

ARKANSAS DEPARTMENT OF TRANSPORTATION



SUBSURFACE INVESTIGATION

STATE JOB NO. 040792

FEDERAL AID PROJECT NO. NHPP-0065(56)

HWY. 45 STRS. & APPRS. (S)

STATE HIGHWAY 45 SECTION 1

IN SEBASTIAN COUNTY

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 DEPARTMENT OF TRANSPORTATION

ARDOT.gov | IDriveArkansas.com | Scott E. Bennett, P.E., Director

MATERIALS DIVISION

11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

June 3, 2019


TO: Mr. Trinity Smith, Engineer of Roadway Design

SUBJECT: Job No. 040792
Hwy. 45 Strs. & Apprs. (S)
Route 45 Section 1
Sebastian County

Based on soil information from projects in the surrounding area, an estimated R-Value of 11 is appropriate for pavement design.

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

Asphalt Concrete Hot Mix		
Type	Asphalt Cement %	Mineral Aggregate %
Surface Course	6.1	93.9
Binder Course	4.2	95.8
Base Course	3.7	96.3


Michael C. Benson
Materials Engineer

MCB:pt:bjj
Attachment

cc: State Constr. Eng. – Master File Copy
District 4 Engineer
System Information and Research Div.
G. C. File



ARKANSAS DEPARTMENT OF TRANSPORTATION

ARDOT.gov | IDriveArkansas.com | Lorie H. Tudor, P.E., Director

MATERIALS DIVISION

11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

September 8, 2020

TO: Mr. Trinity Smith, Engineer of Roadway Design

SUBJECT: Job No. 040792
Hwy. 45 Strs. & Apprs. (S)
Route 45 Section 1
Sebastian County

Attached is the requested soil survey, strength data and Resilient Modulus test results for the above referenced job. The project consists of replacing 3 bridges on Highway 45. Samples were obtained in the existing travel lanes and ditch line. There were no paved shoulders within the project limits.

The subgrade soils consist primarily of sandy clay and highly weathered shale. The subgrade soils are expected to provide a stable working platform with conventional processing if the weather is favorable during construction.

The maximum embankment height is approximately 15 feet. All soft unstable organic material should be undercut, anticipated to be no more than two feet, prior to embankment construction. The embankment may be constructed with locally available unspecified material. The proposed embankment slopes are acceptable as shown.

The proposed cut slopes are acceptable as 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 Greenwood.

2. Asphalt Concrete Hot Mix

Type	Asphalt Cement %	Mineral Aggregate %
Surface Course	6.1	93.9
Binder Course	4.2	95.8
Base Course	3.7	96.3


Jonathan A. Annable
Materials Engineer

JAA:pt:bjj
Attachment

cc: State Constr. Eng. – Master File Copy
District 4 Engineer
System Information and Research Div.
G. C. File

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
JONATHAN A. ANNABLE, MATERIALS ENGINEER
*** SOIL SURVEY STRENGTH TEST REPORT ***

DATE - 09/01/2020
JOB NUMBER - 040792

SEQUENCE NO. - 1
MATERIAL CODE - SSRV
SPEC. YEAR - 2014
SUPPLIER ID. - 1
COUNTY/STATE - 65
DISTRICT NO. - 04

JOB NAME - HWY. 45 STRS. & APPRS. (S)

* STATION LIMITS R-VALUE AT 240 psi *

BEGIN JOB - END JOB LESS THAN 5

RESILIENT MODULUS
STA. 107+00 11875
STA. 307+00 10591
STA. 511+00 10532

REMARKS -

-
AASHTO TESTS : T190

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

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

Job No.	040792	Material Code	SSRVPS
Date Sampled:	7/30/2020	Station No.:	107+00
Date Tested:	August 19, 2020	Location:	20' RT
Name of Project:	HWY. 45 STRS. & APPRS. (S)		
County:	Code: 65	Name:	SEBASTIAN
Sampled By:	FRAZIER / JORDAN		
Lab No.:	20201541	Depth:	0-5
Sample ID:	RV335	AASHTO Class:	A-2-6 (1)
LATITUDE:		Material Type (1 or 2):	2
		LONGITUDE:	

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	3.96
Bottom	3.95
Average	3.96
Membrane Thickness (in):	0.01
Height of Specimen, Cap and Base (in):	8.02
Height of Cap and Base (in):	0.00
Initial Length, Lo (in):	8.02
Initial Area, Ao (sq. in):	12.22
Initial Volume, AoLo (cu. in):	98.01

3. Soil Specimen Weight:

Weight of Wet Soil Used (g):	3139.20
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4. Soil Properties:

Optimum Moisture Content (%):	14.9
Maximum Dry Density (pcf):	110.5
95% of MDD (pcf):	105.0
In-Situ Moisture Content (%):	N/A

5. Specimen Properties:

Wet Weight (g):	3139.20
Compaction Moisture content (%):	14.6
Compaction Wet Density (pcf):	122.04
Compaction Dry Density (pcf):	106.49
Moisture Content After Mr Test (%):	14.6

6. Quick Shear Test (Y=Yes, N=No, N/A=Not Applicable):	#VALUE!
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7. Resilient Modulus, Mr:	17208(S _c) ^{-0.22503} (S ₃) ^{0.19125}
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8. Comments

9. Tested By: GW

Date: August 19, 2020

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

SSRVPS
107+00
20' RT

0-5
A-2-6 (1)
2

PARAMETER	TEST DATA											Resilient Modulus
	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	
DESIGNATION	S ₃	S _{cyclic}	P _{max}	P _{cyclic}	P _{contact}	S _{max}	S _{cyclic}	S _{contact}	H _{avg}	ε _r	M _r	
UNIT	psi	psi	lbs	lbs	lbs	psi	psi	psi	in	in/in	psi	
Sequence 1	6.0	2.0	25.4	22.6	2.8	2.1	1.9	0.2	0.00073	0.00009	20,485	
Sequence 2	6.0	4.0	47.5	44.7	2.8	3.9	3.7	0.2	0.00152	0.00019	19,323	
Sequence 3	6.0	6.0	70.2	66.6	3.6	5.7	5.4	0.3	0.00247	0.00031	17,728	
Sequence 4	6.0	8.0	93.3	87.3	6.0	7.6	7.1	0.5	0.00374	0.00047	15,326	
Sequence 5	6.0	10.0	115.4	106.9	8.5	9.4	8.7	0.7	0.00515	0.00064	13,625	
Sequence 6	4.0	2.0	25.3	22.5	2.8	2.1	1.8	0.2	0.00078	0.00010	18,932	
Sequence 7	4.0	4.0	47.3	44.6	2.7	3.9	3.6	0.2	0.00168	0.00021	17,443	
Sequence 8	4.0	6.0	69.0	66.2	2.8	5.6	5.4	0.2	0.00272	0.00034	15,986	
Sequence 9	4.0	8.0	91.9	86.8	5.2	7.5	7.1	0.4	0.00394	0.00049	14,440	
Sequence 10	4.0	10.0	114.5	106.9	7.6	9.4	8.7	0.6	0.00535	0.00067	13,109	
Sequence 11	2.0	2.0	25.1	22.4	2.8	2.1	1.8	0.2	0.00091	0.00011	16,189	
Sequence 12	2.0	4.0	47.1	44.3	2.7	3.9	3.6	0.2	0.00192	0.00024	15,178	
Sequence 13	2.0	6.0	68.4	65.6	2.8	5.6	5.4	0.2	0.00310	0.00039	13,877	
Sequence 14	2.0	8.0	90.4	86.2	4.3	7.4	7.1	0.3	0.00441	0.00055	12,815	
Sequence 15	2.0	10.0	112.7	106.1	6.6	9.2	8.7	0.5	0.00587	0.00073	11,875	

TESTED BY	GW	DATE	August 19, 2020
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.	040792	Material Code SSRVPS
Date Sampled:	7/30/2020	Station No.: 107+00
Date Tested:	August 19, 2020	Location: 20' RT
Name of Project:	HWY. 45 STRS. & APPRS. (S)	
County:	Code: 65	Name: SEBASTIAN
Sampled By:	FRAZIER / JORDAN	
Lab No.:	20201541	Depth: 0-5
Sample ID:	RV335	AASHTO Class: A-2-6 (1)
LATITUDE:		Material Type (1 or 2): 2
		LONGITUDE:

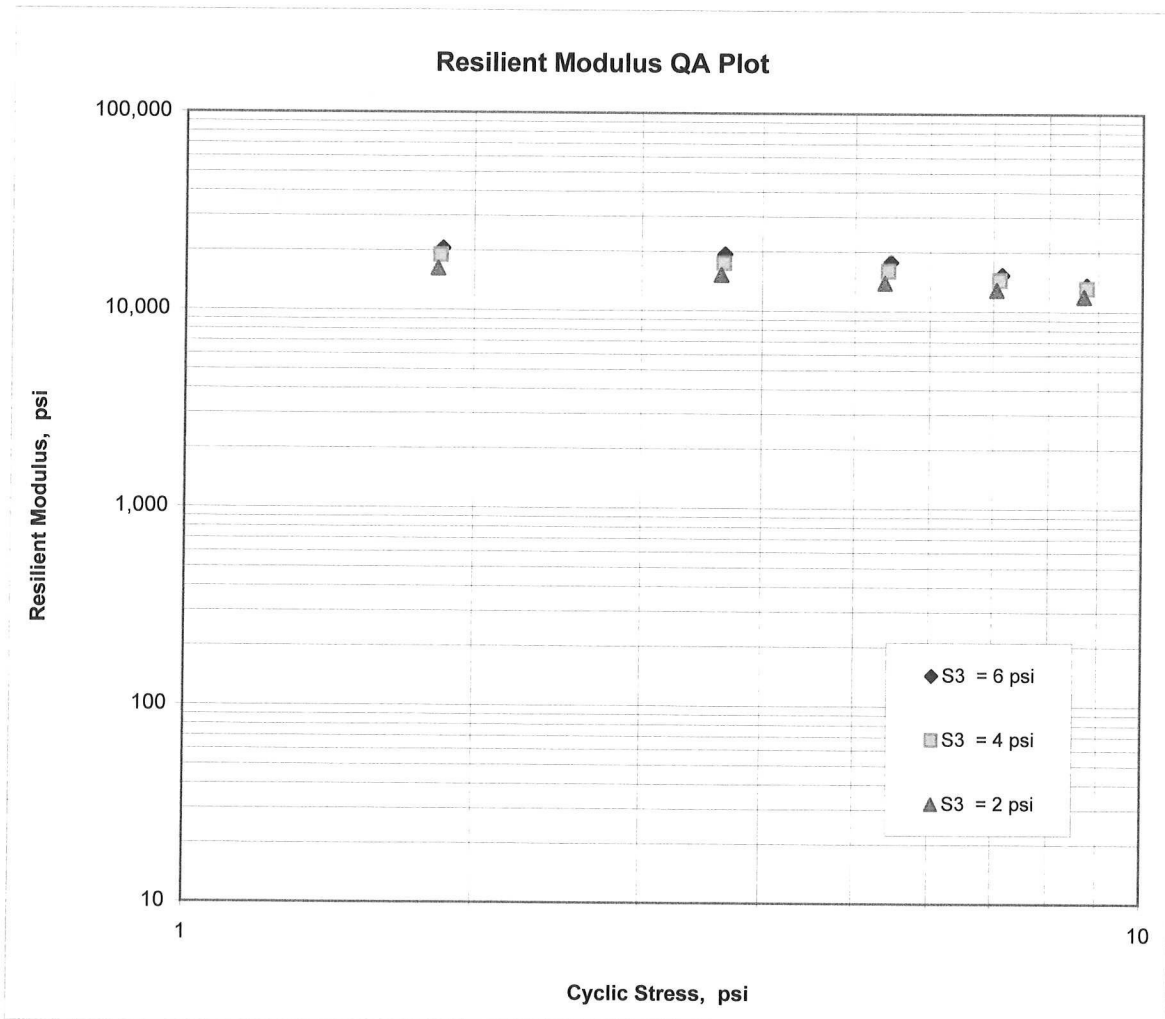
$$M_R = K_1 (S_c)^{K_2} (S_3)^{K_5}$$

$$K_1 = 17,208$$

$$K_2 = -0.22503$$

$$K_5 = 0.19125$$

$$R^2 = 0.92$$



ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT
MATERIALS DIVISION

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

Job No.	040792	Material Code	SSRVPS
Date Sampled:	7/30/2020	Station No.:	307+00
Date Tested:	August 19, 2020	Location:	20' RT
Name of Project:	HWY. 45 STRS. & APPRS. (S)		
County:	Code: 65	Name:	SEBASTIAN
Sampled By:	FRAZIER / JORDAN	Depth:	0-5
Lab No.:	20201542	AASHTO Class:	A-6 (7)
Sample ID:	RV336	Material Type (1 or 2):	2
LATITUDE:		LONGITUDE:	

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	3.96
Bottom	3.95
Average	3.95
Membrane Thickness (in):	0.01
Height of Specimen, Cap and Base (in):	8.02
Height of Cap and Base (in):	0.00
Initial Length, Lo (in):	8.02
Initial Area, Ao (sq. in):	12.20
Initial Volume, AoLo (cu. in):	97.85

3. Soil Specimen Weight:

Weight of Wet Soil Used (g):	3148.60
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4. Soil Properties:

Optimum Moisture Content (%):	14.4
Maximum Dry Density (pcf):	111.7
95% of MDD (pcf):	106.1
In-Situ Moisture Content (%):	N/A

5. Specimen Properties:

Wet Weight (g):	3148.60
Compaction Moisture content (%):	14.3
Compaction Wet Density (pcf):	122.61
Compaction Dry Density (pcf):	107.27
Moisture Content After Mr Test (%):	14.2

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

#VALUE!

