

ARKANSAS DEPARTMENT OF TRANSPORTATION



SUBSURFACE INVESTIGATION

STATE JOB NO. 090402

FEDERAL AID PROJECT NO. NHPP-0004(50)

LITTLE OSAGE CREEK STR. & APPRS. (S)

STATE HIGHWAY 264 SECTION 3

IN BENTON 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 STATE HIGHWAY AND TRANSPORTATION DEPARTMENT

October 2, 2014

TO: Mr. Rick Ellis, Bridge Engineer

SUBJECT: Job No. 090402
Little Osage Creek Str. & Apprs. (S)
Route 264 Section 3
Benton County

Transmitted herewith are a brief summary of the geology and site conditions, unconfined compressive strength test results, D50 analysis test results, 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. The rock cores are available for inspection at the Materials Division.

Based on the depth at which bedrock was encountered, it is anticipated that the interior bents will be founded on spread footings. Spread footings should be sized based on the values provided in Table 1.

TABLE 1 – Bearing Capacity Recommendations for Interior bents

Foundation Description	Nominal Bearing Resistance (ksf)	Resistance Factor	Factored Bearing Resistance (ksf)
Spread Footings	81	0.45	36.5

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



Michael C. Benson
Materials Engineer

MCB:rpt

cc: State Construction Engineer - Master File Copy
District 9 Engineer
G.C. File

GEOLOGY AND SITE CONDITIONS
Job No. 090402
Little Osage Creek Str. & Apprs. (S)
Route 264 Section 3
Benton County

Site Conditions

The existing bridge is an eleven span structure over the Little Osage Creek. The bridge is constructed of precast concrete deck, except spans 6 and 7 which are composed of concrete deck supported by 5 steel beams with concrete bents and end walls. The guardrail is constructed of steel with concrete posts. Overhead power lines parallel the north side of the roadway. Trees line the channel with pasture surrounding the bridge. Located southwest of the bridge is a gated subdivision. The stream flows to the south, at the job location.

Site Geology

The project alignment is located on rocks mapped as the Boone Formation (map symbol Mb). The Boone Formation consists of gray, fine- to coarse-grained fossiliferous limestone interbedded with chert. Some sections may be predominantly limestone or chert. The chert is dark in color in the lower part of the sequence and light in the upper part. The quantity of chert varies considerably both vertically and horizontally. The Boone Formation is well known for dissolutional features, such as sinkholes, caves, and enlarged fissures. Only one small vug (less than one inch in diameter) was observed in the cores.

The thickness of the Boone Formation is 300 to 350 feet in most of northern Arkansas, but as much as 390 feet has been reported. Depth to bedrock varied in borings from 3.7 to 10.2 feet below ground level. The elevation of the top of bedrock varied from 1084.2 to 1085.0 feet above MSL.

Subsurface Conditions

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

- 0 to 3.7 Feet: Consists of wet, loose to very dense, brown sand with gravel (chert fragments) to gravel and cobbles (chert fragments).
- 3.7 to 10.2 Feet: Varies from moist, soft to stiff, brown clay with some gravel (chert fragments) to wet, very dense, white gravel (chert fragments) with sand to moderately hard, gray limestone with chert layers to hard, gray limestone with chert layers. There are some vertical fractures in this zone.
- 10.2 to 33.3 Feet: Consists of hard gray limestone with chert layers. There are some vertical fractures in this zone.

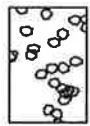
**D₅₀ AGGREGATE ANALYSIS
FOR SCOUR CALCULATIONS**

Job No. 090402					
Creek Name	Station	Sample Type	Location	Depth (FT)	Aggregate Size (D50) (IN)
Little Osage Creek	113+09	Creek Bank	15' Rt. C.L. Construction	N/A	0.75

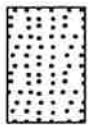
LEGEND

SOIL TYPES

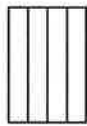
(SHOWN IN SYMBOL COLUMN)
(PREDOMINANT TYPE SHOWN HEAVY)



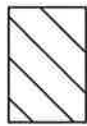
GRAVEL



SAND



SILT



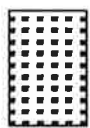
CLAY



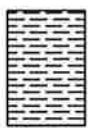
ORGANIC
MATTER

ROCK TYPES

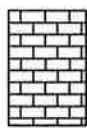
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SANDSTONE



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

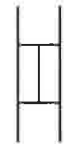


SAMPLE
RECOVERY



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.

