GEOTECHNICAL INVESTIGATION

COUNTS MASSIE ROAD STREET AND DRAINAGE PROJECT

MAUMELLE, ARKANSAS

for

CITY OF MAUMELLE
MAUMELLE, ARKANSAS

December 2013

Project No. LR135736

Prepared By:

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MAUMELLE, ARKANSAS

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EXECUTIVE SUMMARY

This is a report of the findings of subsurface exploration for the proposed Counts Massie Road Street and Drainage project that will extend along the existing Counts Massie Road east from the intersection with Northwood Creek Road for an approximate length of 3,600 feet. This report includes site-preparation and construction recommendations. The following is a summary of significant findings:

- Six (6) borings were conducted along approximately 3,600 feet of planned roadway additions east of the intersection of Counts Massie Road and Northwood Creek Road.
- A surface stratum of silty topsoil was found to be an average of six (6) inches in thickness in non-paved areas.
- Borings drilled through existing pavement encountered approximately two (2) inches of asphalt underlain by approximately six (6) inches of base course material.
- Subgrade soils were found to be soft sandy clay material that varied in plasticity and moisture content.
- Groundwater was not encountered in any of the boring locations.
- Onsite soils not considered adequate for use as fill beneath pavement sections.
- Pavement design parameters may use the California Bearing Ration (CBR) value of 6.0 for the native subgrade material.
- The Structural Number used for the pavement design is 4.41.

- Options for pavement sections for this project are recommended to be as detailed below:

Option - 1

	Thickness (in)	Pavement Section Structural Number
ACHM Surface Course	3	
ACHM Binder Course	4	**4.48**
Class 7 Base Course at 95% MPD	10	

Option - 2

	Thickness (in)	Pavement Section Structural Number
ACHM Surface Course	2	
ACHM Binder Course	3	**4.4**
Class 7 Base Course at 95% MPD	10	
Subgrade	10	

Option - 3

	Thickness (in)	Pavement Section Structural Number
ACHM Surface Course	3	
ACHM Binder Course	3	**4.44**
Class 7 Base Course at 95% MPD	6	
Subgrade	12	

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INTRODUCTION

An investigation of subsurface soil conditions was conducted by McClelland Consulting Engineers, Inc., within the area of the proposed Counts Massie Road Street and Drainage project in Maumelle, Arkansas. The authorization to obtain subsurface soil conditions at the project site and to prepare pavement design recommendations for the proposed roadway was given by Mr. Stacy Akin, PE, of McClelland Consulting Engineers, Inc. in Little Rock, Arkansas.

The data was determined from the following three phase program:

A. An investigation of the subsurface conditions and visual soil classification by use of sample borings.

B. A laboratory testing program to determined the strength parameters and engineering properties of the soil strata.

C. An engineering analysis of the laboratory and field data for bearing capacity and foundation recommendations.

FIELD INVESTIGATION

The subsurface soil conditions in the project area were investigated by six (6) borings. The borings were conducted to planned terminal depths of approximately seven and one-half (7.5) feet below existing ground elevations. The boring locations

are indicated on Plates 1A and 1B. Descriptions and classifications of the soil strata encountered and the results of the field and laboratory tests are given on the boring logs, Plates 2 through 7. A key to the terms and symbols used on the boring logs is presented on Plate 8.

The borings were drilled using a truck-mounted rotary drilling rig and with a six and one-half (6-½) inch hollow-stem auger. Soil samples were obtained at the depths indicated on the borings by the use of a two (2) inch split-spoon sampler, for obtaining samples from non-cohesive or slightly cohesive soils. The split-spoon sampler was driven by blows from a 140-pound hammer dropped thirty (30) inches. The number of blows required to drive the split-spoon sampler the final twelve (12) inches of an eighteen (18) inch drive, or portion thereof, is referred to as the Standard Penetration value, N, and is recorded on the boring logs in the blows-per-foot column.

The field tests performed included visual soil classifications and groundwater observations. The visual soil classifications are given on the boring logs. The groundwater table was not encountered by the borings at the time of drilling.

LABORATORY TESTS

Laboratory tests were performed on soil samples recovered from the borings. The laboratory tests are directed at determining the engineering properties of the soil strata. The tests performed on samples from the borings included moisture content, unit

weight, gradation, Atterberg Limits, Standard Moisture-Density Relationship, and California Bearing Ratio (CBR).

Results of laboratory testing are provided on the boring logs, Plates 2 through 7, and on the Laboratory Test Results Summary, found on Plates 9 and 10. Standard Proctor and CBR results can be referenced in Figures 1 and 2 at the end of this report.

The natural soil moisture content was determined for the selected soil samples to provide a moisture profile for each test pit and boring. Unit weight determinations were performed on suitable undisturbed soil samples and the dry unit weight was obtained.

Atterberg Limits tests (liquid and plastic limits) were performed on selected samples to aid in the soil classification and to help evaluate the volume change characteristics of each soil stratum.

Gradation analyses were performed on representative soil samples to aid in the soil classification of the selected soil strata.

A Standard Proctor Test (ASTM D 698) was performed on representative subgrade material to determine the relationship between moisture content and compacted unit weight of the material. California Bearing Ratio Tests (ASTM D 1883) were performed to evaluate the potential strength of subgrade materials. The results of the

Standard Proctor test and the CBR values at ninety-eight (98) percent Standard Proctor density for the onsite soils are presented in Figures 1 and 2, respectively.

GENERAL SOIL CONDITIONS

According to the USDA soil survey map for the project area, the following soil types exist in the project area:

- Tiak Fine Sandy Loam. This soil type is indicated across the majority of the project area.
- Perry Clay. This soil type is indicated southeast and east of the project area.

The existing pavement section encountered by Boring 5 was approximately two (2) inches of asphalt underlain by six (6) inches of base course material.

The borings encountered a surface stratum of topsoil approximately six (6) inches in thickness in non-paved areas. All of the borings encountered fine-grained soils beneath the existing pavement and topsoil stratum, where applicable, to their terminal depths. The subgrade soils varied in classification and were found to be soft to firm sandy clays. The variance in the subgrade material was generally with regards to plasticity and moisture content. The encountered fine-grained soils are considered moisture-sensitive and may lose strength upon saturation and/or disturbance.