7. Resilient Modulus, Mr:

$15350(S_c)^{-0.23792}(S_3)^{0.22445}$

8. Comments

9. Tested By:

GW

Date: August 19, 2020

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

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

Job No.	040792	Material Code	SSRVPS
Date Sampled:	7/30/2020	Station No.:	307+00
Date Tested:	August 19, 2020	Location:	20' RT
Name of Project:	HWY. 45 STRS. & APPRS. (S)	Depth:	0-5
County:	Code: 65 Name: SEBASTIAN	AASHTO Class:	A-6 (7)
Sampled By:	FRAZIER / JORDAN	Material Type (1 or 2):	2
Lab No.:	20201542	LONGITUDE:	
Sample ID:	RV336		
LATITUDE:			

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
DESIGNATION UNIT	S ₃ psi	S _{cyclic} psi	P _{max} lbs	P _{cyclic} lbs	P _{contact} lbs	S _{max} psi	S _{cyclic} psi	S _{contact} psi	H _{avg} in	ε _r in/in	M _r psi
Sequence 1	6.0	2.0	25.3	22.5	2.8	2.1	1.8	0.2	0.00077	0.00010	19,170
Sequence 2	6.0	4.0	47.5	44.7	2.8	3.9	3.7	0.2	0.00164	0.00020	17,940
Sequence 3	6.0	6.0	70.1	66.5	3.6	5.7	5.5	0.3	0.00269	0.00034	16,232
Sequence 4	6.0	8.0	93.5	87.5	6.0	7.7	7.2	0.5	0.00407	0.00051	14,133
Sequence 5	6.0	10.0	115.8	107.4	8.4	9.5	8.8	0.7	0.00554	0.00069	12,738
Sequence 6	4.0	2.0	25.4	22.7	2.7	2.1	1.9	0.2	0.00085	0.00011	17,571
Sequence 7	4.0	4.0	47.3	44.6	2.7	3.9	3.7	0.2	0.00184	0.00023	15,961
Sequence 8	4.0	6.0	68.9	66.2	2.7	5.6	5.4	0.2	0.00300	0.00037	14,506
Sequence 9	4.0	8.0	91.9	86.8	5.1	7.5	7.1	0.4	0.00435	0.00054	13,104
Sequence 10	4.0	10.0	114.6	107.1	7.5	9.4	8.8	0.6	0.00585	0.00073	12,030
Sequence 11	2.0	2.0	25.2	22.5	2.7	2.1	1.8	0.2	0.00099	0.00012	14,894
Sequence 12	2.0	4.0	47.0	44.3	2.7	3.9	3.6	0.2	0.00216	0.00027	13,499
Sequence 13	2.0	6.0	68.1	65.3	2.8	5.6	5.3	0.2	0.00348	0.00043	12,317
Sequence 14	2.0	8.0	90.0	85.6	4.3	7.4	7.0	0.4	0.00496	0.00062	11,354
Sequence 15	2.0	10.0	112.3	105.6	6.7	9.2	8.7	0.6	0.00655	0.00082	10,591

TESTED BY	GW	DATE	August 19, 2020
	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.	040792	Material Code	SSRVPS
Date Sampled:	7/30/2020	Station No.:	307+00
Date Tested:	August 19, 2020	Location:	20' RT
Name of Project:	HWY. 45 STRS. & APPRS. (S)		
County:	Code: 65	Name:	SEBASTIAN
Sampled By:	FRAZIER / JORDAN		
Lab No.:	20201542	Depth:	0-5
Sample ID:	RV336	AASHTO Class:	A-6 (7)
LATITUDE:		Material Type (1 or 2):	2
		LONGITUDE:	

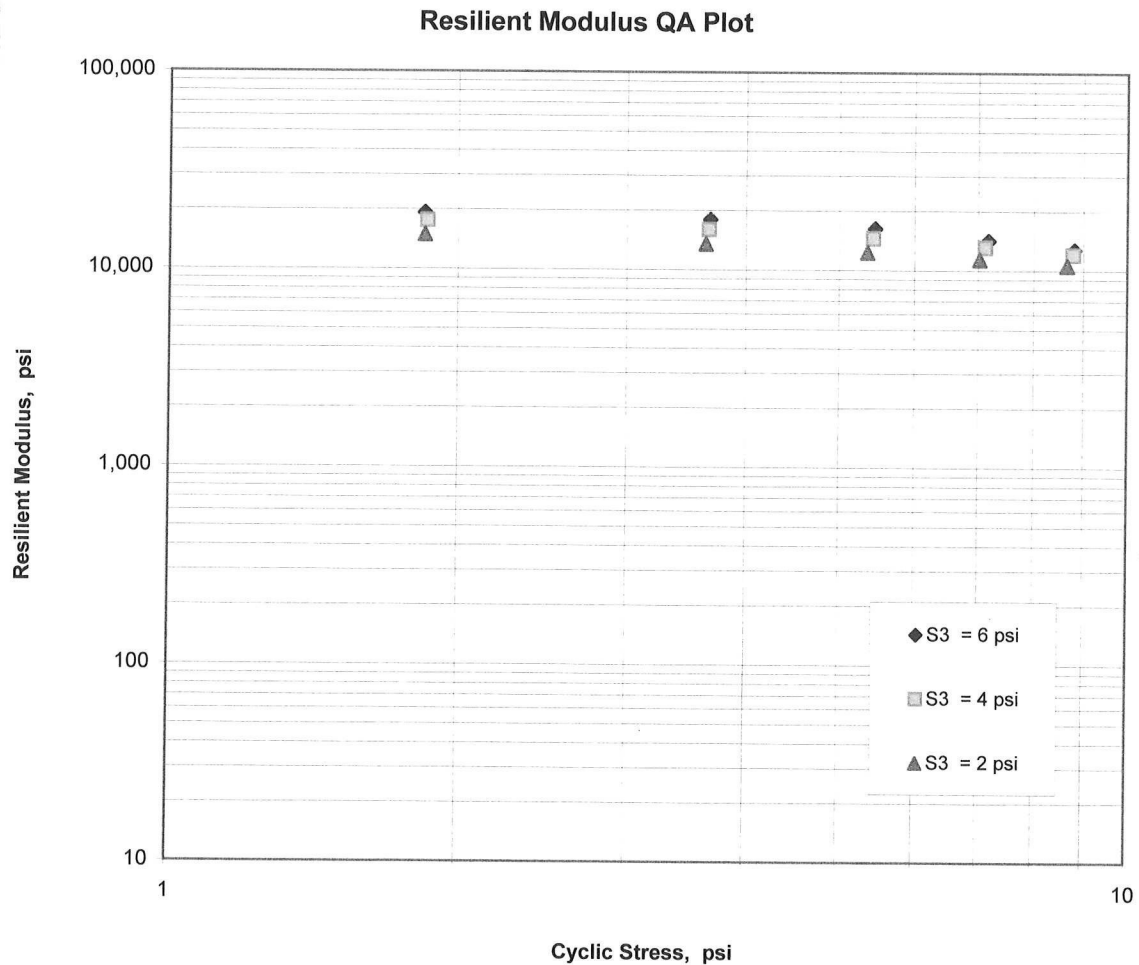
$$M_R = K_1 (S_c)^{K_2} (S_3)^{K_5}$$

$$K_1 = 15,350$$

$$K_2 = -0.23792$$

$$K_5 = 0.22445$$

$$R^2 = 0.95$$



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

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

Job No.	040792	Material Code	SSRVPS
Date Sampled:	7/30/2020	Station No.:	511+00
Date Tested:	August 19, 2020	Location:	20' LT
Name of Project:	HWY. 45 STRS. & APPRS. (S)		
County:	Code: 65	Name:	SEBASTIAN
Sampled By:	FRAZIER / JORDAN		
Lab No.:	20201543	Depth:	0-5
Sample ID:	RV337	AASHTO Class:	A-6 (7)
LATITUDE:		Material Type (1 or 2):	2
		LONGITUDE:	

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	3.95
Bottom	3.95
Average	3.95
Membrane Thickness (in):	0.01
Height of Specimen, Cap and Base (in):	8.02
Height of Cap and Base (in):	0.00
Initial Length, Lo (in):	8.02
Initial Area, Ao (sq. in):	12.18
Initial Volume, AoLo (cu. in):	97.68

3. Soil Specimen Weight:

Weight of Wet Soil Used (g):	3118.30
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4. Soil Properties:

Optimum Moisture Content (%):	15.7
Maximum Dry Density (pcf):	109.3
95% of MDD (pcf):	103.8
In-Situ Moisture Content (%):	N/A

5. Specimen Properties:

Wet Weight (g):	3118.30
Compaction Moisture content (%):	15.6
Compaction Wet Density (pcf):	121.63
Compaction Dry Density (pcf):	105.22
Moisture Content After Mr Test (%):	15.4

6. Quick Shear Test (Y=Yes, N=No, N/A=Not Applicable):	#VALUE!
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7. Resilient Modulus, Mr:	$15539(S_c)^{-0.22720}(S_3)^{0.16301}$
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8. Comments

9. Tested By:

GW

Date: August 19, 2020

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

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

Job No.	040792	Material Code	SSRVPS
Date Sampled:	7/30/2020	Station No.:	511+00
Date Tested:	August 19, 2020	Location:	20' LT
Name of Project:	HWY. 45 STRS. & APPRS. (S)		
County:	Code: 65	Name:	SEBASTIAN
Sampled By:	FRAZIER / JORDAN		
Lab No.:	20201543	Depth:	0-5
Sample ID:	RV337	AASHTO Class:	A-6 (7)
LATITUDE:		Material Type (1 or 2):	2
		LONGITUDE:	

