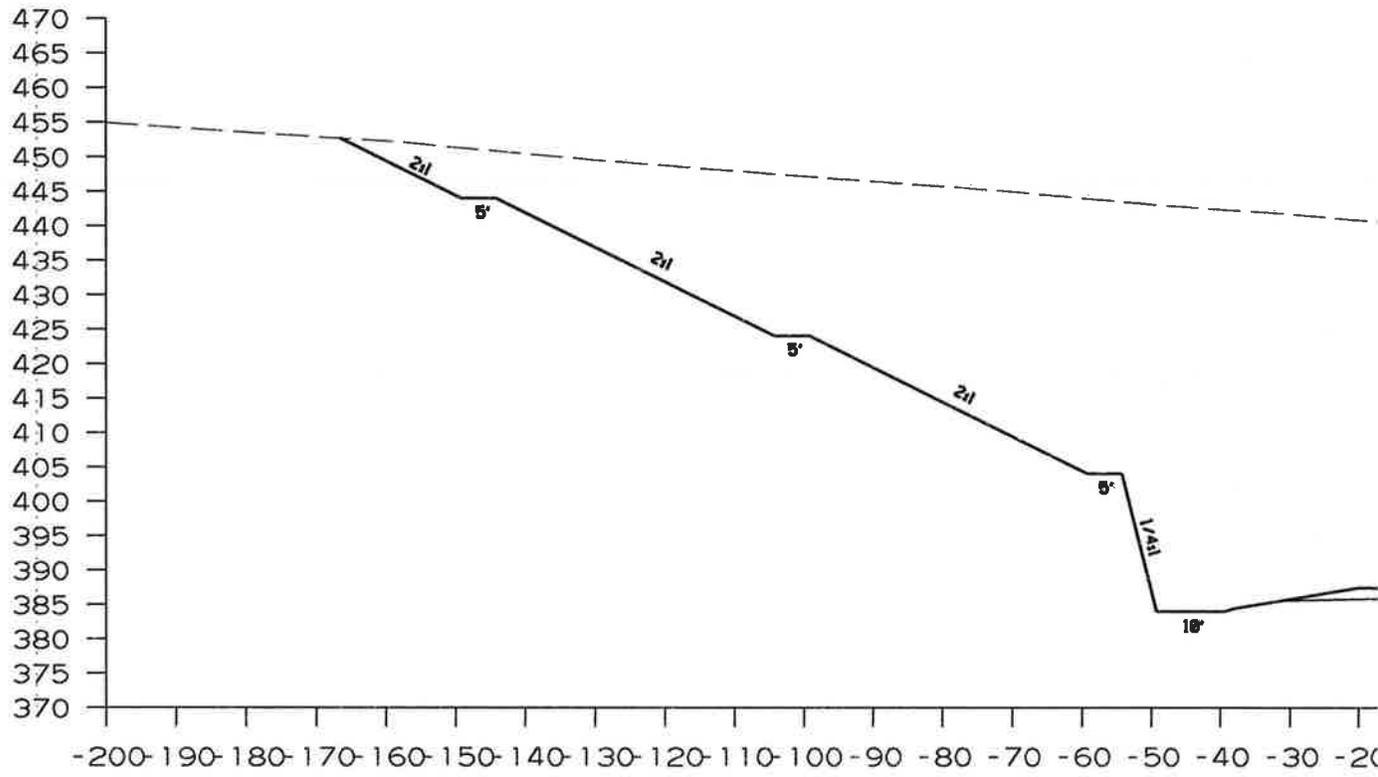
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JOB NO. 050249	White County	DATE:	August 20, 2014
JOB NAME:	Hwy. 36 - Hwy. 16 (Gr. & Strs.) S.H. 13 Extension	TYPE OF DRILLING:	Hollow Stem Auger & Diamond Coring
STATION:	229+92	EQUIPMENT:	CME 850 w/ CME Automatic Hammer
LOCATION:	39' Right of Center Line of Construction	HAMMER CORRECTION FACTOR:	1.23
LOGGED BY:	Tracy Henderson		