Fine-Grained Soil Analysis

The clay fractions of the sandy clay (CL) materials have a low to moderate plasticity and a moderate potential for volumetric changes due to changes and sensitivity to the

soil moisture content. The liquid limit of the CL soils ranged from 28 to 49 and the plasticity index of those soils ranged from 11 to 30. The clay fractions of the CL materials make up between 52 and 91 percent of the entire soil mass as indicated by the results of gradation analyses from the borings.

The clay fractions of the sandy clay (CH) materials have a moderate to high plasticity and a high potential for volumetric changes due to changes and sensitivity to the soil moisture content. The liquid limit of the CH soils ranged from 50 to 61 and the plasticity index of those soils ranged from 26 to 33. The clay fractions of the CH materials make up between 53 and 57 percent of the entire soil mass as indicated by the results of gradation analyses from the borings.

The clayey soils have a low permeability of approximately $1x10^{-6}$ cm/sec and a very low vertical percolation rate into the soil mass.

ANALYSIS AND RECOMMENDATIONS

Site Grading

The grading for the project area should include the removal of all topsoil and other deleterious material to a minimum depth of ten (10) inches below planned bottom of pavement elevation. The grading depth could increase to a maximum of twenty (20) inches below planned bottom of pavement elevation, depending on the chosen pavement section option. Soft or yielding subgrade material may require an additional undercut depth of two (2) feet below finish subgrade elevation in isolated areas.

Rock excavation techniques are not intended to be required during the project. If rock material is encountered during site grading, it should be excavated to an elevation that will allow for the placement and compaction of a minimum six (6) inches of base course material.

The native subgrade material shall be prepared in accordance with Section 212 of the AHTD Standard Specifications for Highway Construction, 2003 edition.

Alternatively, the native subgrade area may be proof-rolled using a tandem-axle, fully-loaded dump truck weighing at least 60,000 lbs, or equivalent equipment. The proof-rolling, if used, should be performed in the presence of the Engineer and/ or Owner. All soft or yielding materials and portions of the subgrade that do not meet the compacted density requirements shall be undercut and stabilized as directed by the Engineer. Native soils in the areas of Borings 4 and 5 were found to have loose in-situ compaction. The "firm" soils encountered by Borings 1, 2, 3 and 6 are considered moisture-sensitive and are likely to lose significant strength upon saturation and/or disturbance. We anticipate maximum undercut depths of two (2) feet below planned subgrade elevation being required, especially if earthwork operations are conducted during wet periods of the year.

The use of thickened lifts of select fill material to a maximum thickness of twenty-four (24) inches is permitted to prevent further undercutting beneath roadway subgrade elevations. The top eight (8) inches of any thickened lift should be compacted and tested per project specifications. Additionally, thickened lifts should be placed so that a

minimum of one (1) standard eight (8) inch lift of select fill material may be placed above the thickened lift to reach planned subgrade elevation.

Site construction is recommended to take place when the moisture content of the subgrade material is near the optimum moisture content as determined by Standard Proctor testing. Should the construction schedule not allow adequate time for the subgrade to dry and be properly compacted, a needle-punched non-woven or woven polypropylene geotextile meeting the requirements of Type 8 Geotextile, contained in Section 625 of the AHTD Standard Specifications for Highway Construction, 2003 edition, is recommended to stabilize subgrade materials. Geotextiles are only to be placed under the direction of the Engineer.

Embankment slopes should not exceed 3:1. All embankment slopes, both of finished construction and at the completion of the various phases of construction, should be stabilized to prevent erosion by placement of topsoil and seeding in accordance with the project specifications. Alternatively, erosion control mats may be used to cover erodible materials in areas where construction is not complete but has been stopped for periods of time in excess of 21 days.

Pavement Design

The CBR of the subgrade materials was found to be 3.0. Pavement sections recommendations for this project are as follows on the next page:

Option - 1

	Thickness (in)	Pavement Section Structural Number
ACHM Surface Course	3	
ACHM Binder Course	4	**4.48**
Class 7 Base Course at 95% MPD	10	

Option - 2

	Thickness (in)	Pavement Section Structural Number
ACHM Surface Course	2	
ACHM Binder Course	3	**4.4**
Class 7 Base Course at 95% MPD	10	
Subgrade	10	

Option - 3

	Thickness (in)	Pavement Section Structural Number
ACHM Surface Course	3	
ACHM Binder Course	3	**4.44**
Class 7 Base Course at 95% MPD	6	
Subgrade	12	

Note: Though not anticipated, if competent rock formations are encountered within the planned pavement sections, the rock should be excavated so that a minimum of six (6) inches of Class 7 base course material may be placed and compacted. The three (3) pavement section options are intended for a subgrade material with a CBR value of 6.0, and not for competent rock material.

The pavement design was based on the design traffic of 12,000 vehicles, as referenced with the current Average Daily Traffic map, provided by the Arkansas State Highway and Transportation Department. The required Structural Number for the pavement design is 4.41 per the pavement design calculation given on Plate 11 at the end of this report. The top 1-1/2 inches of the existing roadway should be milled to accept the new pavement in the area of transition from new roadway to existing roadway.

Select Fill Material

Native soils are not considered suitable for use as fill beneath pavement and sidewalks. Imported fill material should meet the requirements of select material. The CBR value for any materials to be classified as "select material" in the pavement subgrade should be tested to ensure a minimum CBR value of eight (8).

Additionally, imported select material is recommended to be locally available material meeting Unified Soils Classification as a GC, GW or GM material, having a Plasticity Index of 20 or less, and having a Liquid Limit of 50 or less. The structural embankment material should be compacted in place in maximum eight (8)-inch compacted lifts to a minimum density of 98 percent of the maximum density as determined by the Standard Proctor Test, ASTM D 698. The select embankment material should be compacted between five (5) percent below and two (2) percent above the optimum moisture content.