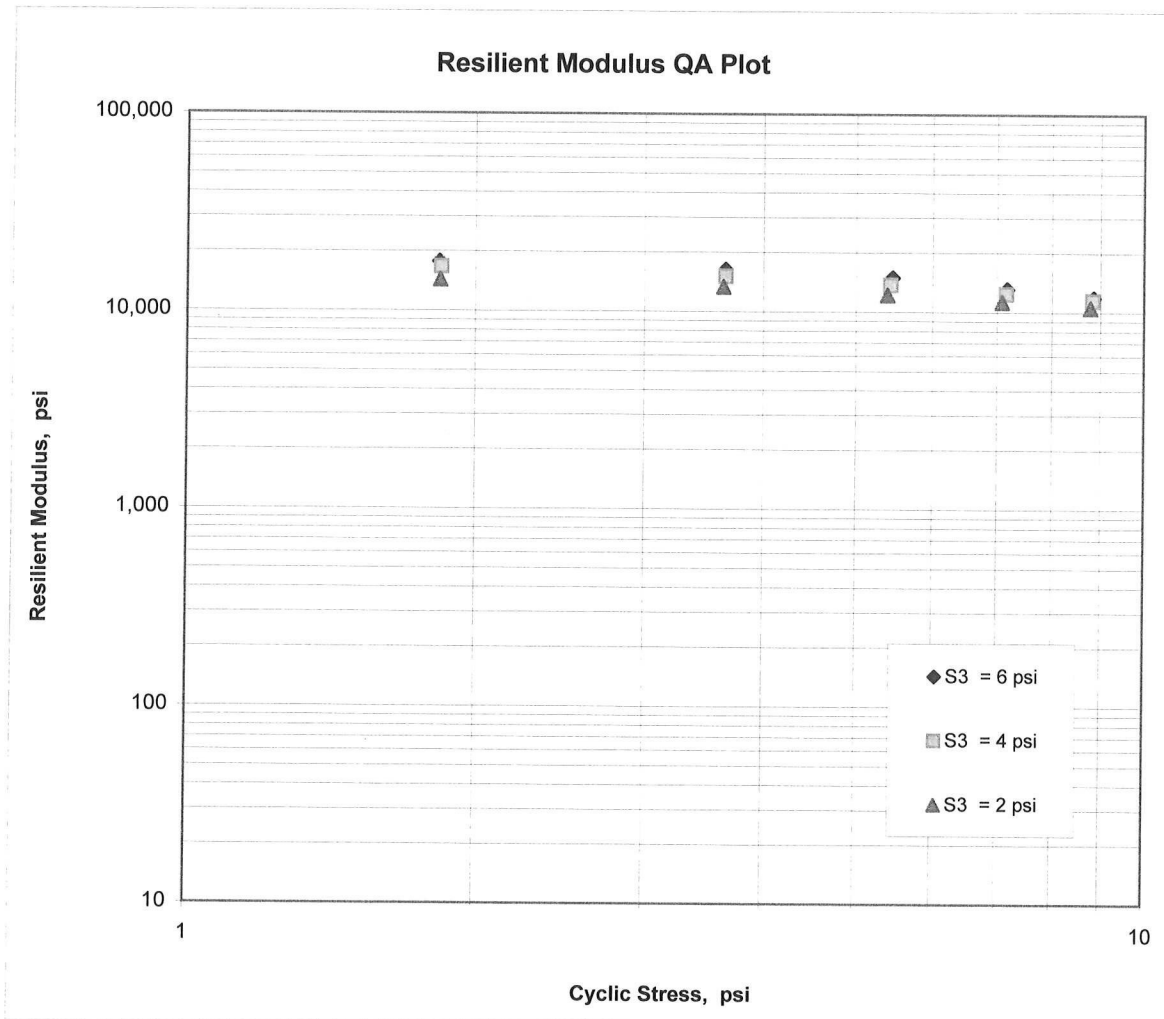
$$M_R = K_1 (S_c)^{K_2} (S_3)^{K_5}$$

$$K_1 = 15,539$$

$$K_2 = -0.22720$$

$$K_5 = 0.16301$$

$$R^2 = 0.94$$



ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION

JONATHAN A. ANNABLE, MATERIALS ENGINEER

*** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE	- 09/01/20	SEQUENCE NO.	- 1
JOB NUMBER	- 040792	MATERIAL CODE	- SSRVPS
FEDERAL AID NO.	- TO BE ASSIGNED	SPEC. YEAR	- 2014
PURPOSE	- SOIL SURVEY SAMPLE	SUPPLIER ID.	- 1
SPEC. REMARKS	- NO SPECIFICATION CHECK	COUNTY/STATE	- 65
SUPPLIER NAME	- STATE	DISTRICT NO.	- 04
NAME OF PROJECT	- HWY. 45 STRS. & APPRS. (S)		
PROJECT ENGINEER	- NOT APPLICABLE		
PIT/QUARRY	- ARKANSAS		
LOCATION	- SEBASTIAN, COUNTY	DATE SAMPLED	- 07/30/20
SAMPLED BY	- FRAZIER/JORDAN	DATE RECEIVED	- 08/05/20
SAMPLE FROM	- TEST HOLE	DATE TESTED	- 09/01/20
MATERIAL DESC.	- SOIL SURVEY - R VALUE- PAVEMENT SOUNDINGS		

LAB NUMBER	- 20201529	- 20201530	- 20201531
SAMPLE ID	- S324	- S325	- S326
TEST STATUS	- INFORMATION ONLY	- INFORMATION ONLY	- INFORMATION ONLY
STATION	- 107+00	- 107+00	- 113+00
LOCATION	- 06 RT	- 20 RT	- 06 LT
DEPTH IN FEET	- 0-5	- 0-5	- 0-5
MAT'L COLOR	- BROWN	- BROWN	- BROWN
MAT'L TYPE	-	-	-
LATITUDE DEG-MIN-SEC	- 35 3 26.50	- 35 03 26.50	- 35 3 30.90
LONGITUDE DEG-MIN-SEC	- 94 20 50.30	- 94 20 50.20	- 94 20 48.70

% PASSING	2 IN.	-	-
	1 1/2 IN.	-	-
	3/4 IN.	-	-
	3/8 IN.	- 100	-
	NO. 4	- 98	- 100
	NO. 10	- 94	- 98
	NO. 40	- 87	- 93
	NO. 80	- 66	- 87
	NO. 200	- 60	- 82
		- 55	- 73

LIQUID LIMIT	- 43	- 31	- 33
PLASTICITY INDEX	- 24	- 13	- 16
AASHTO SOIL	- A-7-6(17)	- A-6(4)	- A-6(10)
UNIFIED SOIL	-	-	-
% MOISTURE CONTENT	- 26.4	- 10.4	- 27.2

ACHMSC	(IN)	- 11.0W	- ---	- 10.0W
ACHMBC	(IN)	- 2.0	- ---	- 3.5
		-	-	-
		-	-	-
		-	-	-
		-	-	-
		-	-	-
		-	-	-
		-	-	-
		-	-	-
		-	-	-

REMARKS - W=MUTTIPLE LAYERS, X=STRIPPED

AASHTO TESTS : T24 T88 T89 T90 T265

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION

JONATHAN A. ANNABLE, MATERIALS ENGINEER

*** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE	- 09/01/20	SEQUENCE NO.	- 3
JOB NUMBER	- 040792	MATERIAL CODE	- SSRVPS
FEDERAL AID NO.	- TO BE ASSIGNED	SPEC. YEAR	- 2014
PURPOSE	- SOIL SURVEY SAMPLE	SUPPLIER ID.	- 1
SPEC. REMARKS	- NO SPECIFICATION CHECK	COUNTY/STATE	- 65
SUPPLIER NAME	- STATE	DISTRICT NO.	- 04
NAME OF PROJECT	- HWY. 45 STRS. & APPRS. (S)		
PROJECT ENGINEER	- NOT APPLICABLE		
PIT/QUARRY	- ARKANSAS		
LOCATION	- SEBASTIAN, COUNTY	DATE SAMPLED	- 07/30/20
SAMPLED BY	- FRAZIER/JORDAN	DATE RECEIVED	- 08/05/20
SAMPLE FROM	- TEST HOLE	DATE TESTED	- 09/01/20
MATERIAL DESC.	- SOIL SURVEY - R VALUE- PAVEMENT SOUNDINGS		

LAB NUMBER	- 20201535	- 20201536	- 20201537
SAMPLE ID	- S329	- S330	- S331
TEST STATUS	- INFORMATION ONLY	- INFORMATION ONLY	- INFORMATION ONLY
STATION	- 314+00	- 314+00	- 504+00
LOCATION	- 06 LT	- 20 LT	- 06 RT
DEPTH IN FEET	- 0-5	- 0-5	- 0-5
MAT'L COLOR	- BROWN	- BROWN	- BROWN
MAT'L TYPE	-	-	-
LATITUDE DEG-MIN-SEC	- 35 6 15.10	- 35 06 15.10	- 35 6 55.10
LONGITUDE DEG-MIN-SEC	- 94 22 2.90	- 94 22 3.00	- 94 22 1.50

% PASSING	2 IN.	-	-
	1 1/2 IN.	-	-
	3/4 IN.	-	-
	3/8 IN.	-	-
	NO. 4	-	-
	NO. 10	-	-
	NO. 40	-	-
	NO. 80	-	-
	NO. 200	-	-

	100	-	-
	99	-	-
	92	-	-
	88	-	-
	84	-	-
	80	-	-
	71	-	-

LIQUID LIMIT	- 49	- 32	- 39
PLASTICITY INDEX	- 30	- 14	- 23
AASHTO SOIL	- A-7-6(20)	- A-6(4)	- A-6(14)
UNIFIED SOIL	-	-	-
% MOISTURE CONTENT	- 21.9	- 22.5	- 21.6

ACHMSC	(IN) - 8.0W	- ---	- 8.0W
ACHMBC	(IN) - 3.0	- ---	- 1.0
AGG.BASE CRS, CL-7	(IN) - 2.0	- ---	- ---
	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED

-
-
-
-

AASHTO TESTS : T24 T88 T89 T90 T265

:

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION

JONATHAN A. ANNABLE, MATERIALS ENGINEER

*** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE	- 09/01/20	SEQUENCE NO.	- 4
JOB NUMBER	- 040792	MATERIAL CODE	- SSRVPS
FEDERAL AID NO.	- TO BE ASSIGNED	SPEC. YEAR	- 2014
PURPOSE	- SOIL SURVEY SAMPLE	SUPPLIER ID.	- 1
SPEC. REMARKS	- NO SPECIFICATION CHECK	COUNTY/STATE	- 65
SUPPLIER NAME	- STATE	DISTRICT NO.	- 04
NAME OF PROJECT	- HWY. 45 STRS. & APPRS. (S)		
PROJECT ENGINEER	- NOT APPLICABLE		
PIT/QUARRY	- ARKANSAS		
LOCATION	- SEBASTIAN, COUNTY	DATE SAMPLED	- 07/30/20
SAMPLED BY	- FRAZIER/JORDAN	DATE RECEIVED	- 08/05/20
SAMPLE FROM	- TEST HOLE	DATE TESTED	- 09/01/20
MATERIAL DESC.	- SOIL SURVEY - R VALUE- PAVEMENT SOUNDINGS		

LAB NUMBER	- 20201538	- 20201539	- 20201540
SAMPLE ID	- S323	- S333	- S334
TEST STATUS	- INFORMATION ONLY	- INFORMATION ONLY	- INFORMATION ONLY
STATION	- 504+00	- 511+00	- 511+00
LOCATION	- 20 RT	- 06 LT	- 20 LT
DEPTH IN FEET	- 0-5	- 0-5	- 0-4z
MAT'L COLOR	- BROWN	- BROWN	- BROWN
MAT'L TYPE	-	-	-
LATITUDE DEG-MIN-SEC	- 35 6 55.10	- 35 07 2.20	- 35 7 2.20
LONGITUDE DEG-MIN-SEC	- 94 22 1.40	- 94 22 1.50	- 94 22 1.60

% PASSING	2 IN.	-	-
	1 1/2 IN.	-	-
	3/4 IN.	- 100	- 100
	3/8 IN.	- 95	- 99
	NO. 4	- 84	- 95
	NO. 10	- 75	- 86
	NO. 40	- 64	- 69
	NO. 80	- 58	- 63
	NO. 200	- 50	- 59

LIQUID LIMIT	- 34	- 42	- 36
PLASTICITY INDEX	- 17	- 21	- 16
AASHTO SOIL	- A-6(5)	- A-7-6(19)	- A-6(7)
UNIFIED SOIL	-	-	-
% MOISTURE CONTENT	- 25.0	- 11.7	- 17.8

ACHMSC	(IN)	- ---	- 8.0WX	- ---
ACHMBC	(IN)	- ---	- 1.0	- ---
AGG.BASE CRS,CL-7	(IN)	- ---	- 2.0	- ---
		-	-	-
		-	-	-
		-	-	-
		-	-	-
		-	-	-
		-	-	-

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED

AASHTO TESTS : T24 T88 T89 T90 T265

:

AASHTO TESTS : T24 T88 T89 T90 T265

JOB: 040792

Arkansas State Highway Transportation Department

JOB NAME: HWY. 45 STRS. & APPRS. (S)

Materials Division

COUNTY NO. 65 DATE TESTED 9/1/2020

Michael Benson, Materials Engineer

STA.#	LOC.	DEPTH	COLOR	#4	#10	#40	#80	#200	L.L.	P.I.	SOIL CLASS	LAB #:	%MOISTURE
				S	I	E	V	E					
113+00	20 LT	0-5	BROWN										
107+00	20 RT	0-5	BROWN	66	57	45	40	35	33	14	A-2-6(1)	RV335	
307+00	20 RT	0-5	BROWN	90	84	76	72	68	32	13	A-6(7)	RV336	
511+00	20 LT	0-4z	BROWN	95	87	68	63	60	36	16	A-6(7)	RV337	
504+00	20 RT	0-5	BROWN	84	75	64	58	50	34	17	A-6(5)	S323	25
107+00	06 RT	0-5	BROWN	98	94	87	80	74	43	24	A-7-6(17)	S324	26.4
107+00	20 RT	0-5	BROWN	88	80	66	60	55	31	13	A-6(4)	S325	10.4
113+00	06 LT	0-5	BROWN	98	93	87	82	73	33	16	A-6(10)	S326	27.2
307+00	06 RT	0-5	BR/GR	98	93	88	87	83	39	22	A-6(18)	S327	23.4
307+00	20 RT	0-5	BROWN	94	87	82	80	75	33	15	A-6(10)	S328	16.5
314+00	06 LT	0-5	BROWN	92	88	84	80	71	49	30	A-7-6(20)	S329	21.9
314+00	20 LT	0-5	BROWN	97	91	68	62	53	32	14	A-6(4)	S330	22.5
504+00	06 RT	0-5	BROWN	96	89	79	74	69	39	23	A-6(14)	S331	21.6
511+00	06 LT	0-5	BROWN	99	97	92	89	87	42	21	A-7-6(19)	S333	11.7
511+00	20 LT	0-4z	BROWN	95	86	69	63	59	36	16	A-6(7)	S334	17.8

comments: W=MULTIPLE LAYERS, X=STRIPPED

Tuesday, September 8, 2020

JOB: 040792

JOB NAME: HWY. 45 STRS. & APPRS. (S)

Arkansas State Highway Transportation Department
Materials Division

COUNTY NO. 65

Michael Benson, Materials Engineer

DATE TESTED
9/1/2020

STA.# LOC.