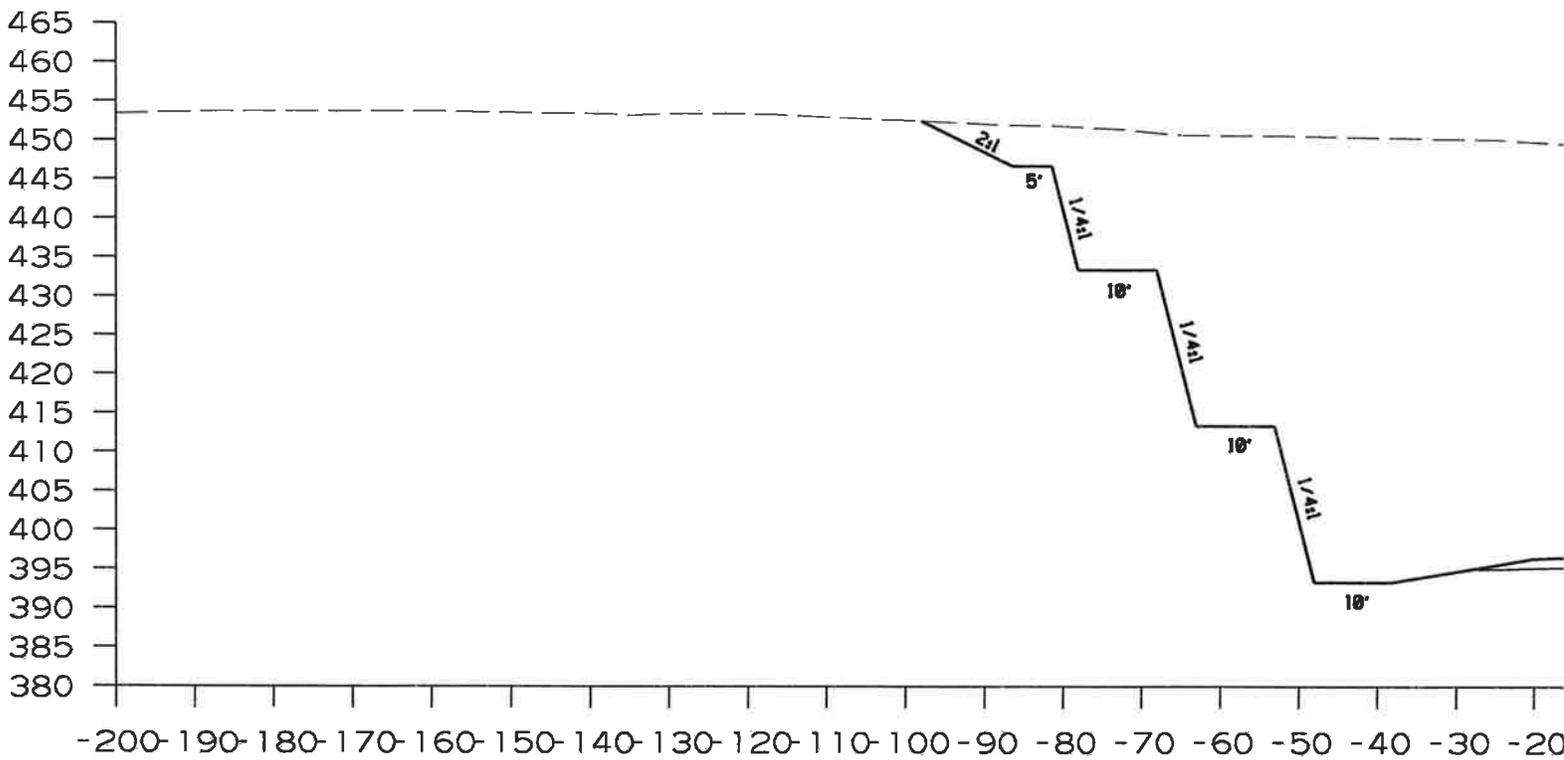
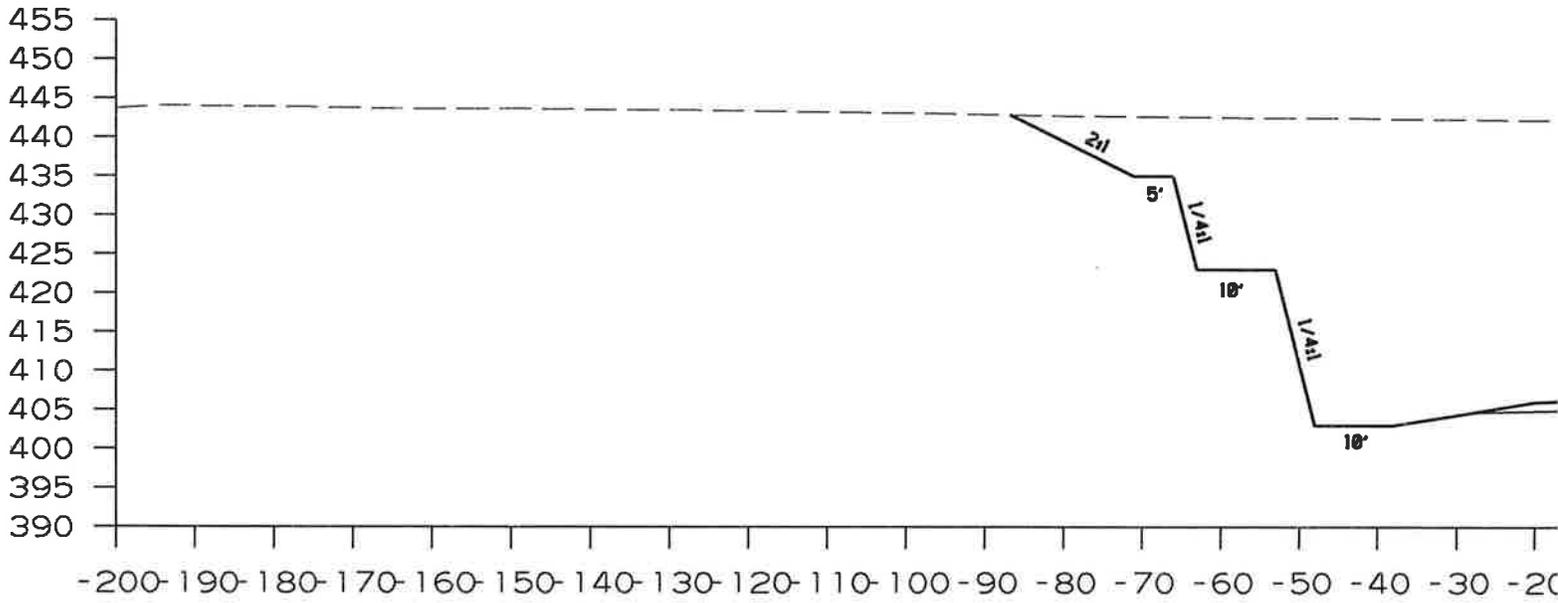
COMPLETION DEPTH: 32.7

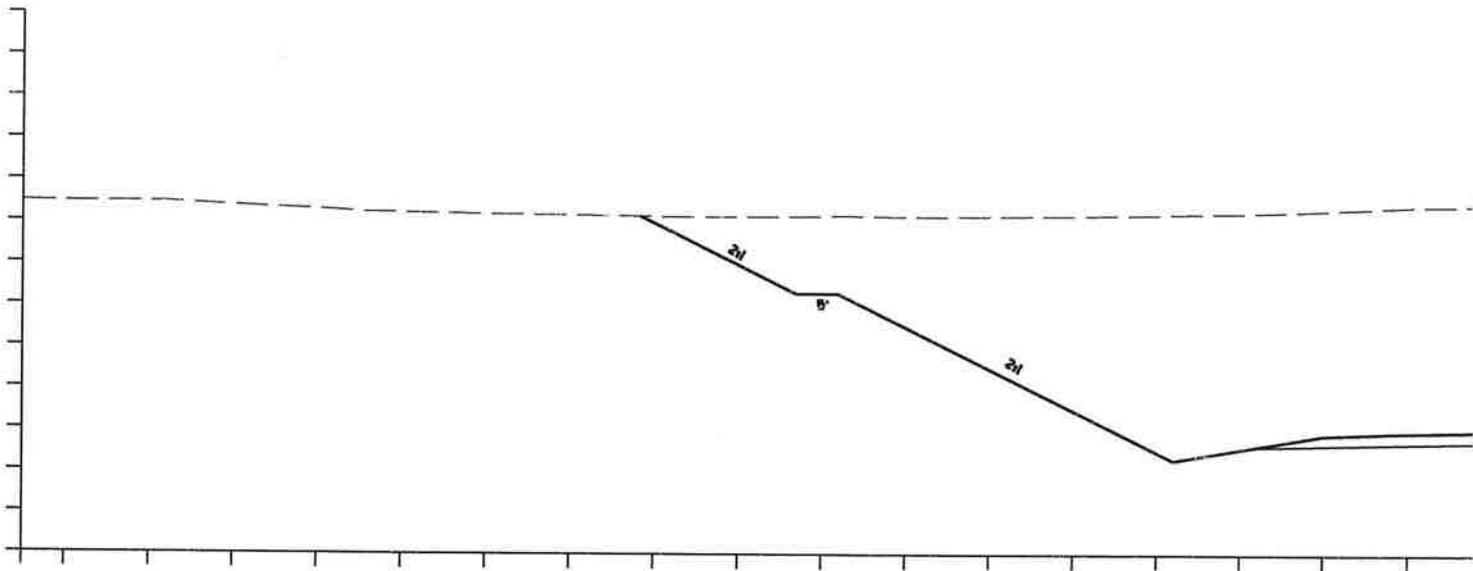
DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% S C R	% R O D
			SURFACE ELEVATION: 398.6									
5		X	SANDSTONE WITH CLAY SEAMS - Reddish Brown, Poorly-Cemented							32 41-60 (3")		
			ALTERNATING LAYERS OF SANDSTONE AND VERY STIFF MOTTLED CLAY - Reddish Brown and Gray, Thin Bedded, Slightly Weathered, Cemented, with Slight Dip								85	0
10			ALTERNATING LAYERS OF SANDSTONE AND VERY STIFF MOTTLED CLAY - Gray, Medium Bedded, Slightly Weathered, Well-Cemented, with Slight Dip								84	0
15			ALTERNATING LAYERS OF SANDSTONE AND VERY STIFF MOTTLED CLAY - Gray, Thin Bedded, Slightly Weathered, Well-Cemented, with Slight Dip								72	0
20			ALTERNATING LAYERS OF SANDSTONE AND VERY STIFF MOTTLED CLAY WITH DARK GRAY SHALE LAYERS - Brown and Gray, Thin Bedded, Slightly Weathered, Cemented, with Slight Dip								92	0
25			ALTERNATING LAYERS OF SANDSTONE AND VERY STIFF MOTTLED CLAY - Gray and Brown, Thin Bedded, Slightly Weathered, Cemented, with Slight Dip								72	0
30			ALTERNATING LAYERS OF SANDSTONE AND VERY STIFF MOTTLED CLAY - Gray and Brown, Thin Bedded, Slightly Weathered, Cemented, with Slight Dip								90	0
35			Boring Terminated									

REMARKS:









177+00  
216+00