Any additional fill material required within the Right-of-Way should also meet the requirements of select material. The soil, fill, and base materials for embankment and subgrade should be controlled in accordance with Section 306 and other appropriate sections of Division 300 of the AHTD Standard Specifications for Highway Construction, 2003 edition.

All trenching and excavation should be conducted in accordance with Arkansas State Law and OSHA guidelines and requirements.

Quality Control testing of the earthwork operation, concrete, paving and other phases is recommended to be utilized during construction to assure the Engineer and Owner that the construction complies with the specifications.

LIMITATIONS AND RESERVED RIGHTS

The recommendations and conclusions made in this report are based on the assumption that the subsoil conditions do not deviate appreciably from those disclosed in the subsurface exploration. Should significant subsoil variations or undesirable conditions, be encountered during construction that are not described herein, the Geotechnical Engineer reserves the right to inspect these conditions for the purpose of reevaluating this report. A review of the final construction plans and specifications by this office is encouraged to ensure compliance with the intent of these recommendations.

Sincerely yours,
McCLELLAND CONSULTING ENGINEERS, INC.

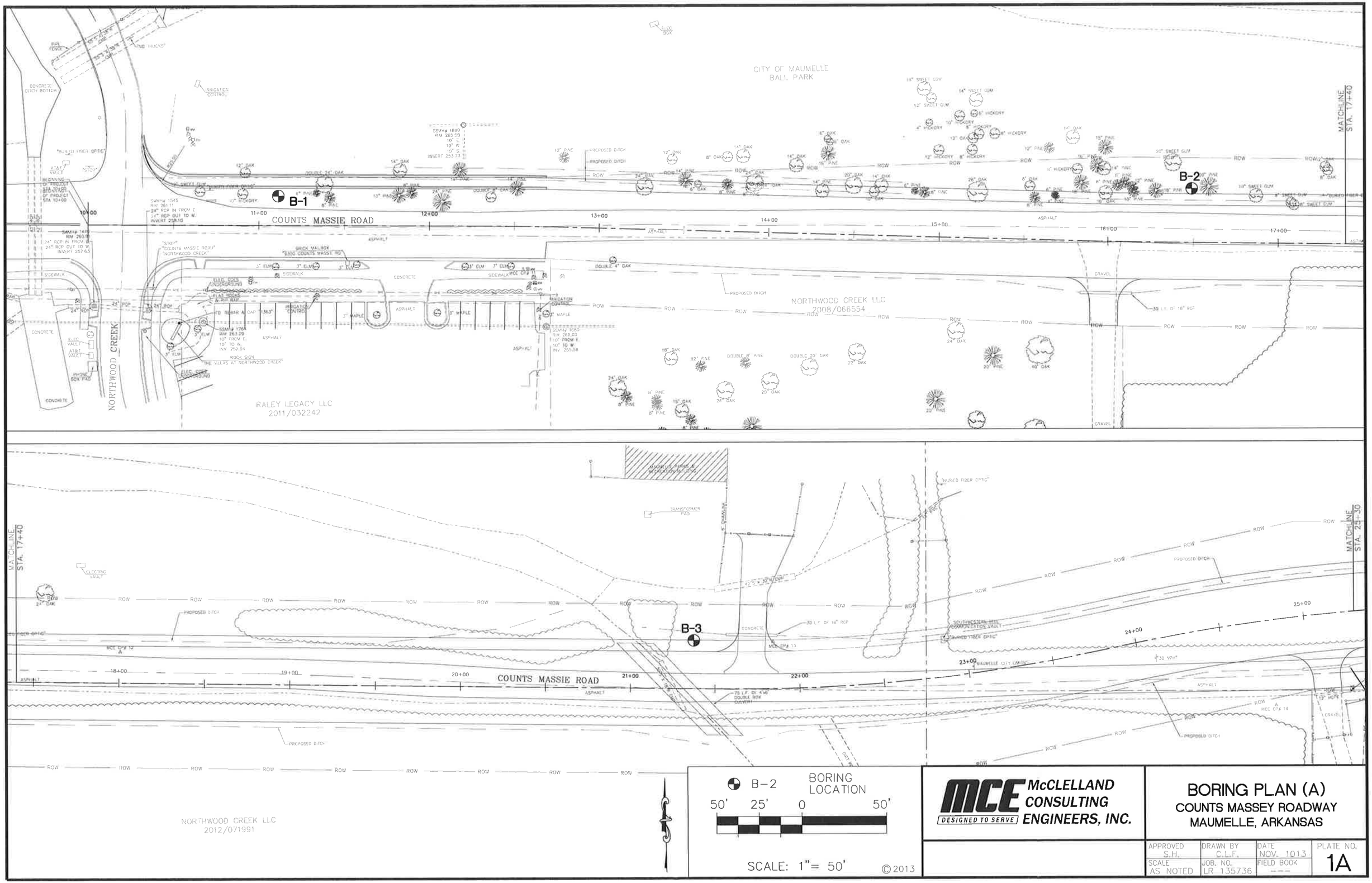
Steven Head, EI
Geotechnical Engineer

R. Wayne Jones, P.E.
Vice President/ Project Manager

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No. 4532 R. WAYNE JONES 12-18-13