PAVEMENT SOUNDINGS

107+00	06 RT	ACHMSC 11.0W	ACHMBC 2.0	
107+00	20 RT	ACHMSC	ACHMBC	
		---	---	
113+00	06 LT	ACHMSC 10.0W	ACHMBC 3.5	
307+00	06 RT	ACHMSC 8.5WX	AGG.BASE CRS,CL-7 2.0	
307+00	20 RT	ACHMSC	AGG.BASE CRS,CL-7	
		---	---	
314+00	06 LT	ACHMSC 8.0W	ACHMBC 3.0	AGG.BASE CRS,CL-7 2.0
314+00	20 LT	ACHMSC	ACHMBC	AGG.BASE CRS,CL-7
		---	---	---
504+00	06 RT	ACHMSC 8.0W	ACHMBC 1.0	AGG.BASE CRS,CL-7
504+00	20 RT	ACHMSC	ACHMBC	---
		---	---	AGG.BASE CRS,CL-7
511+00	06 LT	ACHMSC 8.0WX	ACHMBC 1.0	AGG.BASE CRS,CL-7 2.0
511+00	20 LT	ACHMSC	ACHMBC	AGG.BASE CRS,CL-7
		---	---	---

comments: W=MULTIPLE LAYERS, X=STRIPPED



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MATERIALS DIVISION

11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

August 17, 2021

TO: Mr. Rick Ellis, Bridge Engineer
SUBJECT: Job No. 040792
Hwy. 45 Strs. & Apprs. (S)
Sebastian County
Route 45, Section 01

Introduction

Submitted herein are foundation recommendations for the proposed bridges planned on State Highway 45 in Sebastian County. Preliminary information and recommendations have been provided to and discussed with bridge designers. Recommendations for the approach embankments will be provided in a supplemental report.

This project consists of constructing two (2) bridges to replace the existing bridges on Highway 45. The bridge over School House Branch (School House Branch Bridge) is planned at Site 1 and will be constructed at an offset location west of the existing bridge. This new bridge will be a three (3)-span, continuous W-beam unit with a total length of approximately 188 ft and an out-to-out width of 36.5 feet.

The other new bridge, Bridge over Johnson Branch (Johnson Branch Bridge) planned at Site 2, will be a replacement bridge to be constructed in the alignment of the existing bridge. The Johnson Branch Bridge will also be a three (3)-span continuous W-beam unit with an out-to-out width of 36.5 feet. Total length of the Johnson Branch Bridge is designed to be 176 feet. 2-Horizontal to 1-vertical (2H:1V) end slopes are planned for both bridges. 3H:1V configuration is designed for the side slopes of both bridges.

Field Investigation

A subsurface investigation was requested on March 10, 2021 by Bridge Division to develop recommendations for bridge foundations and to verify suitability of bridge abutment embankment configuration. A total of eight (8) borings were requested and seven (7) borings were completed.

Site 1 subsurface conditions were investigated using a combination of three (3) borings and two (2) test pits. A test pit (Test Pit 1) was excavated at the exact location of a completed boring (Boring 2 School House Branch, Sta. 109+77.5, 18 ft Right of Construction C.L.) to verify boring results. The boring originally planned in the creek channel of School House Branch (Boring 3 School House Branch, Sta. 110+42.5, C.L. of Construction) was not drilled due to soft ground and inaccessibility to the planned location by drill rig. Consequently, a test pit (Test Pit 2) was excavated at this planned boring location in lieu of that boring to investigate subsurface conditions. In addition, some borings were slightly offset due to presence of a sewer line at Site 1.

Site 2 subsurface conditions were investigated by drilling four (4) borings. As noted, Johnson Branch Bridge is a replacement bridge planned in the alignment of existing bridge. Boring 2 was drilled at ground elevation and offset 18 ft right of centerline due to access issues.



Boring 3 was drilled through the existing bridge deck at a suitable location determined by ARDOT Heavy Bridge Section.

The approximate locations of the borings and test pits are presented in the Plan of Borings and Test Pits included in Attachment A for the School House Branch Bridge and in Attachment B for the Johnson Branch Bridge. The borings were advanced with a CME 45B rotary drill rig using a combination of hollow-stem auger and diamond core method. The respective boring logs, showing the subsurface conditions encountered in the borings and the results of field and laboratory tests, are also included in Attachment A and Attachment B, immediately following the Plan of Borings and Test Pits. Standard Penetration Tests (SPT) were conducted in accordance with ASTM D1586 for field testing and soil sampling. The correction factor for the hammer is indicated on the boring logs. Liners were not used inside the standard split-barrel samplers.

The number of blows required to drive the standard split-barrel sampler for each 6-inch penetration of the total 18-inch drive were counted and shown on the logs. SPT N-values are defined as the number of blows required to advance the split barrel the final 12 inches. The SPT N-values indicated on the logs are raw (uncorrected) blow count measured in field.

Core samples of bedrock were retrieved by using NQ3-size triple-tube core barrels (rock core diameter of 1-3/4 in. and hole diameter of 3 in.). For each core run, Rock Quality Designation (RQD) was determined in field by logger and further evaluated by Professional Geologist (PG). RQD, expressed in percent, is defined as the sum of the intact core pieces that are longer than 4 in. divided by the total length of the core run. The RQD of each core run is indicated on corresponding log. Core pictures are included in Attachment A and Attachment B for Site 1 and Site 2, respectively.

The test pits were performed using a track-mounted excavator fitted with a 24 in.-wide bucket. Representative soil and weathered rock samples were obtained from excavation spoil for further evaluation or for laboratory testing.

Groundwater was also observed during the drilling and excavating process. Groundwater observations were noted on the logs.

Lab Investigation

All samples were brought to the Materials laboratory for further evaluation and testing. Rock cores were first examined by licensed Professional Geologists to verify RQD measured in field and to determine Geological Strength Index (GSI) and Rock Mass Rating (RMR). Compressive strength of rock cores was then determined by uniaxial compressive test on intact rock cores in accordance with ASTM D7012, Method C. The results of uniaxial compressive tests on intact rock cores are presented in Attachment C for Site 1 and Site 2. GSI and RMR, as evaluated by Professional Geologist, are also included in Attachment C.

Site Conditions

Site 1 - School House Branch. The existing 3-span bridge over School House Branch consists of precast concrete channel beam unit with a total length of approximately 69 ft and an out-to-out width of approximately 28 feet. All the bents are supported by concrete bents on concrete columns with abutment slopes protected by concrete riprap. The meandering School



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House Branch was observed to flow eastward under the south span and middle span (July 2021). The channel bottom is primarily comprised of round to sub-angular gravel, cobbles, and boulders. Localized scour around existing columns were observed. The new bridge will be constructed on the west side of existing bridge. The area in the new bridge alignment is generally vegetated with localized underbrush near the creek banks. An approximately 4-in. diameter underground PVC sewer line is in this alignment.

Site 2 – Johnson Branch. The existing bridge over Johnson Branch is a 7-span precast concrete channel beam unit with a total length of approximately 133 ft and an out-to-out width of approximately 25 feet. All the bents are supported by concrete bents on concrete columns with abutment slopes protected by concrete riprap. The Johnson Branch was observed to flow eastward under the 4th and 5th spans (July 2021). A buried water line and a telecommunication line parallels the east side of the roadway. The water line is covered by concrete in the channel. Scour has caused the south bank to collapse over the water line. A residence is located to the northeast of the bridge. The slightly longer (176 ft) new bridge will be constructed in the same alignment as the existing bridge.

Site Geology

The project alignment is located on rocks mapped as the McAlester Formation (map symbol P_{ma}). The McAlester consists of (in ascending order): several hundred feet of shale with thin sandstone and coal (the Lower Hartshorne coal is just above the base), several hundred feet of shale with a few sandstone beds and coal (Upper Hartshorne Coal), and capped by several hundred feet of shale with a few coal beds. The unit ranges from about 500 to 2,300 feet in thickness.

Generalized Subsurface Conditions

Site 1 - School House Branch. The ground surface is typically covered by a thin layer of soft dark brown silty clay with organics. Below the surface organic-containing silty clay, the overburden soils are generally comprised of medium hard, brown and gray shale to sandstone gravel, cobbles to boulders with variable amount of silty clay (completely weathered shale), clayey sand (completely weathered sandstone), to sand (completely weathered sandstone). These materials are considered as completely weathered shale or sandstone with less weathered zones in the form of gravel, cobbles, and boulders. Locally this stratum is less weathered and transforms to soft, brown and gray highly weathered shale (Test Pit 2 and Boring 4). The overburden soils and highly weathered shale are not competent and not suitable to support bridge foundations.

Competent medium hard gray, slightly weathered to unweathered shale was encountered in the borings and Test Pit 2 at depths of 7.0 ft to 17 feet (Elev. 588.8 to 586.7). The estimated elevation of the competent rock, as revealed by the borings and test pit, are summarized below in Table 1a.

Table 1a: Estimated Elevation of Competent Rock – School House Branch

Bent No.	Ground Surface Elevation @ Boring Location, ft	Depth to Competent Rock, ft	Estimated Elevation of Competent Rock, ft
1	603.7	16.3	587.4
2	603.7	17.0	586.7
3	595.8	7.0	588.8
4	596.3	8.0	588.3

Site 2 – Johnson Branch. The overburden soils are generally comprised of very loose to loose, brown clayey sand to sand with some shale fragments. The sandy soils are underlain by dense to very dense, dark gray shale fragments, cobbles, to boulders with variable amounts of clay and medium stiff sandy clay with rock fragments. These materials are considered as completely weathered shale with less weathered zones in the form of shale fragments, cobbles, and boulders. Locally this stratum is less weathered and transforms to medium hard, brown and gray, highly weathered to weathered shale (Boring 2 and Boring 4). The overburden soils and highly weathered to weathered shale are not competent.

Competent medium hard, dark gray, slightly weathered to unweathered shale was encountered in the borings at depths of 6.8 ft to 20.5 feet (Elev. 517.3 to 510.4). The estimated elevation of the competent rock, as revealed by the borings, are summarized below in Table 1b.

Table 1b: Estimated Elevation of Competent Rock – Johnson Branch

Bent No.	Ground Surface Elevation, ft	Depth to Competent Rock, ft	Estimated Elevation of Competent Rock, ft
1	530.9	20.5	510.4
2	523.9	8.7	515.2
3	522.1	6.8	515.3
4	531.2	13.9	517.3

Seismic Conditions

In light of the average subsurface conditions as revealed by the borings, a Seismic Site Class B (Rock Profile) is calculated for the project site. Utilizing the Seismic Site Class B and the approximate GPS coordinates of the project sites, the following design peak ground acceleration coefficient (A_S), design short-period spectral acceleration coefficient (S_{DS}), as well as design long-period spectral acceleration coefficient (S_{D1}), are determined. These seismic coefficients are summarized in Table 2a and Table 2b below for Site 1 and Site 2, respectively. Design Response Spectrum for each site is presented in Attachment D.



Table 2a: Summary of Design Ground Motion Acceleration Response Coefficients – Site 1

Acceleration Coefficient	Value (g)
A_S (Site PGA)	0.055
S_{DS} (0.2 sec)	0.129
S_{D1} (1 sec)	0.052

Table 2b: Summary of Design Ground Motion Acceleration Response Coefficients – Site 2

Acceleration Coefficient	Value (g)
A_S (Site PGA)	0.055
S_{DS} (0.2 sec)	0.128
S_{D1} (1 sec)	0.051

For the larger design long-period spectral acceleration coefficient (S_{D1}) of 0.052, a Seismic Performance Zone 1 is considered applicable to both project sites.

