

**ARKANSAS DEPARTMENT OF TRANSPORTATION**



**SUBSURFACE INVESTIGATION**

STATE JOB NO. BR4707

FEDERAL AID PROJECT NO. STPB-0047(71)

PEMISCOTT BAYOU STR. & APPRS. (S)

COUNTY ROAD NO. CR 197

IN MISSISSIPPI 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

July 22, 2019

**TO:** Mr. Rick Ellis, Bridge Engineer

**SUBJECT:** Job No. BR4707  
Pemiscot Bayou Str. & Apprs. (S)  
County Road 197  
Mississippi County

Transmitted herewith are a brief summary of the geology and site conditions, D50 scour analysis, summary of percent material passing #200 sieve and Atterberg Limits test results (for liquefaction susceptibility analysis), and the logs of the borings conducted for the structure and approaches of the above referenced project. 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.

This project consists of replacing the bridge crossing Pemiscot Bayou, on Mississippi County Road 197, west of Blytheville. The existing bridge is out of service and the new bridge is to be constructed on the existing alignment. Due to steep slopes, conflicts with utilities, and high water levels in the channel only two of the four requested borings were obtained. The borings that were obtained are located at: 103+77 8' Rt. of Construction Centerline and 105+61 8' Rt. of Construction Centerline.

Based on plans provided by Bridge Division and the findings from this subsurface investigation, it is anticipated that all bents will be founded on concrete filled steel shell piling.

Embankment analyses included global stability with seismic design consideration utilizing a horizontal acceleration coefficient of 0.936, as provided by Bridge Design. It is assumed that the operational classification for this bridge is "other", as defined in Section 3.10.5 of the AASHTO LRFD Bridge Design Specification, Seventh Edition, 2014. Since this is not a "critical" or "essential" bridge the large expense and additional time associated with removing existing embankments and reconstructing reinforced embankments with significant ground improvement, to satisfy seismic consideration, is not recommended. Embankment displacement is expected to occur in a large seismic event. The proposed embankment configuration provides for a satisfactory Factor of Safety for static conditions.

  
Michael C. Benson  
Materials Engineer

MCB:rpt:mlg

cc: State Construction Engineer - Master File Copy  
District 10 Engineer  
State Aid  
G.C. File

## GEOLOGY AND SITE CONDITIONS

Job No. BR4707

Pemiscot Bayou Str. & Apprs. (S)

County Road 197

Mississippi County

### **Site Conditions**

The existing bridge is a seven span structure over Pemiscot Bayou. The bridge deck is constructed of concrete supported by 11 timber beams on timber pilings. The deck has curbs, but no guardrail. Many of the pilings show damage, and the bridge is currently closed to traffic. Overhead power lines parallel the west side of the roadway. There are residences on both sides of the roadway up-station from the bridge. There is also a residence on the west side of the road down-station from the bridge. There is an agricultural field located on the west side of the road, down-station from the bridge. A slope failure is located under the up-station end of the bridge (See Figure 1.).

### **Site Geology**

The Pemiscot Bayou is a former distributary of the Mississippi River. It was active for approximately 2,000-3,000 years, flowing southwest toward the St. Francis River. When active the channel in this area would have been over 1,000 feet wide and, based on soil samples recovered, had a depth of at least 36.5 feet. The present channel is mostly infilled with silt and sandy silt. The current Pemiscot Bayou at the job site has been incorporated into the extensive system of ditches in northeast Arkansas.

The two borings drilled as part of this subsurface investigation encountered very different soils in the upper 36.5 feet. The up-station boring (**Boring 2**) encountered very loose to loose clayey sand in the upper 10 feet. These may represent backswamp deposits. Below this layer, sand with silt was encountered most likely representing point bar deposits, which grades into the generally coarser glacial outwash sands.