Enclosures: Boring Layout
Boring Logs
Laboratory Testing Results
Pavement Design

BORING LAYOUT



McCLELLAND CONSULTING ENGINEERS, INC.
DESIGNED TO SERVE

BORING PLAN (A)
COUNTS MASSEY ROADWAY
MAUMELLE, ARKANSAS

APPROVED	DRAWN BY	DATE	PLATE NO.
S.H.	C.L.F.	NOV. 1013	1A
SCALE AS NOTED	JOB. NO. LR 135736	FIELD BOOK — —	

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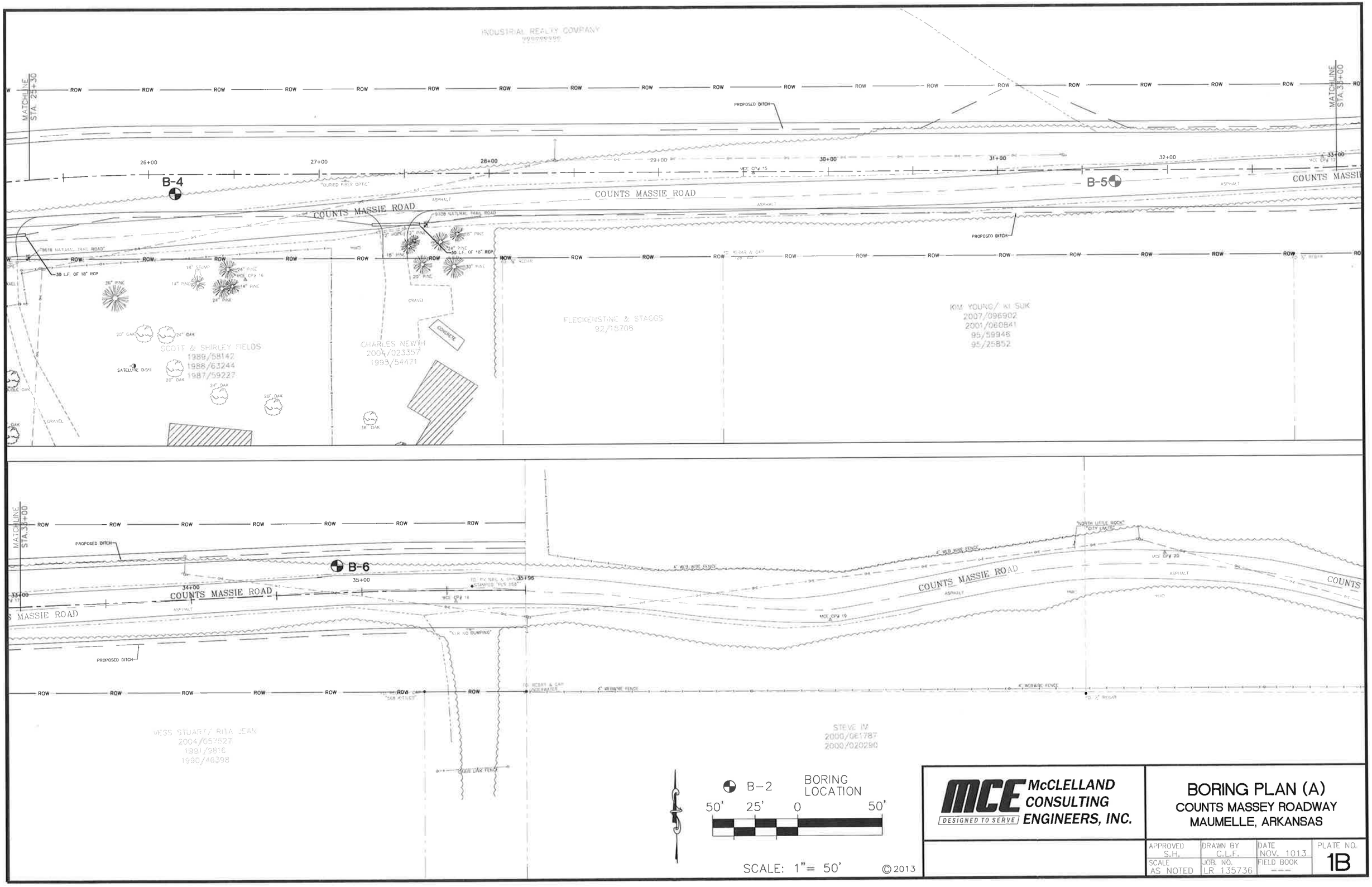

McCLELLAND CONSULTING ENGINEERS, INC.
DESIGNED TO SERVE

BORING PLAN (A)
COUNTS MASSEY ROADWAY
MAUMELLE, ARKANSAS

APPROVED	DRAWN BY	DATE	PLATE NO.
S.H.	C.L.F.	NOV. 1013	1B
SCALE AS NOTED	JOB. NO. LR 135736	FIELD BOOK — —	

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BORING LOGS

LOG OF BORING NO. B- 1

PROJECT OWNER: City of Maumelle
DESCRIPTION: Maumelle Counts Massie Road
LOCATION: Maumelle, Arkansas
DRILLING METHOD: 6-1/2" Hollow Stem Auger

PROJECT NO.: LR135736
DATE DRILLED: 9/19/2013
PROJECT ENGINEER: R. Wayne Jones, PE
EL: 262.0 **BORING LOCATION:** See Plate 1

Depth (Feet)	Elevation (Feet)	Sample No.	Blows/ Foot	Soil Legend	USCS Type	Description of Material (Color, Type, Moisture, and Consistency)	Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	P200	Lab Q_u (TSF)	Field Q_u (TSF)	Dry Density (pcf)
0	262	1				Tan Silty Topsoil	6.6							
		2	11		CH	Tan to Gray Sandy Clay; Firm; High Plasticity	19.8					4.52		88.1
2	260	3	9			(Soft from 2 to 4 feet)	19.2	50	24	26	53.6			86.6
4	258	4	19			(Firm from 4 to 6 feet)	10.1					3.53		103.7
6	256	5	9		CL	Reddish-Tan Sandy Clay; Soft	11.5	28	17	11	52.6			85.5
						END OF BORING								
8	254													
10	252													
12	250													

Completion Depth: 7.5 feet **Depth to Water:** Dry **Logged By:** G. Brown

This information pertains only to this boring and should not be interpreted as being indicative of the site.