Foundation Recommendations

Steel H-Piling – Bents 1 and 4 of Both Bridges. It is anticipated steel h-piling will be utilized to support the foundation loads at the end bents (Bents 1 and 4 of both sites / bridges). Final pile size has not been determined. Steel h-piles should be driven to practical refusal and should penetrate through embankment fill, the overburden soils and the highly weathered to weathered shale, to bear in the competent slightly weathered to unweathered shale. Preboring will be required at all the end bent locations for penetrating through the overburden soils with gravel, cobbles, and / or boulders.

Practical refusal is defined as a maximum penetration of 1.0 inch for 20 blows by a pile hammer. For the purpose of estimating pile length, a pile penetration of 1 ft into the competent rock is assumed. This estimated penetration is based on the results of the borings / test pits and our experience with similar foundation rock. The results of the borings indicate moderate to severe driving conditions are expected to be experienced. Consequently, rock points are recommended for all the h-piles driven to refusal.

A minimum pile penetration of 10 ft, measured below natural ground surface, is recommended. Greater pile length / penetration may be warranted by lateral resistance demand. Preboring is expected to be required for achieving the minimum 10 ft of penetration at Bent 4 of the School House Branch Bridge (Site 1). Based on the results of the borings and the assumption of approximately 1 ft penetration into the competent rock, the estimated shallowest pile tip elevation is summarized below in Table 3.

Table 3: Summary of Estimated Shallowest Pile Tip Elevation

Bridge	Bent No.	Estimated Shallowest Pile Tip Elevation	Comments
School House Branch	1	Elev. 586	Prebore to penetrate cobbles
	4	Elev. 586	Prebore to achieve the required min. 10 ft of penetration
Johnson Branch	1	Elev. 509	Prebore to penetrate cobbles
	4	Elev. 516	Prebore to penetrate cobbles

The estimated shallowest pile tip elevation summarized in the table above is based on our evaluation of the rock cores retrieved from the borings. Actual subsurface conditions can vary from those encountered in the borings. As-constructed pile tip elevation can vary and must be field verified.

Nominal axial resistance of steel h piles driven to refusal in competent rock is governed by the structural capacity of the piles. Therefore the nominal resistance should be determined by the Structural Engineer utilizing applicable AASHTO LRFD design procedures. The Geotechnical Section is available to provide geotechnical inputs for structural evaluation of the nominal axial pile resistance. In light of the expected moderate to severe driving conditions, a resistance factor (ϕ_c) of 0.50 is recommended for calculating factored structural bearing resistance of h-piles. For steel piling driven to refusal in competent rock, long-term, post-construction settlement is expected to be negligible.

Spread Footings – Bents 2 and 3 of Both Bridges. It is understood spread footings are preferred by the bridge designers for use to support the foundation loads of the intermediate bents (Bents 2 and 3) of both bridges. It is also understood bridge designers plan to embed the spread footings 2 ft into competent rock. Based on the results of the borings and our field observations, spread footings founded 2 ft into competent rock are suitable to be utilized to support the intermediate bents. Plan footing bottom elevations, as provided by bridge designers, are summarized below in Table 4. Recommendations for spread footings are provided below. Other foundation types can be evaluated upon request.

Table 4: Summary of Plan Footing Bottom Elevation

Bridge	Bent No.	Plan Footing Bottom Elevation
School House Branch	2	Elev. 585.2
	3	Elev. 586.8
Johnson Branch	2	Elev. 513.03
	3	Elev. 513.03

It is recommended a maximum nominal bearing capacity of 35 ksf be utilized for spread footings embedded at least 2 ft into competent slightly weathered to unweathered shale. A resistance factor (ϕ_b) of 0.45 is considered suitable for evaluation of factored bearing resistance of spread footings on rock. Consequently, a maximum factored bearing capacity of 15.8 ksf is



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suitable. Post-construction settlement of spread footings founded in competent rock is expected to be negligible.

Uplift resistance can be provided by footing self-weight and structure dead loads. Footings may be sized to negate the factored uplift loads. If additional uplift resistance is needed, rock anchors can be utilized. Recommendations of rock anchors can be provided upon request. It is understood footings are so designed to provide adequate uplift resistance and rock anchors are not needed.

Lateral resistance of spread footings can be evaluated utilizing a maximum nominal coefficient of friction ($\tan\delta$) of 0.70 for concrete footings on clean rock and a resistance factor for sliding (ϕ_r) of 0.85. Additional lateral resistance may be provided by passive resistance of the competent rock that is in hard contact with the spread footings and below scour depth. Passive resistance from any overburden soils, weathered rock, and upper 2 ft of competent rock should be neglected from passive resistance evaluation. Factored passive resistance can be provided upon request. It is understood the footings will be embedded 2 ft in the competent rock. Consequently, passive resistance should be neglected in design.

It is recommended the water flow be diverted from the plan footing excavation areas before starting footing excavation. Any underground utilities in the plan footing excavation areas should be completely removed or relocated and properly backfilled to prevent seepage into excavation bottom. As a minimum, sump pump should be established to remove any water seepage into the excavation bottom. Any footing over-excavation should be properly backfilled with Class S concrete.

D₅₀ for Scour Analysis

The particle size through which 50% of particles by weight passing, D₅₀, is summarized below in Table 5. Detailed particle size distribution curves used for D₅₀ determination are included in Attachment E.

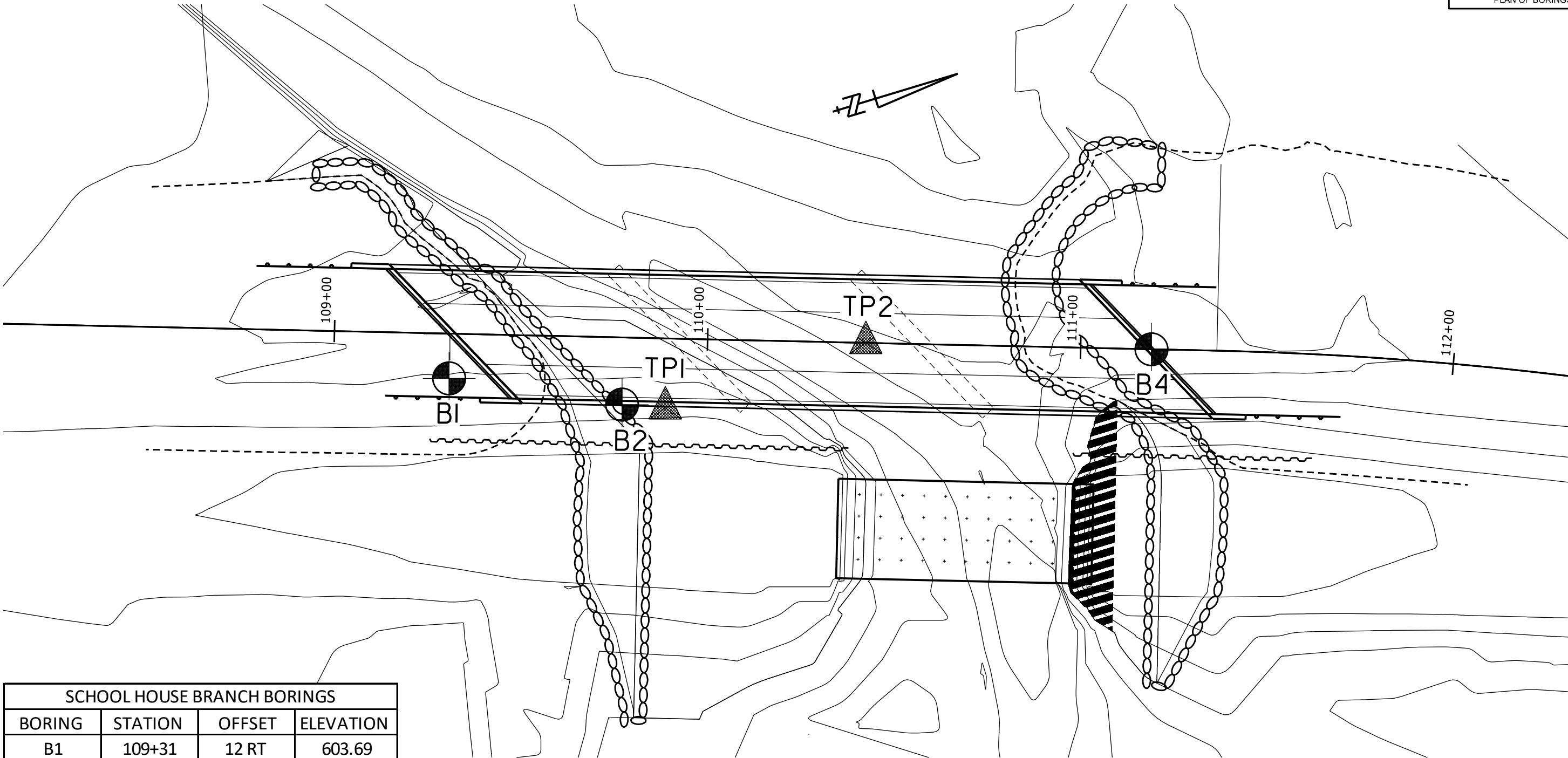
Table 5: Summary of D₅₀ for Scour Analysis

Bridge	Station	Sample Type	Location	D ₅₀ , mm
School House	109+17, 41 Lt.	Bulk	Creek Bank	4.75
Johnson	310+78, 16 Lt.	Bulk	Creek Bank	<0.075


Jonathan A. Annable
Materials Engineer

JAA:yz:mlg:jcs
cc: State Construction Engineer
District 4 Engineer
G. C. File

Attachment A



SCHOOL HOUSE BRANCH BORINGS			
BORING	STATION	OFFSET	ELEVATION
B1	109+31	12 RT	603.69
B2	109+78	18 RT	603.67
B4	111+19	CL	596.29

SCHOOL HOUSE BRANCH TEST PITS		
BORING	STATION	OFFSET
TP1	109+78	18 RT
TP2	110+43	CL

**ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. 1 School House Branch
PAGE 1 OF 1

JOB NO. 040792 Sebastian County
JOB NAME: Hwy 45 Strs. & Apprs. (S)
Route 45, Section 01
STATION: 109+31
LOCATION: 17' Right of Construction Centerline
LOGGED BY: Anthony Nicholson

DATE: June 15, 2021
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 45B
HAMMER CORRECTION FACTOR: 1.47

COMPLETION DEPTH: 36.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) ● PL +-----+ LL 10 20 30 40 50 60 70								PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% T C R	% R Q D
			SURFACE ELEVATION: 603.7													
6			Moist, Medium Dense, Brown Sand with Gravel, Cobbles, and Boulders											11 16-13		
12			Brown and Gray Sandstone Cobbles and Boulders*												50	0
18			SHALE - Slightly Weathered, Medium Hard, Gray												30	0
24			SHALE - Unweathered, Medium Hard, Occasional Fractures, Gray												100	28
30			SHALE - Unweathered, Medium Hard, Slightly Dipping, Gray												96	38
36			SHALE - Unweathered, Medium Hard, Slightly Dipping, Gray												100	70
			Boring Terminated												100	100
42																

REMARKS: Lost circulation and approximately 11.3' below ground level.

**ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. 2 School House Branch
PAGE 1 OF 1


JOB NO. 040792 Sebastian County
JOB NAME: Hwy 45 Strs. & Apprs. (S)
Route 45, Section 01
STATION: 109+77.5
LOCATION: 18' Right of Construction Centerline
LOGGED BY: Anthony Nicholson

DATE: June 15, 2021
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 45B
HAMMER CORRECTION FACTOR: 1.47

COMPLETION DEPTH: 32


DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) ● PL +-----+ LL 10 20 30 40 50 60 70							PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% T C R	% R Q D
			SURFACE ELEVATION: 603.7												
5															
10			Moist, Medium Dense, Brown Clayey Sand with Sandstone Cobbles and Boulders*										3 11-12		
15			Brown Sandstone Boulders											33	0
20			SHALE - Slightly Weathered, Medium Hard, Slickensided, Gray											11	0
25			SHALE - Unweathered, Medium Hard, Gray											96	76
30														96	60
35			Boring Terminated											86	46

REMARKS: * Auger refusal at 10.8' below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION MATERIALS DIVISION - GEOTECHNICAL SEC.						BORING NO. TP-1 School House Branch PAGE 1 OF 1										
JOB NO. 040792 Sebastian County JOB NAME: Hwy 45 Strs. & Apprs. (S) Route 45, Section 01 STATION: 109+77.5 LOCATION: 18' Right of Construction Centerline LOGGED BY: Yongsheng Zhao						DATE: July 20, 2021 TYPE OF DRILLING: Backhoe dug trench EQUIPMENT: HAMMER CORRECTION FACTOR: N/A										
COMPLETION DEPTH: 11																
D E P T H	S Y M B O L	S A M P L E S	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) ● PL +-----+ LL 10 20 30 40 50 60 70								PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% T C R	% R Q D
FT.			SURFACE ELEVATION: 603.7													
—			Soft, Dark Brown Silty Clay with Shale and Sandstone Fragments													
—			Medium Hard, Silty Clay with Sandstone Cobbles and Occasional Boulders													
5																
—																
—			Shale and Sandstone Cobbles and Boulders with Silty Clay*													
10																
—			Boring Terminated													
—																
15																
—																
—																
20																
—																
—																
25																
—																
—																
30																
—																
—																
35																
REMARKS: * Water Seepage at 10' below ground level. Backhoe refusal at 11' below ground level.																