ARKANSAS HWY. & TRANS. DEPARTMENT		BORING NO. 1
MATERIALS DIVISION - GEOTECHNICAL SEC.		PAGE 1 OF 1
JOB NO. 090402	Benton County	DATE: September 9, 2014
JOB NAME: Little Osage Creek Str. & Apprs.	S.H. 264	TYPE OF DRILLING: Hollow Stem Auger & Diamond Coring
STATION: 112+04		EQUIPMENT: CME 850 w/ CME Automatic Hammer
LOCATION: 16' Right of Center Line of Construction		HAMMER CORRECTION FACTOR: 1.23
LOGGED BY: David Allen		

COMPLETION DEPTH: 28.2

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: 1089.9									
5			Wet, Medium Dense to Very Dense, Brown and Gray Sand with Gravel (Cherty Limestone Fragments)							3 2-23		
			LIMESTONE WITH CHERT LAYERS - Gray, Medium Bedded, Slightly Weathered, Hard, with Slight Dip							60 (2")	98	56
10			LIMESTONE WITH CHERT LAYERS - Gray, Thick Bedded, Slightly Weathered, Hard, with Slight Dip								100	38
15			LIMESTONE WITH CHERT LAYERS - Gray, Thick Bedded, Slightly Weathered, Hard, with Slight Dip								100	58
20			LIMESTONE WITH CHERT LAYERS - Gray, Thick Bedded, Slightly Weathered, Hard, with Slight Dip								100	60
25			LIMESTONE WITH CHERT LAYERS - Gray, Medium Bedded, Slightly Weathered, Hard, with Slight Dip								100	40
30			Boring Terminated									
35												

REMARKS:


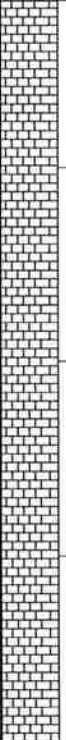
**ARKANSAS HWY. & TRANS. DEPARTMENT
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. 2
PAGE 1 OF 1

JOB NO. 090402 Benton County
JOB NAME: Little Osage Creek Str. & Apprs.
S.H. 264
STATION: 112+78
LOCATION: 15.5' Right of Center Line of Construction
LOGGED BY: David Allen

DATE: September 10, 2014
TYPE OF DRILLING: Hollow Stem Auger &
Diamond Coring
EQUIPMENT: CME 850 w/ CME
Automatic Hammer
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 23

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: 1088.5										
			Wet, Very Dense, Brown Sand with Gravel (Cherty Limestone Fragments)							60 (2")			
5			LIMESTONE WITH CHERT LAYERS - Gray, Medium Bedded, Slightly Weathered, Hard, with Slight Dip and Fractured Layers								100	30	
10											100	24	
15												100	18
20												100	40
25			Boring Terminated										
30													
35													

REMARKS:

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

BORING NO. 3
PAGE 1 OF 1

JOB NO. 090402 Benton County
JOB NAME: Little Osage Creek Str. & Apprs.
S.H. 264
STATION: 113+93
LOCATION: 11' Right of Center Line of Construction
LOGGED BY: David Allen

DATE: September 16, 2014
TYPE OF DRILLING: Hollow Stem Auger &
Diamond Coring
EQUIPMENT: CME 850 w/ CME
Automatic Hammer
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 28.4

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
			SURFACE ELEVATION: 1091.1									
5			Gravel (Cherty Limestone Fragments) and Cobbles							5 4-60 (3")		
			LIMESTONE WITH CHERT LAYERS - Gray, Thin Bedded, Slightly Weathered, Hard, with Slight Dip and Fractured Layers								83	0
10			LIMESTONE WITH CHERT LAYERS - Gray, Thick Bedded, Slightly Weathered, Hard, with Slight Dip and Fractured Layers								94	30
15											100	14
20			LIMESTONE WITH CHERT LAYERS - Gray, Medium Bedded, Slightly Weathered, Hard, with Slight Dip and Fractured Layers								100	14
25											100	22
30			Boring Terminated									
35												

REMARKS:





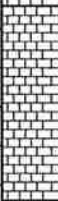

**ARKANSAS HWY. & TRANS. DEPARTMENT
MATERIALS DIVISION - GEOTECHNICAL SEC.**

BORING NO. 4
PAGE 1 OF 1

JOB NO. 090402 Benton County
JOB NAME: Little Osage Creek Str. & Apprs.
S.H. 264
STATION: 114+95
LOCATION: 6' Right of Center Line of Construction
LOGGED BY: David Allen

DATE: September 16, 2014
TYPE OF DRILLING: Hollow Stem Auger &
Diamond Coring
EQUIPMENT: CME 850 w/ CME
Automatic Hammer
HAMMER CORRECTION FACTOR: 1.23

COMPLETION DEPTH: 32.4

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
			SURFACE ELEVATION: 1094.9									
5		X	Wet, Loose, Brown and Gray Sand with Gravel (Cherty Limestone Fragments) and some Organic Matter							4 34		
10		X	Gravel (Cherty Limestone Fragments) and Cobbles							4 6-60 (5")		
15			LIMESTONE WITH CHERT LAYERS - Gray, Thin Bedded, Slightly Weathered, Hard, with Slight Dip and Fractured Layers **								91	36
20			LIMESTONE WITH CHERT LAYERS - Gray, Medium Bedded, Slightly Weathered, Hard, with Slight Dip and Fractured Layers **								30*	0
25			LIMESTONE WITH CHERT LAYERS - Gray, Thick Bedded, Slightly Weathered, Hard, with Slight Dip								100	30
30			LIMESTONE WITH CHERT LAYERS - Gray, Thick Bedded, Slightly Weathered, Hard, with Slight Dip								100	52
35			Boring Terminated									

REMARKS: * Poor core recovery due to core barrel malfunction. ** Total water loss was encountered from 12.8' to 16.2' and at 24.4'.