LOG OF BORING NO. B- 2

PROJECT OWNER: City of Maumelle
PROJECT NO.: LR135736
DESCRIPTION: Maumelle Counts Massie Road
DATE DRILLED: 9/19/2013
LOCATION: Maumelle, Arkansas
PROJECT ENGINEER: R. Wayne Jones, PE
DRILLING METHOD: 6-1/2" Hollow Stem Auger
EL: 265.0 **BORING LOCATION:** See Plate 1

Depth (Feet) / Elevation (Feet)	Sample No.	Blows/ Foot	Soil Legend	USCS Type	Description of Material (Color, Type, Moisture, and Consistency)	Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	P200	Lab Q_u (TSF)	Field Q_u (TSF)	Dry Density (pcf)
0 / 265	1				Tan Silty Topsoil	5.9							
0 / 265	2	10		CL	Tan to Gray Sandy Clay; Firm	19.9	35	18	17	65.1			90.4
2 / 263	3	7			(Soft from 2 to 4 feet)	13.0							
4 / 261	4	19			(Firm from 4 to 6 feet)	23.0					1.80		87.3
6 / 259	5	9			Reddish-Tan to Gray Sandy Clay; Soft	20.0	44	22	22	91.1			82.9
7.5 / 257.5					END OF BORING								
8 / 257													
10 / 255													
12 / 253													

Completion Depth: 7.5 feet **Depth to Water:** Dry **Logged By:** G. Brown

This information pertains only to this boring and should not be interpreted as being indicative of the site.

LOG OF BORING NO. B- 3

PROJECT OWNER: City of Maumelle
PROJECT NO.: LR135736
DESCRIPTION: Maumelle Counts Massie Road
DATE DRILLED: 9/19/2013
LOCATION: Maumelle, Arkansas
PROJECT ENGINEER: R. Wayne Jones, PE
DRILLING METHOD: 6-1/2" Hollow Stem Auger
EL: 264.5 **BORING LOCATION:** See Plate 1

Depth (Feet)	Elevation (Feet)	Sample No.	Blows/ Foot	Soil Legend	USCS Type	Description of Material (Color, Type, Moisture, and Consistency)	Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	P200	Lab Q_u (TSF)	Field Q_u (TSF)	Dry Density (pcf)
0	264	1				Tan Silty Topsoil	8.8							
		2	10		CL	Tan to Gray Sandy Clay; Firm	10.8	30	19	11	79.7			
2	262	3	5			(Soft from 2 to 4 feet)	9.6							111.4
4	260	4	6				24.2	49	19	30	55.1			85.1
6	258	5	7				24.8					1.25		85.5
						END OF BORING								
8	256													
10	254													
12														

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Completion Depth: 7.5 feet **Depth to Water:** Dry **Logged By:** G. Brown

LOG OF BORING NO. B- 4

PROJECT OWNER: City of Maumelle
DESCRIPTION: Maumelle Counts Massie Road
LOCATION: Maumelle, Arkansas
DRILLING METHOD: 6-1/2" Hollow Stem Auger

PROJECT NO.: LR135736
DATE DRILLED: 9/19/2013
PROJECT ENGINEER: R. Wayne Jones, PE
EL: 269.0 **BORING LOCATION:** See Plate 1

Depth (Feet)	Elevation (Feet)	Sample No.	Blows/ Foot	Soil Legend	USCS Type	Description of Material (Color, Type, Moisture, and Consistency)	Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	P200	Lab Q_u (TSF)	Field Q_u (TSF)	Dry Density (pcf)
0	269	1				Tan Silty Topsoil	4.1							
		2	9		CL	Tan to Gray Sandy Clay; Soft	9.8							
2	267	3	8				10.4	37	21	16	80.0			
4	265	4	16			(Firm from 4 to 7.5 feet)	14.1					4.45		105.8
6	263	5	13				14.2							89.0
8	261					END OF BORING								
10	259													
12	257													

Completion Depth: 7.5 feet **Depth to Water:** Dry **Logged By:** G. Brown

This information pertains only to this boring and should not be interpreted as being indicative of the site.

LOG OF BORING NO. B- 5

PROJECT OWNER: City of Maumelle
PROJECT NO.: LR135736
DESCRIPTION: Maumelle Counts Massie Road
DATE DRILLED: 9/19/2013
LOCATION: Maumelle, Arkansas
PROJECT ENGINEER: R. Wayne Jones, PE
DRILLING METHOD: 6-1/2" Hollow Stem Auger
EL: 271.0 **BORING LOCATION:** See Plate 1

Depth (Feet) / Elevation (Feet)	Sample No.	Blows/ Foot	Soil Legend	USCS Type	Description of Material (Color, Type, Moisture, and Consistency)	Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	P200	Lab Q_u (TSF)	Field Q_u (TSF)	Dry Density (pcf)
0 / 270	1				Asphalt (2 inches)								
					Base Course Material (6 inches)	5.3							
	2	8		CL	Tan to Gray Sandy Clay; Soft	14.9				75.4			75.6
2 / 268	3	6				15.4					1.26		92.7
4 / 266	4	12		CH	Tan to Gray Sandy Clay; Firm; High Plascticity	17.1	61	28	33	57.2			86.6
6 / 264	5	9			(Soft from 6.5 to 8 feet)	19.6					1.97		88.5
8 / 262					END OF BORING								
10 / 260													
12													

Completion Depth: 7.8 feet **Depth to Water:** Dry **Logged By:** G. Brown

This information pertains only to this boring and should not be interpreted as being indicative of the site.

LOG OF BORING NO. B- 6

PROJECT OWNER: City of Maumelle
PROJECT NO.: LR135736
DESCRIPTION: Maumelle Counts Massie Road
DATE DRILLED: 9/19/2013
LOCATION: Maumelle, Arkansas
PROJECT ENGINEER: R. Wayne Jones, PE
DRILLING METHOD: 6-1/2" Hollow Stem Auger
EL: 272.5 **BORING LOCATION:** See Plate 1

Depth (Feet)	Elevation (Feet)	Sample No.	Blows/ Foot	Soil Legend	USCS Type	Description of Material (Color, Type, Moisture, and Consistency)	Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	P200	Lab Q_u (TSF)	Field Q_u (TSF)	Dry Density (pcf)
0	272	1				Tan Silty Topsoil	3.6							
		2	10		CL	Tan to Gray Sandy Clay; Firm	19.9				73.5			
2	270	3	10				7.8							79.8
4	268	4	17				18.1					4.11		85.0
6	266	5	14				13.6							115.0
8	264					END OF BORING								
10	262													
12														

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Completion Depth: 7.5 feet **Depth to Water:** Dry **Logged By:** G. Brown

SYMBOLS AND TERMS USED ON BORING LOGS

Symbol	Description
Strata symbols	
	High plasticity clay
	Low plasticity clay
	Gravel
	Silt
	Elastic silt
	Poorly graded sand
	Fill

Symbol	Description
	Granite
	Limestone
	Organics
	Sandstone
	Shale
	Topsoil
Misc. Symbols	
	Water table during drilling

Symbol	Description
	Water table at second check
Soil Samplers	
	Bulk sample taken from 6 in. auger
	Standard penetration test
	Undisturbed thin wall Shelby tube
	Rock core
	Denison

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE-GRAINED SOILS (major portion retained on #200 sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

DESCRIPTIVE TERM	RELATIVE DENSITY
Loose	0 to 40%
Medium Dense	40 to 70%
Dense	70 to 100%

FINE-GRAINED SOILS (major portion passing #200 sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated.