BORING NO. TP-2 School House Branch
PAGE 1 OF 1

DATE:	July 20, 2021
TYPE OF DRILLING:	Backhoe dug Trench
EQUIPMENT:	
HAMMER CORRECTION FACTOR:	N/A

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%)								PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% T C R	% R Q D
					PL							LL				
			SURFACE ELEVATION: 595.8		10	20	30	40	50	60	70					
			Soft, Dark Brown Silty Clay with Some Organic Matter (Roots)													
			Medium Hard, Silty Clay with Sandstone Cobbles and Boulders													
5			SHALE - Highly Weathered, Soft Brown and Gray													
			SHALE - Weathered, Medium Hard, Dark Gray*													
10			Boring Terminated													
15																
20																
25																
30																
35																

REMARKS: Backhoe refusal at 7' below ground level.

**ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. 4 School House Branch
PAGE 1 OF 1

JOB NO. 040792 Sebastian County
JOB NAME: Hwy 45 Strs. & Apprs. (S)
Route 45, Section 01
STATION: 111+19
LOCATION: Construction Centerline
LOGGED BY: Anthony Nicholson

DATE: June 22, 2021
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 45B
HAMMER CORRECTION FACTOR: 1.47

COMPLETION DEPTH: 20

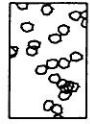
DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) ● PL +-----+ LL 10 20 30 40 50 60 70							PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% T C R	% R Q D
			SURFACE ELEVATION: 596.3												
5			Moist, Medium Dense, Brown Clayey Sand with Gravel										12		
			Moist, Dense, Brown Clayey Sand with Gravel										11-16		
			Moist, Dense, Brown Gravel (Rock Fragments)										11		
			Brown Clayey Sand with Gravel and Cobbles										13-35	62	29
10			SHALE - Slightly Weathered, Medium Hard, Frequent Slickensides, Dark Gray												
			SHALE - Slightly Weathered, Medium Hard with Soft Layers, Frequent Slickensides, Dark Gray											99	46
15			SHALE - Slightly Weathered, Medium Hard, Frequent Slickensides, Dark Gray											92	52
20			Boring Terminated												
25															
30															
35															

REMARKS:

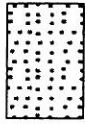
LEGEND

SOIL TYPES

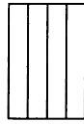
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(PREDOMINANT TYPE SHOWN HEAVY)



GRAVEL



SAND



SILT



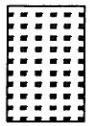
CLAY



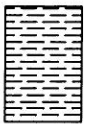
ORGANIC
MATTER

ROCK TYPES

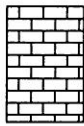
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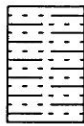
SANDSTONE



SHALE
or
SILTSTONE



LIMESTONE
or
DOLOMITE



ALTERNATING
LAYERS of
SHALE and
SANDSTONE



OTHER

SAMPLER TYPES

(SHOWN IN SAMPLE COLUMN)

SHELBY TUBE



UNDISTURBED
SAMPLE
RECOVERY

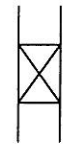


DISTURBED
SAMPLE
RECOVERY

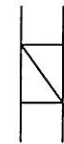


NO
RECOVERY

SPLIT SPOON

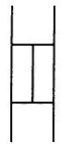


SAMPLE
RECOVERY



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.



ROCK CORE PHOTO

Job No.: 040792

Job Name: Hwy. 45 Strs. & Apprs. (S)



D40792
109+31 17' Rt + CL
9.1-21.3'

Sandstone boulders

Slightly weathered shale starts here @ 16.3 ft

D-19.06

Station and Offset, ft: Sta. 109+31, 17 Rt. (Boring 1 School House
Branch) Depth, ft: 9.1 - 21.3



ROCK CORE PHOTO

Job No.: 040792

Job Name: Hwy. 45 Strs. & Apprs. (S)



Station and Offset, ft: Sta. 109+31, 17 Rt. (Boring 1 School House Branch) Depth, ft: 21.3 - 31.3



ROCK CORE PHOTO

Job No.: 040792

Job Name: Hwy. 45 Strs. & Apprs. (S)



Station and Offset, ft: Sta. 109+31, 17 Rt. (Boring 1 School House Branch)

Depth, ft: 31.3 - 36.3



ROCK CORE PHOTO

Job No.: 040792

Job Name: Hwy. 45 Strs. & Apprs. (S)



Station and Offset, ft: Sta. 109+77.5, 18 Rt. (Boring 2 School House Branch)
Depth, ft: 10.8-22.0



ROCK CORE PHOTO

Job No.: 040792

Job Name: Hwy. 45 Strs. & Apprs. (S)



Station and Offset, ft: Sta. 109+77.5, 18 Rt. (Boring 2 School House Branch)
Depth, ft: 22.0-32.0



ROCK CORE PHOTO

Job No.: 040792

Job Name: Hwy. 45 Strs. & Apprs. (S)



Station and Offset, ft: Sta. 111+19, C.L. (Boring 4 School House Branch)
Depth, ft: 5.0-15.0



ROCK CORE PHOTO

Job No.: 040792

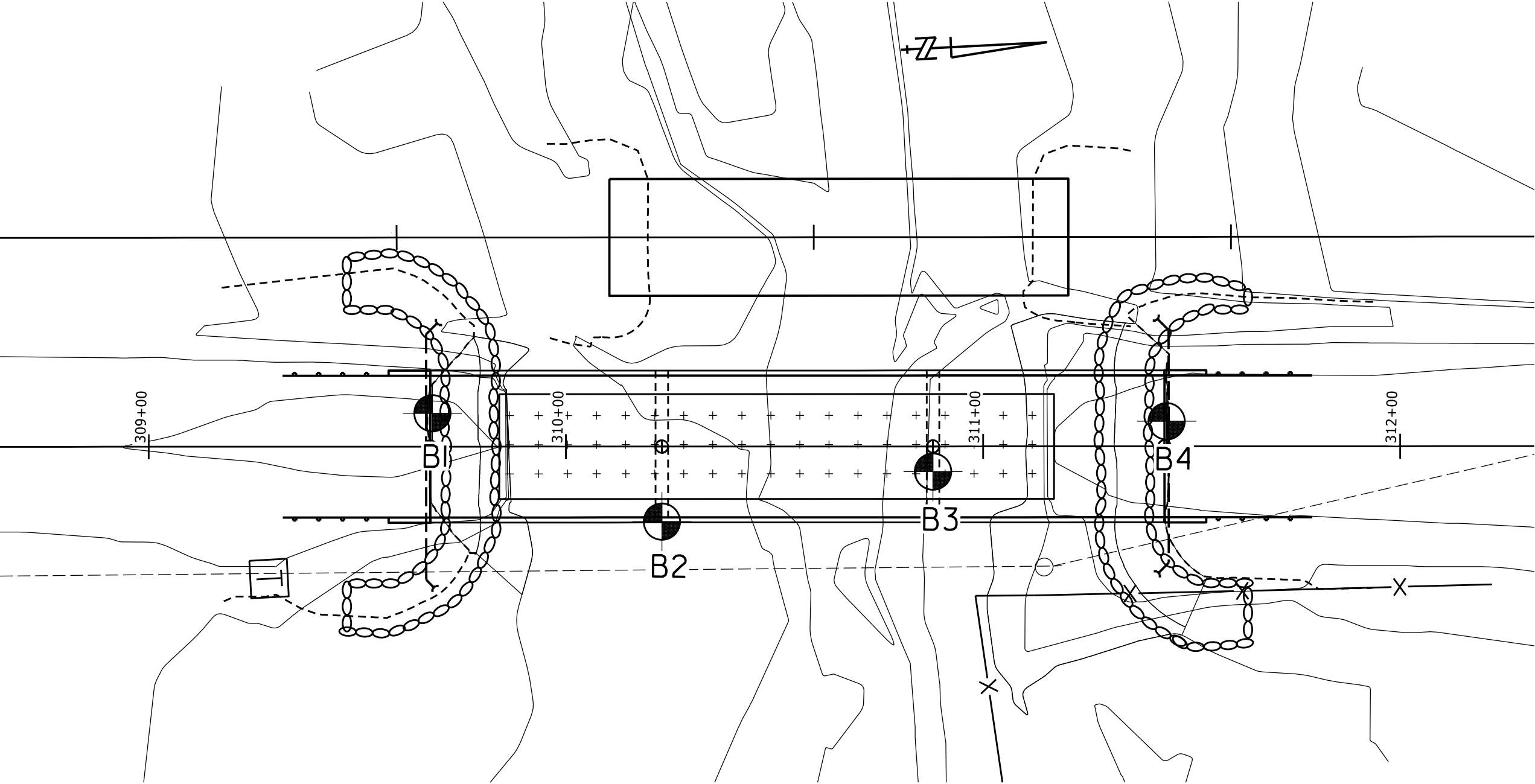
Job Name: Hwy. 45 Strs. & Apprs. (S)



Station and Offset, ft: Sta. 111+19, C.L. (Boring 4 School House Branch)
Depth, ft: 15.0-20.0

Attachment B

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
6	AR			
JOB NO.		040792		
PLAN OF BORINGS AND TEST PITS				



JOHNSON BRANCH BORINGS			
BORING	STATION	OFFSET	ELEVATION
B1	309+68	8 LT	530.90
B2	310+23	18 RT	523.94
B3	310+88	6 RT	522.14
B4	311+44	6 LT	531.20

PLAN OF BORINGS AND TEST PITS	
HWY. 45 STRS. & APPRS. (S) ROUTE 45, SECTION 1 SEBASTIAN COUNTY JOHNSON BRANCH	
JOB NO. 040792	SHEET 1/1

**ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. 1 Johnson Branch
PAGE 1 OF 1

JOB NO. 040792 Sebastian County
JOB NAME: Hwy 45 Strs. & Apprs. (S)
Route 45, Section 01
STATION: 309+68
LOCATION: 8' Left of Construction Centerline
LOGGED BY: Anthony Nicholson

DATE: June 23, 2021
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 45B
HAMMER CORRECTION FACTOR: 1.47

COMPLETION DEPTH: 32

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%)						PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% T C R	% R Q D
			SURFACE ELEVATION: 530.9		PL	+	-	-	-	+	LL			
5			Moist, Very Loose, Brown Clayey Sand with Some Gravel									3 2-2		
10			Moist, Very Stiff, Brown Clay									2 7-9		
			Dry, Dense, Dark Gray Shale Fragments									8 21-29		
15			Sandy Clay with Rock Fragments										8	0
20													30	24
25			SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS - Slightly Weathered, Medium Hard, Dark Gray										99	96
30			SHALE - Unweathered, Medium Hard, Dark Gray										100	100
			Boring Terminated											
35														

REMARKS:

**ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. 2 Johnson Branch
PAGE 1 OF 1

JOB NO. 040792 Sebastian County
JOB NAME: Hwy 45 Strs. & Apprs. (S)
Route 45, Section 01
STATION: 310+23
LOCATION: 18' Right of Construction Centerline
LOGGED BY: Anthony Nicholson

DATE: June 13, 2021
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 45B
HAMMER CORRECTION FACTOR: 1.47

COMPLETION DEPTH: 20.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) ● PL +-----+ LL 10 20 30 40 50 60 70								PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% T C R	% R Q D
5			SURFACE ELEVATION: 523.9													
			SHALE - Highly Weathered, Medium Hard, Brown and Gray		●									26 60-40 (8")		
10			SHALE - Weathered With Highly Weathered Layers, Medium Hard with Soft Layers, Brown and Gray												86	54
			SHALE - Unweathered, Medium Hard, Dark Gray													
15			SHALE - Unweathered, Medium Hard, Occasional Fractures, Dark Gray												99	80
			SHALE - Unweathered, Medium Hard, Dark Gray												94	94
20																
25			Boring Terminated													
30																
35																