The down-station boring (**Boring 1**) encountered soils indicative of the infilled channel. These soils consist of loose to very loose silt to silt with sand and soft silty clay down to a depth of 36.5 feet (the uppermost sample in this zone was medium dense). As water stopped flowing in the channel, the channel started to fill up with fine-grained sediment. Below the infilled sediment layer, the soils in Boring 1 are part of the same sand unit observed in Boring 2 where sand with silt most likely representing point bar deposits grades into the generally coarser glacial outwash sands. The sands become siltier in both borings at depths greater than 80 feet.

Fine soil was recovered from the up-station side of the channel while sampling for the D-50 scour test. This may indicate that the high silt content channel fill soils may continue to the up-station side of the stream.



Figure 1. Up-station stream bank under the bridge

### **Scour Potential**

Scouring is occurring in association with ditches on both sides of the roadway. Riprap has been placed in the ditches as they enter the channel to minimize erosion. The stream is clear and flowing indicating that there is little active erosion in the channel (See Figures 2. and 3.).



Figure 2. Scouring in drainage on the down-station side of the channel and east side of the roadway.





Figure 3. Scouring in drainage on the up-station side of the channel and west side of the roadway.

### **Subsurface Conditions**

Based on the results of the borings, the subsurface stratigraphy may be generalized as follows:

- 0 to 40 Feet: Varies from moist to wet, very loose, to medium dense, brown to gray **silt to sandy silt to clayey sand**. One sample in this zone contained wet, soft **silty clay**.
- 40 to 65 Feet: Consists of wet, medium dense to dense, brown **sand to sand with silt with trace gravel**.
- 65 to 85 Feet: Consists of wet, dense to very dense, brown **sand to sand with silt with trace gravel**.
- 85 to 101.5 Feet: Consists of wet, very dense, brown **sand with silt**.

**D<sub>50</sub> AGGREGATE ANALYSIS  
FOR SCOUR CALCULATIONS**

**Job No. BR4707**

<b>Creek Name</b>	<b>Station</b>	<b>Sample Type</b>	<b>Location</b>	<b>Depth (ft.)</b>	<b>Aggregate Size (D50) (in.)</b>
Pemiscot Bayou	105+19	Creek Bank	60' Rt. of Const. C.L.	NA	Less Than 0.0029

# Lab Test Summary

Project Number: BR4707

Project Name: Pemiscot Bayou Str. & Apprs. (S)

Station	Location	Depth (ft.)	Plastic Limit	Liquid Limit	Plasticity Index	% Passing No. 200
103+77	8' RT.	4.6	NP			58
103+77	8' RT.	9.7	20	27	7	90
103+77	8' RT.	14.6	NP			92
103+77	8' RT.	20	NP			91
103+77	8' RT.	25	NP			92
103+77	8' RT.	30	NP			74
103+77	8' RT.	35	NP			52
103+77	8' RT.	40	NP			8
103+77	8' RT.	45	NP			9
103+77	8' RT.	50	NP			3
103+77	8' RT.	55	NP			4
103+77	8' RT.	60	NP			4
103+77	8' RT.	65	NP			5
103+77	8' RT.	70	NP			4
103+77	8' RT.	75	NP			ND
103+77	8' RT.	80	NP			7
103+77	8' RT.	85	NP			8
103+77	8' RT.	90	NP			8
103+77	8' RT.	95	NP			20
103+77	8' RT.	100	NP			7
105+60.94	8' RT.	4.8	ND			31
105+60.94	8' RT.	9.8	14	35	11	19
105+60.94	8' RT.	15	NP			8
105+60.94	8' RT.	20	NP			5
105+60.94	8' RT.	25	NP			4
105+60.94	8' RT.	30	NP			5
105+60.94	8' RT.	35	NP			4
105+60.94	8' RT.	40	NP			4
105+60.94	8' RT.	45	NP			2
105+60.94	8' RT.	50	NP			4
105+60.94	8' RT.	55	NP			3
105+60.94	8' RT.	60	NP			3
105+60.94	8' RT.	65	NP			3
105+60.94	8' RT.	70	NP			4
105+60.94	8' RT.	75	NP			3
105+60.94	8' RT.	80	NP			2
105+60.94	8' RT.	85	NP			6
105+60.94	8' RT.	90	NP			5
105+60.94	8' RT.	95	NP			6
105+60.94	8' RT.	100	NP			5