DESCRIPTIVE TERM	UNCONFINED COMPRESSION STRENGTH (TSF)
Very Soft	Less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very Stiff	2.00 to 4.00
Hard	4.00 and higher

Note: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above because of planes of weakness or cracks in the soil. The consistency rating of such soils are based on penetration readings.

TERMS CHARACTERIZING SOIL STRUCTURE

Slickensided	having inclined planes of weakness that are slick and glossy in appearance
Fissured	containing shrinkage cracks, frequently filled with fine sand or silt, usually vertical
Laminated	composed of thin layers of varying color and texture
Interbedded	composed of alternate layers of different soil types
Calcareous	containing appreciable quantities of calcium carbonate
Well Graded	having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Poorly Graded	predominantly of one grain size, or having a range in sizes with some intermediate sizes missing

Terms used in this report for describing soils according to their texture or grain size distribution are in accordance with the UNITED SOIL CLASSIFICATION SYSTEM as described in ASTM D 2488

McCLELLAND CONSULTING ENGINEERS, INC.

TESTING RESULTS

LABORATORY TEST RESULTS

PROJECT NUMBER: LR135736
PROJECT: Maumelle Counts Massie Road
DATE: Wednesday, November 13, 2013

B #	S #	Description	Depth Feet	Moisture (%)	LL	PL	PI	USCS	AASHTO	SIEVE ANALYSIS % FINER					UDW pcf	U_c tsf
										3/4 IN	No. 4	NO. 10	NO. 40	NO. 200		
1																
	1	Tan Silty Topsoil	0'-6"	6.6												
	2	Tan to Gray Sandy Clay	6"-1'6"	19.8											88.1	4.52
	3	Tan to Gray Sandy Clay	2'6"-3'6"	19.2	50	24	26	CH	A-7-6(11)	100.0	99.7	98.4	80.1	53.6	86.6	
	4	Tan to Gray Sandy Clay	4'6"-5'6"	10.1											103.7	3.53
	5	Reddish-Tan Sandy Clay	6'6"-7'6"	11.5	28	17	11	CL	A-6(3)	100.0	99.8	99.4	97.4	52.6	85.5	
2																
	1	Tan Silty Topsoil	0'-6"	5.9												
	2	Tan to Gray Sandy Clay	6"-1'6"	19.9	35	18	17	CL	A-6(9)	100.0	99.6	98.3	83.4	65.1	90.4	
	3	Tan to Gray Sandy Clay	2'6"-3'6"	13.0												
	4	Tan to Gray Sandy Clay	4'6"-5'6"	23.0											87.3	1.80
	5	Reddish-Tan to Gray Sandy Clay	6'6"-7'6"	20.0	44	22	22	CL	A-7-6(21)	100.0	99.9	99.9	94.8	91.1	82.9	
3																
	1	Tan Silty Topsoil	0'-6"	8.8												
	2	Tan to Gray Sandy Clay	6"-1'6"	10.8	30	19	11	CL	A-6(7)	100.0	99.5	98.0	90.8	79.7		
	3	Tan to Gray Sandy Clay	2'6"-3'6"	9.6											111.4	
	4	Tan to Gray Sandy Clay	4'6"-5'6"	24.2	49	19	30	CL	A-7-6(13)	92.6	92.5	91.7	79.5	55.1	85.1	
	5	Tan to Gray Sandy Clay	6'6"-7'6"	24.8											85.5	1.25
4																
	1	Tan Silty Topsoil	0'-6"	4.1												
	2	Tan to Gray Sandy Clay	6"-1'6"	9.8												
	3	Tan to Gray Sandy Clay	2'6"-3'6"	10.4	37	21	16	CL	A-6(12)	100.0	99.9	99.9	97.0	80.0		
	4	Tan to Gray Sandy Clay	4'6"-5'6"	14.1											105.8	4.45
	5	Tan to Gray Sandy Clay	6'6"-7'6"	14.2											89.0	
5																
	1	Dark Brown Base Course Material	3"-9"	5.3												
	2	Tan to Gray Sandy Clay	9"-1'9"	14.9						100.0	98.3	96.9	90.8	75.4	75.6	
	3	Tan to Gray Sandy Clay	2'9"-3'9"	15.4											92.7	1.26
	4	Tan to Gray Sandy Clay	4'9"-5'9"	17.1	61	28	33	CH	A-7-6(16)	100.0	94.2	92.5	83.0	57.2	86.6	
	5	Reddish-Tan to Gray Sandy Clay	6'9"-7'9"	19.6											88.5	1.97

LABORATORY TEST RESULTS

PROJECT NUMBER: LR135736
PROJECT: Maumelle Counts Massie Road
DATE: Wednesday, November 13, 2013