REMARKS:

**ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. 3 Johnson Branch
PAGE 1 OF 1

JOB NO. 040792 Sebastian County
JOB NAME: Hwy 45 Strs. & Apprs. (S)
Route 45, Section 01
STATION: 310+88
LOCATION: 6' Left of Construction Centerline
LOGGED BY: Anthony Nicholson

DATE: July 20, 2021
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 45B
HAMMER CORRECTION FACTOR: 1.47

COMPLETION DEPTH: 22.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) ●							PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% T C R	% R Q D
					PL	+	-	-	-	+	LL				
			SURFACE ELEVATION: 522.1		10	20	30	40	50	60	70				
5															
			SHALE - Slightly Weathered, Medium Hard, Gray										30 (2")		
10														99	99
15			SHALE - Unweathered, Medium Hard Dark Gray											100	100
20														92	90
25			Boring Terminated												
30															
35															

REMARKS:

**ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. 4 Johnson Branch
PAGE 1 OF 1

JOB NO. 040792 Sebastian County
JOB NAME: Hwy 45 Strs. & Apprs. (S)
Route 45, Section 01
STATION: 311+43.5
LOCATION: 6' Left of Construction Centerline
LOGGED BY: Anthony Nicholson

DATE: June 29, 2021
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 45B
HAMMER CORRECTION FACTOR: 1.47

COMPLETION DEPTH: 27

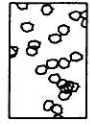
DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%)						PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% T C R	% R Q D
			SURFACE ELEVATION: 531.2		PL	+	---	+	LL					
					10	20	30	40	50	60	70			
5			Moist, Very Loose, Brown Sand with Some Shale Fragments									3 2-2		
10			Dry, Very Dense, Dark Gray Shale Fragments and Boulders (No Recovery)									10 23-35 (8")	0	0
15			SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS - Weathered, Medium Hard, Occasional Fractures, Dark Gray										94	52
20			SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS - Slightly Weathered, Medium Hard, Dark Gray										92	88
25			SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS - Unweathered, Medium Hard, Occasional Fractures, Dark Gray										100	99
30			Boring Terminated											
35														

REMARKS:

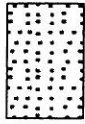
LEGEND

SOIL TYPES

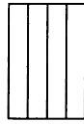
(SHOWN IN SYMBOL COLUMN)
(PREDOMINANT TYPE SHOWN HEAVY)



GRAVEL



SAND



SILT



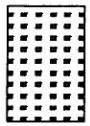
CLAY



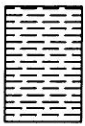
ORGANIC
MATTER

ROCK TYPES

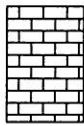
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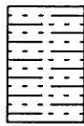
SANDSTONE



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.



ROCK CORE PHOTO

Job No.: 040792

Job Name: Hwy. 45 Strs. & Apprs. (S)



Station and Offset, ft: Sta. 309+68, 8 Lt. (Boring 1 Johnson Branch)
Depth, ft: 13.7-27.0



ROCK CORE PHOTO

Job No.: 040792

Job Name: Hwy. 45 Strs. & Apprs. (S)



Station and Offset, ft: Sta. 309+68, 8 Lt. (Boring 1 Johnson Branch)
Depth, ft: 27.0-32.0



ROCK CORE PHOTO

Job No.: 040792

Job Name: Hwy. 45 Strs. & Apprs. (S)



Station and Offset, ft: Sta. 311+43.5, 6 Lt. (Boring 1 Johnson Branch)
Depth, ft: 12.0-23.0



ROCK CORE PHOTO

Job No.: 040792

Job Name: Hwy. 45 Strs. & Apprs. (S)



Station and Offset, ft: Sta. 311+43.5, 6 Lt. (Boring 1 Johnson Branch)
Depth, ft: 23.0-28.0

Attachment C

Rock Core Unconfined Compression Test Summary

Project Number: 040792
 Project Name: Hwy. 45 Strs. & Apprs. (S)
 Date Tested: 8/12/2021

Station	Location	Sample No.	Depth (ft.)	Diameter (in)	Height (in)	Total Load (lbs.)	Correction Factor	Stress (psi)	Remarks
109+31	17' Rt.	1	19.0						Broke
109+31	17' Rt.	2	22.7	1.75	3.89	2,080		864	
109+31	17' Rt.	3	25.6	1.75	3.61	6,120		2,544	
109+31	17' Rt.	4	28.0						Broke
109+77.5	18' Rt.	5	17.5	1.75	3.61	4,800		1,995	
109+77.5	18' Rt.	6	18.3	1.75	3.40	4,550		1,891	
109+77.5	18' Rt.	7	22.0						Broke
109+77.5	18' Rt.	8	25.9	1.75	3.45	4,630		1,924	
109+77.5	18' Rt.	9	30.7						Broke
111+19	CL	10	6.0	1.75	3.51	5,230		2,174	
111+19	CL	11	10.5						Broke
111+19	CL	12	11.5						Broke
111+19	CL	13	19.1	1.75	3.50	5,180		2,153	
309+67.5	8' Lt.	14	17.2	1.75	3.50	7,400		3,076	
309+67.5	8' Lt.	15	17.6						Broke
309+67.5	8' Lt.	16	22.7						Broke
310+23	18' Rt.	17	9.2	1.75	3.48	11,260		4,681	
310+23	18' Rt.	18	9.7	1.75	3.43	9,640		4,007	
310+23	18' Rt.	19	11.9						Broke
310+88	6' Rt.	20	8.5						Broke
310+88	6' Rt.	21	9.0						Broke
311+43.5	6' Lt.	22	14.2	1.75	3.50	12,010		4,993	
311+43.5	6' Lt.	23	14.7	1.75	3.50	10,330		4,294	
311+43.5	6' Lt.	24	16.3						Broke

* Please note any broken samples, fractures or other characteristics of sample in Remarks.

ROCK MASS RATING SUMMARY

JOB # 040792

SAMPLE #1

Station/Location	109+31/17' Rt
Depth (ft)	19.0
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

SAMPLE #2

Station/Location	109+31/17' Rt
Depth (ft)	22.7
	Relative Rating
Uniaxial Compressive Strength	1
RQD	8
Spacing of Joints	20
Condition of Joints	25
Groundwater Conditions	7
Sum	61
Class Number	II
Description	GOOD ROCK

SAMPLE #3

Station/Location	109+31/17' Rt
Depth (ft)	25.6
	Relative Rating
Uniaxial Compressive Strength	2
RQD	13
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	38
Class Number	IV
Description	POOR ROCK

SAMPLE #4

Station/Location	109+31/17' Rt
Depth (ft)	28.0
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

SAMPLE #5

Station/Location	109+77.5/18' Rt
Depth (ft)	17.5
	Relative Rating
Uniaxial Compressive Strength	2
RQD	13
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	38
Class Number	IV
Description	POOR ROCK

SAMPLE #6

Station/Location	109+77.5/18' Rt
Depth (ft)	18.3
	Relative Rating
Uniaxial Compressive Strength	2
RQD	13
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	38
Class Number	IV
Description	POOR ROCK

SAMPLE #7

Station/Location	109+77.5/18' Rt
Depth (ft)	22.0
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

SAMPLE #8

Station/Location	109+77.5/18' Rt
Depth (ft)	25.9
	Relative Rating
Uniaxial Compressive Strength	2
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	33
Class Number	IV
Description	POOR ROCK

SAMPLE #9

Station/Location	109+77.5/18' Rt
Depth (ft)	30.7
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

SAMPLE #10

Station/Location	111+19/CL
Depth (ft)	8.5
	Relative Rating
Uniaxial Compressive Strength	2
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	33
Class Number	IV
Description	POOR ROCK

SAMPLE #11

Station/Location	111+19/CL
Depth (ft)	10.5
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

SAMPLE #12

Station/Location	111+19/CL
Depth (ft)	11.5
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

SAMPLE #13

Station/Location	111+19/CL
Depth (ft)	19.1
	Relative Rating
Uniaxial Compressive Strength	2
RQD	13
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	38
Class Number	IV
Description	POOR ROCK

SAMPLE #14

Station/Location	309+67.5/8'Lt
Depth (ft)	17.2
	Relative Rating
Uniaxial Compressive Strength	2
RQD	17
Spacing of Joints	30
Condition of Joints	25
Groundwater Conditions	7
Sum	81
Class Number	I
Description	VERY GOOD ROCK

SAMPLE #15

Station/Location	309+67.5/8'Lt
Depth (ft)	17.6
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

SAMPLE #16

Station/Location	309+67.5/8'Lt
Depth (ft)	22.7
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

SAMPLE #17

Station/Location	310+23/18' Rt
Depth (ft)	9.2
	Relative Rating
Uniaxial Compressive Strength	4
RQD	13
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	64
Class Number	II
Description	GOOD ROCK

SAMPLE #18

Station/Location	310+23/18' Rt
Depth (ft)	9.7
	Relative Rating
Uniaxial Compressive Strength	4
RQD	13
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	64
Class Number	II
Description	GOOD ROCK

SAMPLE #19

Station/Location	310+23/18' Rt
Depth (ft)	11.9
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

SAMPLE #20

Station/Location	310+88/6' Rt
Depth (ft)	8.5
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

SAMPLE #21

Station/Location	310+88/6' Rt
Depth (ft)	9.0
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

SAMPLE #22

Station/Location	311+43.5/6'Lt
Depth (ft)	14.2
	Relative Rating
Uniaxial Compressive Strength	4
RQD	17
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	68
Class Number	II
Description	GOOD ROCK

SAMPLE #23

Station/Location	311+43.5/6'Lt
Depth (ft)	14.7
	Relative Rating
Uniaxial Compressive Strength	4
RQD	17
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	68
Class Number	II
Description	GOOD ROCK

SAMPLE #24

Station/Location	311+43.5/6'Lt
Depth (ft)	16.3
	Relative Rating
Uniaxial Compressive Strength	Broke
RQD	
Spacing of Joints	
Condition of Joints	
Groundwater Conditions	
Sum	
Class Number	
Description	

Attachment D

Title: 040792 - Site 1

Latitude: 35.05783

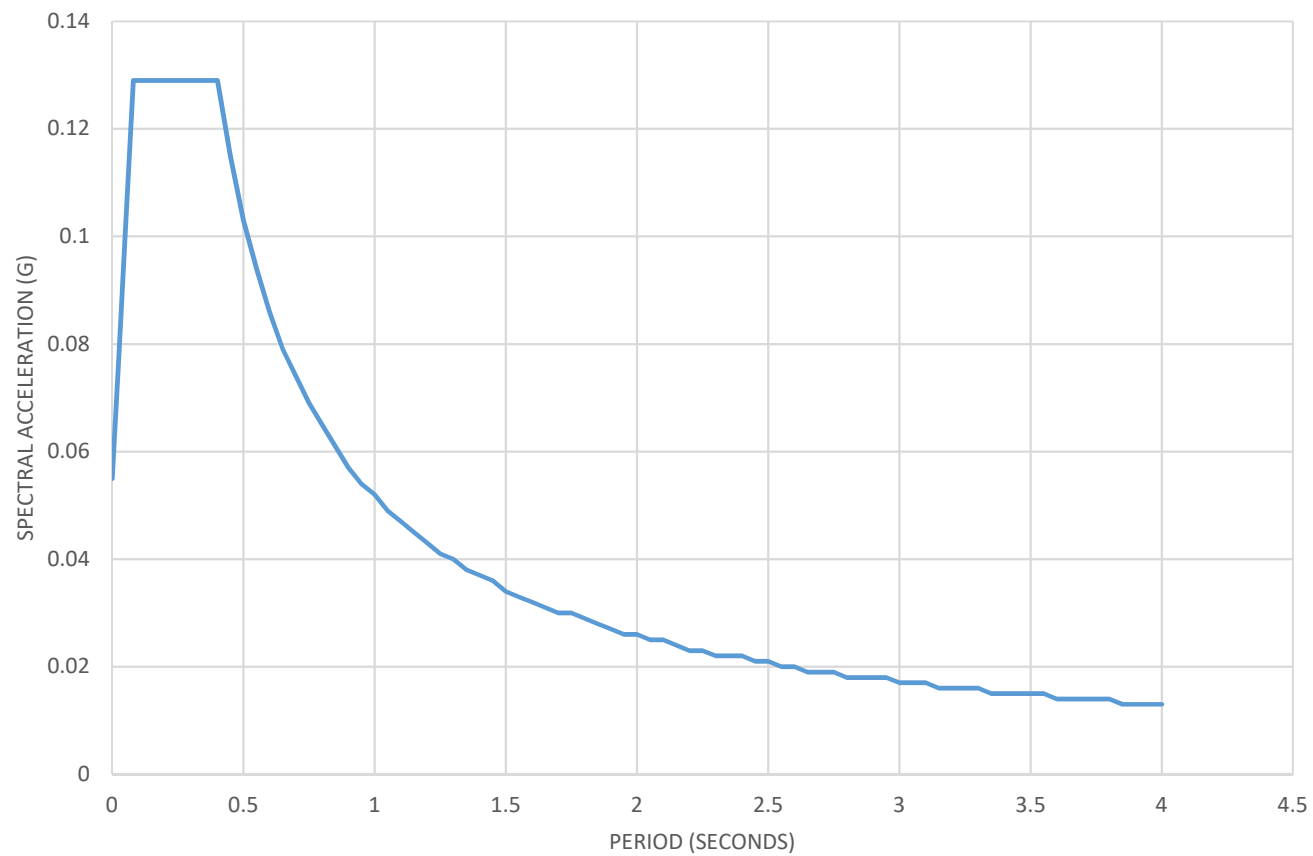
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F_V :	1
S_{D1} :	0.052
S_{DC} :	A
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T_0 :	0.08