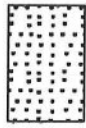
# LEGEND

## SOIL TYPES

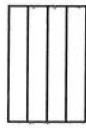
(SHOWN IN SYMBOL COLUMN)  
(PREDOMINANT TYPE SHOWN HEAVY)



GRAVEL



SAND



SILT



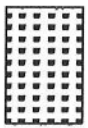
CLAY



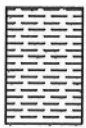
ORGANIC  
MATTER

## ROCK TYPES

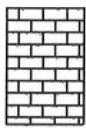
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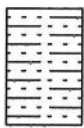
SANDSTONE



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, and 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:  $\frac{6}{8-9} \Rightarrow 8+9 = 17 \text{ blows} / \text{ft}$ . 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 DEPARTMENT OF TRANSPORTATION  
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. 1  
PAGE 1 OF 3

JOB NO. BR4707 Mississippi County  
JOB NAME: Pemiscot Bayou Str. & Apprs. (S)  
Co. Rd. 197  
STATION: 103+77  
LOCATION: 8' Right of Construction Centerline  
LOGGED BY: Austin Dillman

DATE: March 26, 2019  
TYPE OF DRILLING:  
Hollow Stem Auger - Rotary Wash  
EQUIPMENT: CME 75  
HAMMER CORRECTION FACTOR: 1.37

COMPLETION DEPTH: 101.5

DEPTH FT.	SYMBOLS	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT	LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% T C R	% R Q D
			SURFACE ELEVATION: 245.6									
5		X	Moist, Medium Dense, Gray Sandy Silt with Trace Gravel	ML	NP					$\frac{2}{5-6}$		
10		X	Wet, Soft, Gray Silty Clay	CL-ML	20		27			$\frac{1}{2-2}$		
15		X		ML	NP					$\frac{1}{1-2}$		
20		X	Wet, Very Loose, Gray Silt	ML	NP					$\frac{1}{1-1}$		
25		X		ML	NP					$\frac{2}{3-3}$		
30		X	Wet, Loose, Gray Silt	ML	NP					$\frac{2}{3-7}$		
35		X	Wet, Loose, Gray Silt with Sand	ML	NP							

REMARKS:

**ARKANSAS DEPARTMENT OF TRANSPORTATION  
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BORING NO. 1  
PAGE 2 OF 3

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			SURFACE ELEVATION: 245.6									
40		X	Wet, Medium Dense, Gray Silt with Sand	ML	NP					$\frac{2}{4-9}$		
45		X	Wet, Medium Dense, Brown, Well-Graded Sand with Silt	SW-SM	NP					$\frac{4}{8-10}$		
50		X	Wet, Medium Dense, Brown, Poorly-Graded Sand with Silt and Trace Gravel	SP-SM	NP					$\frac{3}{7-10}$		
55		X	Wet, Dense, Brown, Poorly-Graded Sand	SP	NP					$\frac{8}{12-20}$		
60		X	Wet, Dense, Brown, Poorly-Graded Sand with Trace Gravel	SP	NP					$\frac{12}{17-28}$		
65		X	Wet, Dense, Brown, Well-Graded Sand with Trace Gravel and Trace Organic Matter	SW	NP					$\frac{12}{14-17}$		
70		X	Wet, Dense, Brown, Poorly-Graded Sand with Silt	SP-SM	NP					$\frac{12}{19-23}$		

REMARKS:

**ARKANSAS DEPARTMENT OF TRANSPORTATION  
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BORING NO. 1  
PAGE 3 OF 3