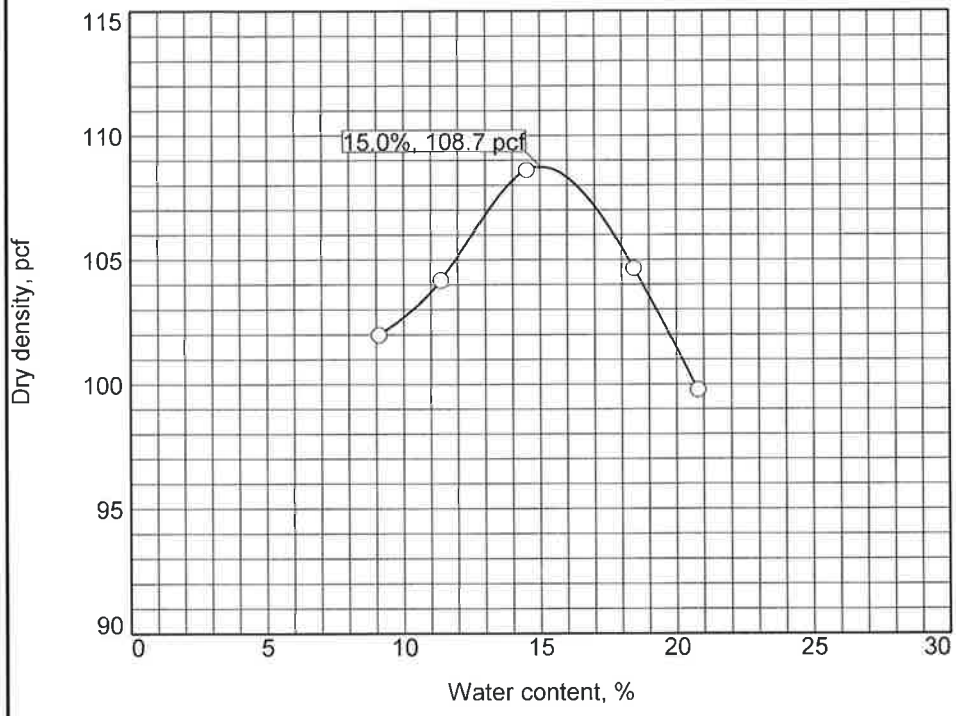
B #	S #	Description	Depth Feet	Moisture (%)	LL	PL	PI	USCS	AASHTO	SIEVE ANALYSIS % FINER					UDW pcf	U_C tsf
										3/4 IN	No. 4	NO. 10	NO. 40	NO. 200		
6																
	1	Tan Silty Topsoil	0'-6"	3.6												
	2	Tan to Gray Sandy Clay	6"-1'6"	19.9						100.0	99.9	99.5	97.8	73.5		
	3	Tan to Gray Sandy Clay	2'6"-3'6"	7.8											79.8	
	4	Tan to Gray Sandy Clay	4'6"-5'6"	18.1											85.0	4.11
	5	Tan to Gray Sandy Clay	6'6"-7'6"	13.6											115.0	

PROCTOR CURVE
and
CBR RESULTS

McCLELLAND CONSULTING ENGINEERS, INC.
DESIGNED TO SERVE
Materials Laboratory

1810 N. College Avenue
P.O. Box 1229
Fayetteville, AR 72703/72702-1229
479-587-1303 · FAX 479-443-9241
www.mcclelland-engrs.com

COMPACTION TEST REPORT



Curve No.
1

Test Specification:
ASTM D 698-07 Method A Standard

Preparation Method	Moist
Hammer Wt.	5.5 lb.
Hammer Drop	12 in.
Number of Layers	three
Blows per Layer	25
Mold Size	0.03333 cu. ft.

Test Performed on Material Passing #4 **Sieve**

NM 20.0 **LL** **PI**
Sp.G. (ASTM D 854)
%>#4 **%<No.200**
USCS CL **AASHTO** A-7-6(13)
Date Sampled 10/23/2013
Date Tested 10/27/2013
Tested By Dustin Lawrence

TESTING DATA

	1	2	3	4	5	6
WM + WS	6150.0	6222.0	6348.0	6342.0	6290.0	
WM	4468.0	4468.0	4468.0	4468.0	4468.0	
WW + T #1	814.2	811.7	837.3	987.3	850.4	
WD + T #1	761.9	747.9	753.4	861.8	731.8	
TARE #1	186.5	186.9	175.4	181.6	161.2	
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	9.1	11.4	14.5	18.5	20.8	
DRY DENSITY	102.0	104.2	108.6	104.6	99.8	

TEST RESULTS

Maximum dry density = 108.7 pcf

Optimum moisture = 15.0 %

Material Description

Tan to Gray Sandy Clay

Project No. LR135736 **Client:** City of Maumelle
Project: Maumelle Counts Massie Road

o **Source of Sample:** TP **Depth:** 1.5 **Sample Number:** 1

Remarks:
Material sampled from Borings 1, 3, and 6 at 1.5 feet below existing ground elevations.

McCLELLAND CONSULTING ENGINEERS, INC.

Fayetteville, Arkansas

Checked by: Steven Head, EI
Title: Geotechnical Engineer

Figure 1

McCLELLAND CONSULTING ENGINEERS, INC.
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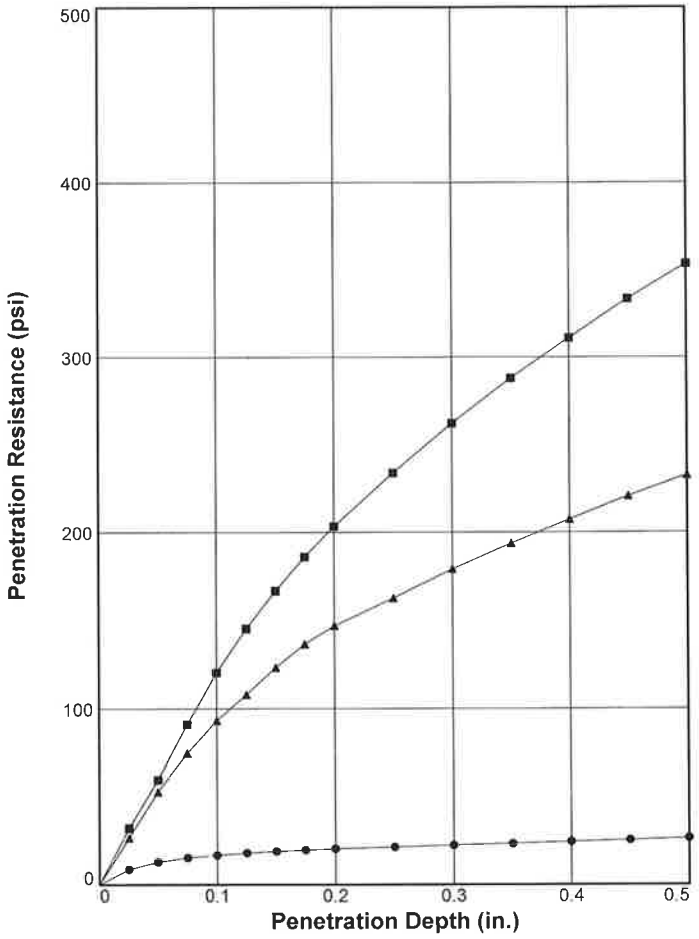
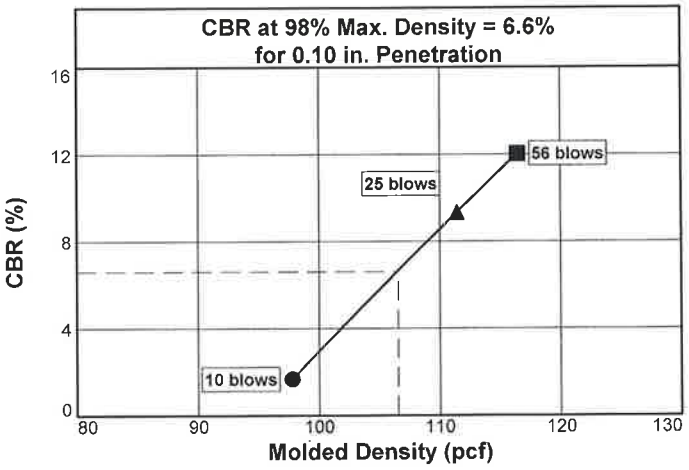
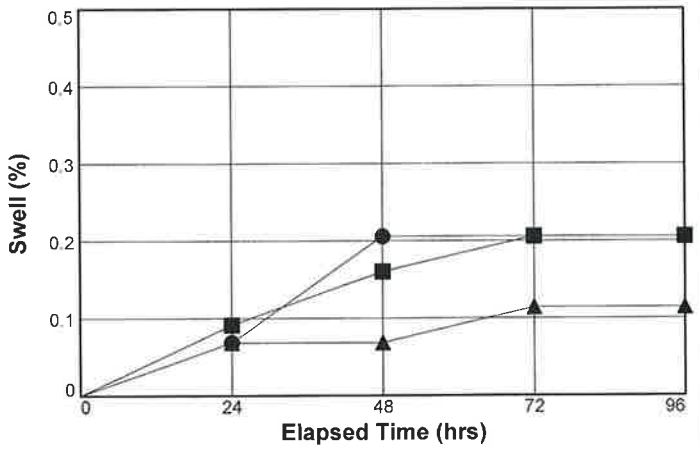
BEARING RATIO TEST REPORT
ASTM D 1883-07







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	97.7	89.9	13.9	97.5	89.7	24.2	1.7	1.4	0.000	25	0.2
2 △	111.4	102.5	14.9	111.3	102.4	18.7	9.3	9.8	0.000	25	0.1
3 □	116.4	107.1	14.2	116.2	106.9	17.5	12.0	13.6	0.000	25	0.2

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Tan to Gray Sandy Clay	CL	108.7	15.0		

Project No: LR135736
Project: Maumelle Counts Massie Road
Source of Sample: TP **Depth:** 1.5
Sample Number: 1
Date: 10/23/2013

Test Description/Remarks:

Material sampled from Borings 1, 3, and 6 at 1.5 feet below existing ground elevations.

BEARING RATIO TEST REPORT
McCLELLAND CONSULTING ENGINEERS, INC.

Figure 2

PAVEMENT DESIGN

McCLELLAND CONSULTING ENGINEERS, INC.

DESIGNED TO SERVE

LR13-5736 Maumelle Counts Massie Road
FLEXIBLE PAVEMENT DESIGN

STREET NAME	Counts Massie Road
DESIGN PARAMETERS:	
Design ESAL	8,000,000
Reliability	90%
Standard Deviation	0.44
ΔPSI (4.2 - 2.5)	1.70
Subgrade Modulus (Mr) (psi)	9,000
Design Structural Number	4.41

SN = a1D1+a2D2m2+a3D3m3

a1 = 0.44 for ACHM, a2 = 0.14 for Crushed Stone Base and a3 = 0.08, m2 and m3 are drainage coefficients = 1
D1, D2 and D3 are thickness of layers

a1 =	0.44	
a2 =	0.14	
a3 =	N/A	
m2 =	1	
m3 =	1	
SN1 =	3	
SN2 =	5	
SN3 =	4.4	
D1 = (SN1/a1) in	7	(ACHM Surface and Binder)
D2 = (SN2-(D1 x a1)/a2) in	14	(Class 7 Base Course)
D3 = (SN3-(a1 x D1)-(a2 x D2))/a3 in	N/A	(Recommend to scarify and recompact subgrade 12", replace bad materials)

Recommendations:

Option - 1

	Thickness (in)	Layer Coefficient	Structural Number
ACHM Surface Course	3	0.44	1.32
ACHM Binder Course	4	0.44	1.76
Class 7 Base Course at 98% MPD	10	0.14	1.4
DESIGN STRUCTURAL NUMBER			**4.48**

Option - 2

	Thickness (in)	Layer Coefficient	Structural Number
ACHM Surface Course	2	0.44	0.88
ACHM Binder Course	3	0.44	1.32
Class 7 Base Course at 98% MPD	10	0.14	1.4
Subgrade	10	0.08	0.8
DESIGN STRUCTURAL NUMBER			**4.4**

Option - 3

	Thickness (in)	Layer Coefficient	Structural Number
ACHM Surface Course	3	0.44	1.32
ACHM Binder Course	3	0.44	1.32
Class 7 Base Course at 98% MPD	6	0.14	0.84
Subgrade	12	0.08	0.96
DESIGN STRUCTURAL NUMBER			**4.44**

PLATE 11