040792 - SITE 1 DESIGN RESPONSE SPECTRUM



Title: 040792 - Site 2

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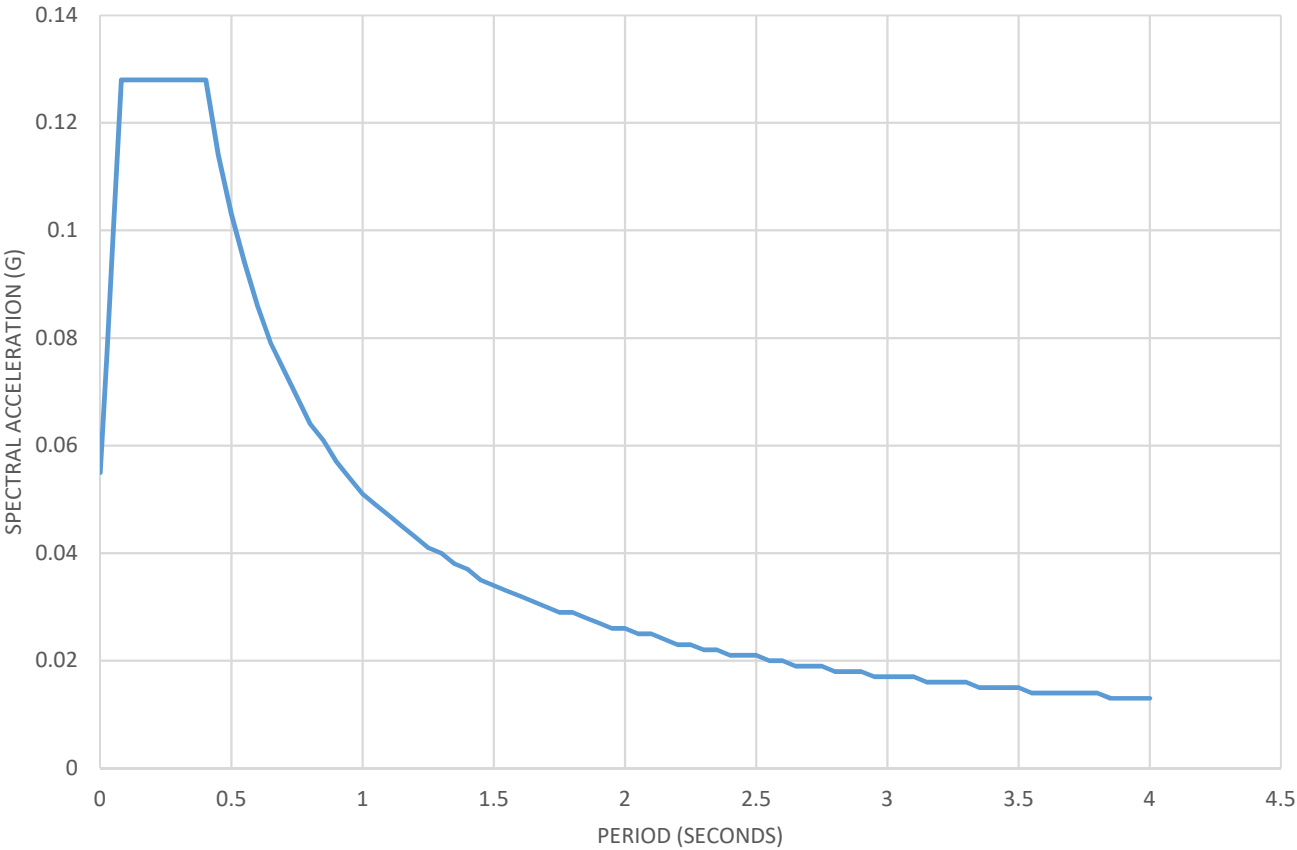
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Site Class: B

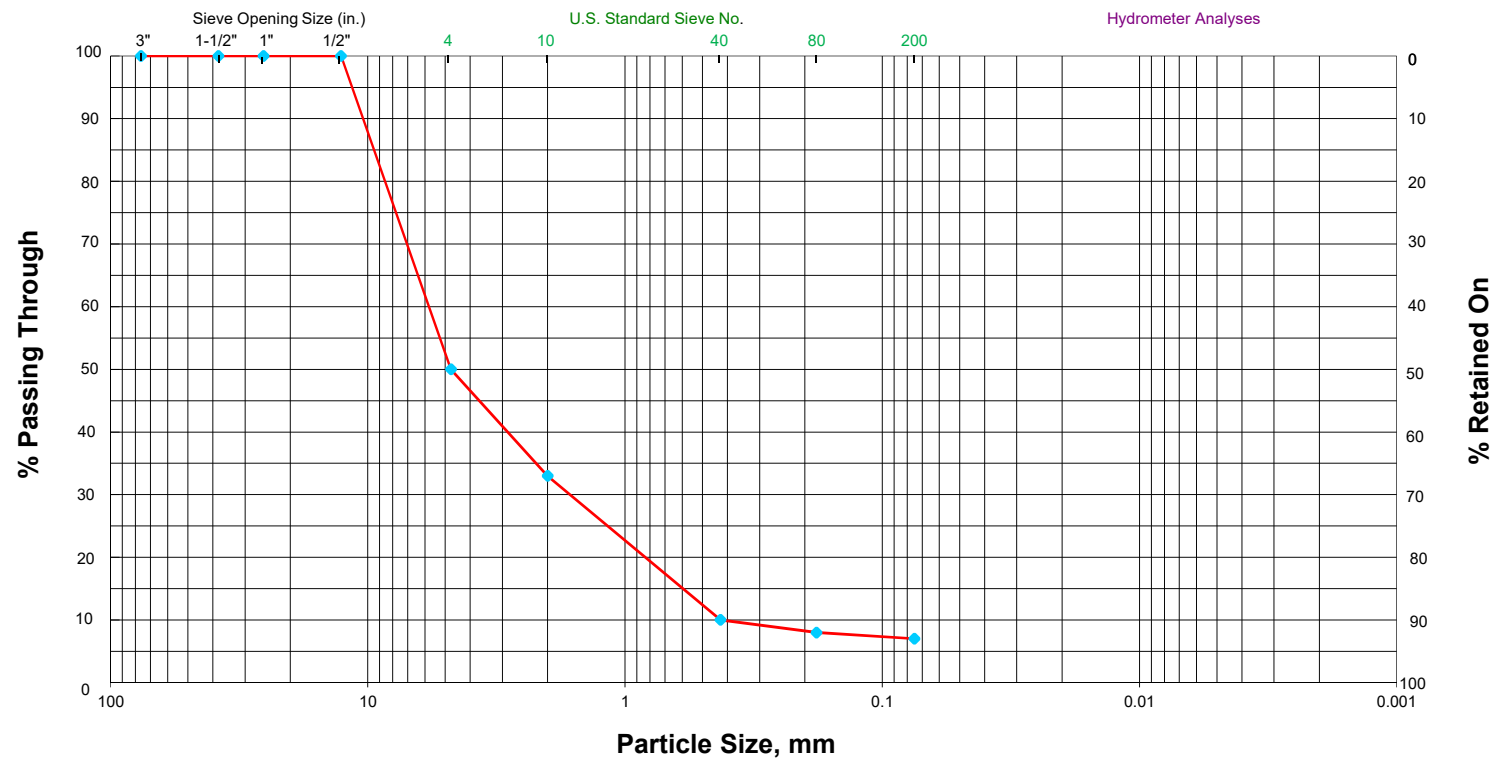
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040792 - SITE 2
DESIGN RESPONSE SPECTRUM

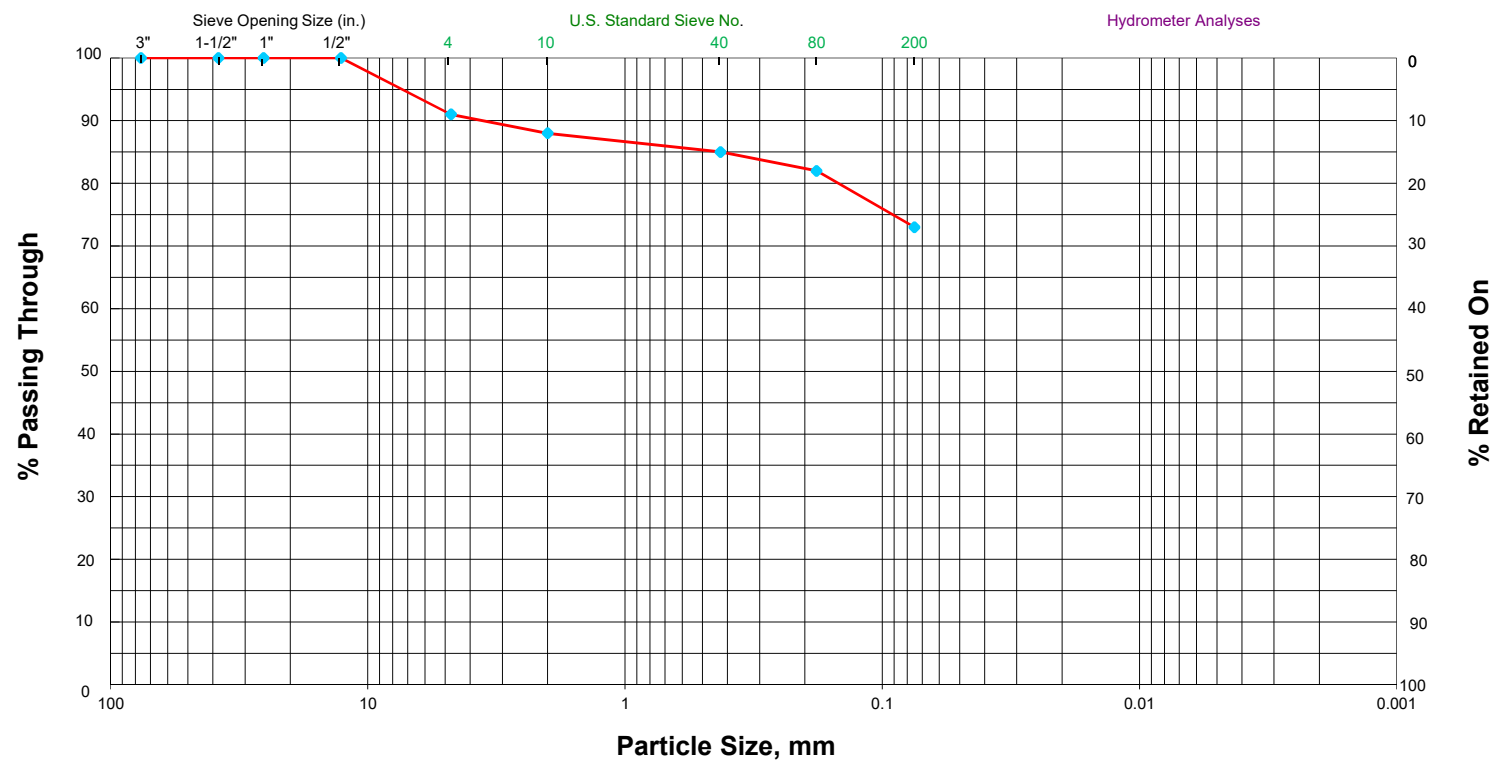


Attachment E



Particle Size Distribution Curve





Particle Size Distribution Curve

