MEMORANDUM

Missouri Department of Transportation

Construction - Materials
Central Laboratory

TO: Paul Huskey-se/gs

CC/ATT: Joe Crader-se/ma

FROM: Easaw Thomas
Sr. Geotechnical Specialist

DATE: April 22, 2014

SUBJECT: Materials
Geotechnical Section
Foundation Investigation for
Structure Design No. FI2169-Pole Barn Building
Job No. R35G
Route 67, Butler County

General

A field investigation was conducted for a proposed Pole Barn Building at Poplar Bluff Maintenance Shed, Butler County, MO. The proposed building location was staked and surveyed by district personnel. Attached are logs of borings for the above noted structure. The layout of the boreholes for the proposed Pole Barn Building is shown in Figure 1.

Based on the exploratory borings taken at the four corners of the proposed Pole Barn Building, the top stratum mainly consists of lean clay to a depth of about 2.5 feet, which is underlain by fat clay scattered gravel and sand to depths ranging from 13.8 feet to the maximum depth explored 16.5 feet.

Recommendations

- Shallow foundation should bear at least 1.5 feet below finish grade for frost protection.
- Shallow foundations that bear at least 1.5 feet below finish grade can be designed using an allowable bearing of 2.5 ksf.
- If unsuitable foundation soil (soft soil) is encountered during excavation, it should be excavated to stiff or better soil/ rock or a maximum of 4 feet, whichever is less, and replaced with engineered fill soil/ or granular material as recommended by the resident engineer.

cs
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Attachments


POPLAR BLUFF POLE BARN
SOUTHEAST DISTRICT
R35G-FI2169
N
W
E
S
523
NW
MID
NE
SW
SE
67
Outer Road 60
60
60
Outer Road 60
437
67
US60W TO US67N
BU 60
BU 67
SCALE 1:1200
j:\sg\workfiles\projectfiles\fi2169\layout
FIGURE-1

Missouri Department of Transportation
Construction and Materials

BORING NO. O-14-28

Job No.: R35G-FI2169 **County:** Butler **Route:** 67 North
Design: FI2169 **Skew:** **Location:** Poplar Bluff Maintenance Shed
Bent: **Logged By:** Easaw Thomas **Operator:** Raymond Murray
Station: SE **Northing:** 351587.58 **Date of Work:** 04/16/14-04/16/14
Offset: **Easting:** 835208.06 **Depth to Water:** 7
Elevation: 510.3 **Requested Northing:** **Depth Hole Open:** 7
Requested Station: **Requested Easting:** **Time Change:** 0 hours
Requested Offset: **Equipment:** Acker Soil XLS ,Split-Spoon Sampler
Requested Elevation: **Location Note:**
Drill No.: G-9462 **Hammer Efficiency:** 69% **Drilling Method:** Hollow Stem Auger

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Strength Data	Field Tests	Index Tests
0		0-0.2' ASPHALT	510						
		0.2-0.6' Brown, LEAN CLAY, very stiff, moist							
		0.6-2.1' GRAVEL, fine grained							
		2.1-4.8' Light reddish brown, FAT CLAY, stiff, moist		X	53	4-3-8 (13)		PP = 2.50 tsf	MC = 27.7% γ_{sat} = 122 pcf(1)
5		4.8-8.5' Light reddish brown, FAT CLAY scattered gravel, stiff to hard, moist to wet	505	X	53	4-20-15 (40)		PP = 1.75 tsf	
				X	60	5-10-9 (22)		PP = 4.50 tsf	
		8.5-16.5' Reddish brown, FAT CLAY scattered fine sand, hard to very stiff, wet							
10			500	X	60	4-6-9 (17)		PP = 4.50 tsf	
				X	60	5-13-17 (35)		PP = 3.50 tsf	
15			495	X	0	9-12-9 (24)			
		Bottom of borehole at 16.5 feet.							

N_{60} = (Em/60)Nm N_{60} - Corrected N value for standard 60% SPT efficiency; Em - Measured hammer efficiency in percent; Nm - Observed N-value
(1) = Assumed, (2) = Actual

Coordinate System: U.S. State Plane 1983 **Coordinate Zone:** Missouri East **Coordinate Proj. Factor:** 1.0000
Coordinate Datum: NAD 83 (CONUS) **Coordinate Units:** U.S. Survey Feet

* Persons using this information are cautioned that the materials shown are determined by the equipment noted and accuracy of the "log of materials" is limited thereby and by judgement of the operator. THIS INFORMATION IS FOR DESIGN PURPOSES ONLY.

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Missouri Department of Transportation
Construction and Materials

BORING NO. O-14-29

Job No.: R35G-FI2169 **County:** Butler **Route:** 67 North
Design: FI2169 **Skew:** **Location:** Poplar Bluff Maintenance Shed
Bent: **Logged By:** Easaw Thomas **Operator:** Raymond Murray
Station: NE **Northing:** 351637.26 **Date of Work:** 04/16/14-04/16/14
Offset: **Easting:** 835207.21 **Depth to Water:**
Elevation: 509.6 **Requested Northing:** **Depth Hole Open:**
Requested Station: **Requested Easting:** **Time Change:**
Requested Offset: **Equipment:** Acker Soil XLS ,Split-Spoon Sampler
Requested Elevation: **Location Note:**
Drill No.: G-9462 **Hammer Efficiency:** 69% **Drilling Method:** Hollow Stem Auger

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Strength Data	Field Tests	Index Tests
0		0-0.1' ASPHALT 0.1-2.5' Brown, LEAN CLAY with gravel, stiff, moist							
		2.5-5.1' Light reddish brown, FAT CLAY, very stiff, moist		X	40	5-6-9 (17)		PP = 3.50 tsf	
			505						
5		5.1-12.5' Reddish brown, FAT CLAY scattered gravel, hard to very stiff, moist		X	7	9-9-10 (22)			
				X	60	8-15-20 (40)		PP = 4.00 tsf	
			500						
10				X	53	5-10-13 (26)		PP = 3.25 tsf	
		12.5-13.8' Reddish brown, FAT CLAY with fine sand, hard, moist		X	53	7-12-22 (39)		PP = 4.00 tsf	
		13.8-16.4' Sandstone, light brown, highly weathered, with chert limestone	495						
15				X	28	9-8-44/0.4'			
		Bottom of borehole at 16.4 feet.							

N_{60} = (Em/60)Nm N_{60} - Corrected N value for standard 60% SPT efficiency; Em - Measured hammer efficiency in percent; Nm - Observed N-value
(1) = Assumed, (2) = Actual

Coordinate System: U.S. State Plane 1983 **Coordinate Zone:** Missouri East **Coordinate Proj. Factor:** 1.0000
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Missouri Department of Transportation
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BORING NO. O-14-30

Job No.: R35G-FI2169 **County:** Butler **Route:** 67 North
Design: FI2169 **Skew:** **Location:** Poplar Bluff Maintenance Shed
Bent: **Logged By:** Easaw Thomas **Operator:** Raymond Murray
Station: Middle **Northing:** 351607.94 **Date of Work:** 04/16/14-04/16/14
Offset: **Easting:** 835123.276 **Depth to Water:**
Elevation: 509.7 **Requested Northing:** **Depth Hole Open:**
Requested Station: **Requested Easting:** **Time Change:**
Requested Offset: **Equipment:** Acker Soil XLS ,Split-Spoon Sampler
Requested Elevation: **Location Note:**
Drill No.: G-9462 **Hammer Efficiency:** 69% **Drilling Method:** Hollow Stem Auger

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Strength Data	Field Tests	Index Tests
0		0-0.3' ASPHALT							
		0.3-1.2' Brown, SANDY GRAVEL, moist							
		1.2-3.9' Brown, LEAN CLAY scattered gravel, very stiff, moist		X	35	13-32-44/0.4'		PP = 3.25 tsf	
		3.9-4.6' BOULDERS	505						
5		4.6-6.9' Reddish brown, FAT CLAY scattered gravel, hard, moist		X	53	8-11-25 (41)		PP = 4.50 tsf	
		6.9-10.4' Reddish brown, SILTY FAT CLAY scattered gravel & sand, hard, moist		X	60	13-15-15 (35)		PP = 4.00 tsf	
10			500						
		10.4-15' Reddish brown, FAT CLAY with fine sand, very stiff, moist		X	60	13-11-13 (28)		PP = 4.00 tsf	
				X	53	12-13-16 (33)		PP = 3.75 tsf	
15			495						
		15-16.5' Reddish brown, FAT CLAY with gravel, hard, moist		X	47	15-21-16 (43)		PP = 4.50 tsf	
		Bottom of borehole at 16.5 feet.							

N_{60} = (Em/60)Nm N_{60} - Corrected N value for standard 60% SPT efficiency; Em - Measured hammer efficiency in percent; Nm - Observed N-value
(1) = Assumed, (2) = Actual

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Missouri Department of Transportation
Construction and Materials

BORING NO. O-14-31

Job No.: R35G-FI2169 **County:** Butler **Route:** 67 North
Design: FI2169 **Skew:** **Location:** Poplar Bluff Maintenance Shed
Bent: **Logged By:** Easaw Thomas **Operator:** Raymond Murray
Station: NW **Northing:** 351636.72 **Date of Work:** 04/17/14-04/17/14
Offset: **Easting:** 835055.32 **Depth to Water:**
Elevation: 509.3 **Requested Northing:** **Depth Hole Open:**
Requested Station: **Requested Easting:** **Time Change:**
Requested Offset: **Equipment:** Acker Soil XLS ,Split-Spoon Sampler
Requested Elevation: **Location Note:**
Drill No.: G-9462 **Hammer Efficiency:** 69% **Drilling Method:** Hollow Stem Auger

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Strength Data	Field Tests	Index Tests
0		0-0.3' GRAVEL							
		0.3-2.2' Brown, LEAN CLAY trace gravel, very stiff, moist							
		2.2-3.9' Brown, LEAN CLAY scattered gravel, very stiff, moist		X	60	18-44/0.3'		PP = 2.50 tsf	
		3.9-6.3' Reddish brown, FAT CLAY scattered gravel & sand, hard, moist	505						
5				X	53	11-13-19 (37)		PP = 4.50 tsf	
		6.3-10' Reddish brown, FAT CLAY with fine sand, trace gravel, very stiff to stiff, moist							
				X	60	5-11-11 (25)		PP = 3.50 tsf	MC = 15.6% γ_{sat} = 136 pcf(1)
			500						
10		10-16.5' Reddish brown, FAT CLAY scattered fine sand, trace gravel, hard, moist		X	60	7-10-12 (25)		PP = 4.00 tsf	
				X	60	10-9-11 (23)		PP = 1.50 tsf	
			495						
15				X	53	7-20-11 (36)		PP = 3.00 tsf	
		Bottom of borehole at 16.5 feet.							

N_{60} = (Em/60)Nm N_{60} - Corrected N value for standard 60% SPT efficiency; Em - Measured hammer efficiency in percent; Nm - Observed N-value
(1) = Assumed, (2) = Actual

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Missouri Department of Transportation
Construction and Materials

BORING NO. O-14-32

Job No.: R35G-FI2169 **County:** Butler **Route:** 67 North
Design: FI2169 **Skew:** **Location:** Poplar Bluff Maintenance Shed
Bent: **Logged By:** Easaw Thomas **Operator:** Raymond Murray
Station: SW **Northing:** 351585.68 **Date of Work:** 04/17/14-04/17/14
Offset: **Easting:** 835062.06 **Depth to Water:**
Elevation: 509.5 **Requested Northing:** **Depth Hole Open:**
Requested Station: **Requested Easting:** **Time Change:**
Requested Offset: **Equipment:** Acker Soil XLS ,Split-Spoon Sampler
Requested Elevation: **Location Note:**
Drill No.: G-9462 **Hammer Efficiency:** 69% **Drilling Method:** Hollow Stem Auger

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Strength Data	Field Tests	Index Tests
0		0-0.2' GRAVEL 0.2-2.1' Brown, LEAN CLAY scattered gravel, very stiff, moist							
		2.1-12' Reddish brown, FAT CLAY trace gravel & sand, very stiff to stiff, moist		X	47	6-11-15 (30)		PP = 4.50 tsf	
			505						
5				X	53	5-7-8 (17)		PP = 3.00 tsf	
				X	53	4-7-14 (24)		PP = 1.25 tsf	
			500						
10				X	60	5-6-9 (17)		PP = 1.00 tsf	MC = 21.4% γ_{sat} = 129 pcf(1)
		12-16.5' Reddish brown, FAT CLAY scattered gravel & sand, very stiff, moist		X	60	4-8-5 (15)		PP = 2.25 tsf	
			495						
15				X	47	6-13-22 (40)		PP = 3.00 tsf	
		Bottom of borehole at 16.5 feet.							

N_{60} = (Em/60)Nm N_{60} - Corrected N value for standard 60% SPT efficiency; Em - Measured hammer efficiency in percent; Nm - Observed N-value
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KEY TO SYMBOLS

Missouri Department of Transportation
1617 Mo. Blvd.
Jefferson City, Mo. 65109

CLIENT MoDOT Southeast District
PROJECT NAME Poplar Bluff Pole Barn
PROJECT NUMBER R35G-FI2169
PROJECT LOCATION Poplar Bluff Maintenance Shed

LITHOLOGIC SYMBOLS
(Unified Soil Classification System)

- ASPHALT: Asphalt
- BLDRCBBL: Boulders and cobbles
- CH: USCS High Plasticity Clay
- CHS: USCS High Plasticity Sandy Clay
- CL: USCS Low Plasticity Clay
- CLG: USCS Low Plasticity Gravelly Clay
- GP: USCS Poorly-graded Gravel
- GP-GM: USCS Poorly-graded Gravel with Silt
- SANDSTONE: Sandstone

SAMPLER SYMBOLS

- Split-Spoon Sampler

WELL CONSTRUCTION SYMBOLS

ABBREVIATIONS

LL - LIQUID LIMIT (%)
PI - PLASTIC INDEX (%)
W - MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NON PLASTIC
-200 - PERCENT PASSING NO. 200 SIEVE
PP - POCKET PENETROMETER (TSF)
TV - TORVANE
PID - PHOTOIONIZATION DETECTOR
UC - UNCONFINED COMPRESSION
ppm - PARTS PER MILLION

▽ Water Level at Time of Drilling

▼ Water Level at End of Drilling

▼ Water Level after Drilling