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			SURFACE ELEVATION: 245.6									
75		X	Wet, Dense, Brown, Poorly-Graded Sand	SP	NP					12 18-24		
80		X	Wet, Very Dense, Brown Sand with Trace Gravel	ND	NP					15 24-34		
85		X	Wet, Very Dense, Brown, Poorly-Graded Sand with Silt	SP-SM	NP					24 68-64		
90		X		SP-SM	NP					20 40-46		
95		X	Wet, Very Dense, Brown Sand with Silt and Trace Organic Matter	SP-SM	NP					17 38-50		
100		X		SP-SM	NP					25 40-57		
101.5			Boring Terminated	SP-SM	NP					20 45-85		

REMARKS:

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

BORING NO. 2  
PAGE 1 OF 3

JOB NO. BR4707 Mississippi County  
JOB NAME: Pemiscot Bayou Str. & Apprs. (S)  
Co. Rd. 197  
STATION: 105+61  
LOCATION: 8' Right of Construction Centerline  
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EQUIPMENT: CME 75  
HAMMER CORRECTION FACTOR: 1.37

COMPLETION DEPTH: 101.5

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.	% T C R	% R Q D
			SURFACE ELEVATION: 245.6									
5			Moist, Very Loose, Brown Clayey Sand with Gravel	-						1 1-2		
10			Moist, Loose, Brown Clayey Sand with Trace Gravel and Trace Organic Matter	SC	14		35			1 2-3		
15			Wet, Medium Dense, Brown, Well-Graded Sand with Silt	SW-SM	NP					4 7-9		
20			Wet, Medium Dense, Brown, Poorly-Graded Sand with Silt with Some Gravel	SP-SM	NP					5 7-8		
25			Wet, Medium Dense, Brown, Poorly-Graded Sand with Trace Gravel	SP	NP					8 11-15		
30			Wet, Medium Dense, Brown, Poorly-Graded Sand with Silt with Trace Gravel	SP-SM	NP					6 12-13		
35												

REMARKS:

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BORING NO. 2  
PAGE 2 OF 3

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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.	% TCR	% RQD
			SURFACE ELEVATION: 245.6									
35	[Dotted Pattern]	X		SP	NP					6 7-8		
40				-								
45	[Dotted Pattern]	X	Wet, Medium Dense, Brown, Poorly-Graded Sand with Trace Gravel	SP	NP					9 14-15		
50				-								
55	[Dotted Pattern]	X	Wet, Dense, Brown, Poorly-Graded Sand with Trace Gravel	SP	NP					11 15-25		
60				-								
65	[Dotted Pattern]	X	Wet, Medium Dense, Brown, Poorly-Graded Sand with Trace Gravel	SP	NP					9 12-10		
70				-								
75	[Dotted Pattern]	X	Wet, Dense, Brown, Poorly-Graded Sand with Trace Gravel	SP	NP					10 19-24		
80				-								

REMARKS:



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PAGE 3 OF 3

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			SURFACE ELEVATION: 245.6									
75		X	Wet, Dense, Brown, Poorly-Graded Sand with Trace Gravel and Trace Organic Matter	SP	NP					12 16-20		
80		X	Wet, Dense, Brown, Poorly-Graded Sand with Trace Gravel	SP	NP					10 15-20		
85		X	Wet, Dense, Brown, Poorly-Graded Sand with Trace Gravel	SP	NP					10 17-18		
90		X	Wet, Very Dense, Brown, Poorly-Graded Sand with Silt and Trace Gravel	SP-SM	NP					22 32-41		
95		X	Wet, Very Dense, Brown, Poorly-Graded Sand with Silt	SP-SM	NP					20 31-44		
100		X	Wet, Very Dense, Brown, Poorly-Graded Sand with Silt and Trace Gravel	SP-SM	NP					26 31-50		
		X		SP-SM	NP					30 70-100		
			Boring Terminated									
105												

REMARKS: