MEMORANDUM

Missouri Department of Transportation
Construction - Materials
Central Laboratory

TO: Joseph Crader-se/gs

CC/ATT: Kevin Griep-co/gs

FROM: Kevin Moore, PE
Senior Geotechnical Specialist

DATE: June 15, 2015

SUBJECT: Materials
Geotechnical Section
Foundation Investigation for
Fredericktown Maintenance Building
Job No. R35G-FI2300
Madison County

Attached are logs of geotechnical borings for the above referenced structure, a proposed new maintenance facility building. Also attached is an aerial photo showing boring locations. See Figure 1: Boring Locations.

Based on information provided with your request, we assume a single-story maintenance building with garage bay doors is proposed to be constructed to the east of the existing maintenance building on the MoDOT maintenance lot at Fredericktown, MO. See Figure 1: Boring Locations. The planned building finished grade and finished floor elevations were not provided in the request. If the structure design is similar to other facilities, the foundation design is based on an assumed bearing capacity of 2000 psf.

Four borings were drilled at the locations indicated on Figure 1: Boring Locations. Based on observations during drilling and sampling from the borings in the vicinity of the proposed structure, the allowable bearing of the foundation soil was estimated to be 2000 psf and will be adequate for your building. Further construction recommendations are provided below.

Recommendations - The following recommendations are made based upon information provided regarding the proposed building, conditions observed at the site, and general knowledge of soils in the area that may be encountered.

The foundation bearing soils appear to be ‘fat’or high-plasticity clays. These types of clay materials may vary in volume and in strength with changes in moisture. These variations may impact construction and long-term performance of the structure. To mitigate the effects of and/or potential variations, consider the following:

- Proof roll the proposed building areas with a tandem axle dump truck loaded with a minimum of 12 tons of material prior to construction or fill placement. Any areas exhibiting pumping or rutting should be excavated to remove the soft material and backfilled with acceptable fill materials and compacted.
- It is recommended that Type 5 or similar granular fill materials meeting the general requirements of the Missouri Department of Transportation Specifications for Highway Construction be used to construct a stable building pad for the floor slab. Fill should be placed and compacted to 95% of standard Proctor maximum dry density. Non-granular fill material should be compacted at or within 3% of optimum moisture content. All fill and cut slopes should be constructed to slope and drain away from the proposed building.
- Foundation bearing surfaces should be free of loose soil or loose fill materials. Loose materials should be hand tamped into the foundation bearing surface prior to placement of reinforcement and concrete for the foundation.
- Care should be taken to protect soil subgrade from excessive changes in moisture during foundation and floor slab construction. Avoid leaving excavations open for extended periods of time. Protect footing and floor slab bearing surfaces from rain or drying out during construction.
- Landscape plantings of shrubs and trees near the structure should be avoided, and native trees and bushes should not be allowed to grow near the foundation of the structure. These plants could desiccate the high-plastic clays resulting in soil settlement.

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Attachments

Missouri Department of Transportation
Construction and Materials

BORING NO. A-15-2

Job No.: R35G-Fi2300 **County:** Madison **Route:** Business 67
Design: Fi2300 **Skew:** **Location:** Madison County
Bent: **Logged By:** Kevin Moore **Operator:** Michael Donahoe
Station: **Northing:** 615791.8 **Date of Work:** 05/26/15-05/26/15
Offset: **Easting:** 876452.2 **Depth to Water:**
Elevation: 771.6 **Requested Northing:** 615789.1 **Depth Hole Open:**
Requested Station: **Requested Easting:** 876454.2 **Time Change:**
Requested Offset: **Equipment:** Failing 1500 ,Split-Spoon Sampler
Requested Elevation: **Location Note:** SW Corner
Drill No.: G-7887 **Hammer Efficiency:** 79% **Drilling Method:** Mud Rotary

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Data	Field Tests	Index Tests
0		0-8' Reddish brown, FAT CLAY trace sand, stiff to very stiff, moist	770						
					100	3-4-5 (12)		PP = 2.00 tsf	
5									
			765		100	3-3-5 (11)		PP = 1.50 tsf	
		8-11.5' Reddish brown, SANDY GRAVEL some lean clay, dense to very dense, moist, coarse grained, poorly graded			100	4-9-10 (25)		PP = 1.50 tsf	
10									
					27	34-31-16 (62)			
		Bottom of borehole at 11.5 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:**
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. A-15-3

Job No.: R35G-Fi2300 **County:** Madison **Route:** Business 67
Design: Fi2300 **Skew:** **Location:** Madison County
Bent: **Logged By:** Kevin Moore **Operator:** Michael Donahoe
Station: **Northing:** 615847.4 **Date of Work:** 05/26/15-05/26/15
Offset: **Easting:** 876463.5 **Depth to Water:**
Elevation: 771.6 **Requested Northing:** 615840.2 **Depth Hole Open:**
Requested Station: **Requested Easting:** 876462.0 **Time Change:**
Requested Offset: **Equipment:** Failing 1500 ,Split-Spoon Sampler
Requested Elevation: **Location Note:** NW Corner
Drill No.: G-7887 **Hammer Efficiency:** 79% **Drilling Method:** Mud Rotary

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Data	Field Tests	Index Tests
0		0-8.5' Reddish brown, FAT CLAY trace sand, stiff to very stiff, moist	770						
				X	100	4-6-8 (18)		PP = 2.00 tsf	
5									
			765	X	100	3-5-11 (21)		PP = 1.50 tsf	
				X	100	5-10-15 (33)		PP = 1.50 tsf	
10		8.5-11.5' Reddish brown, CLAYEY SAND some lean clay, trace gravel, dense to very dense, moist, coarse grained, poorly graded							
				X	73	11-10-14 (32)			
		Bottom of borehole at 11.5 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:**
Coordinate Datum: NAD 83 (CONUS) **Coordinate Units:** U.S. Survey Feet

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Missouri Department of Transportation
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BORING NO. A-15-4

Job No.: R35G-Fi2300 **County:** Madison **Route:** Business 67
Design: Fi2300 **Skew:** **Location:** Madison County
Bent: **Logged By:** Kevin Moore **Operator:** Michael Donahoe
Station: **Northing:** 615768.5 **Date of Work:** 05/26/15-05/26/15
Offset: **Easting:** 876603.4 **Depth to Water:**
Elevation: 771.3 **Requested Northing:** 615766.3 **Depth Hole Open:**
Requested Station: **Requested Easting:** 876606.9 **Time Change:**
Requested Offset: **Equipment:** Failing 1500 ,Split-Spoon Sampler
Requested Elevation: **Location Note:** SE Corner
Drill No.: G-7887 **Hammer Efficiency:** 79% **Drilling Method:** Mud Rotary

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Data	Field Tests	Index Tests
0		0-7' Reddish brown, FAT CLAY trace sand, stiff to very stiff, moist	770						
				X	87	3-3-3 (8)		PP = 2.00 tsf	
5									
			765	X	100	2-2-3 (7)		PP = 1.50 tsf	
		7-9.5' Reddish brown, FAT CLAY with sand, trace gravel, very stiff, moist							
				X	100	2-9-18 (36)		PP = 1.50 tsf	
10		9.5-11.5' Reddish brown, SANDY GRAVEL little lean clay, dense to very dense, moist, coarse grained, poorly graded	760	X	93	18-8-9 (22)			
		Bottom of borehole at 11.5 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:**
Coordinate Datum: NAD 83 (CONUS) **Coordinate Units:** U.S. Survey Feet

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Missouri Department of Transportation
Construction and Materials

BORING NO. A-15-5

Job No.: R35G-Fi2300 **County:** Madison **Route:** Business 67
Design: Fi2300 **Skew:** **Location:** Madison County
Bent: **Logged By:** Kevin Moore **Operator:** Michael Donahoe
Station: **Northing:** 615821.4 **Date of Work:** 05/26/15-05/26/15
Offset: **Easting:** 876612.8 **Depth to Water:**
Elevation: 771.8 **Requested Northing:** 615815.9 **Depth Hole Open:**
Requested Station: **Requested Easting:** 876613.3 **Time Change:**
Requested Offset: **Equipment:** Failing 1500 ,Split-Spoon Sampler
Requested Elevation: **Location Note:** NE Corner
Drill No.: G-7887 **Hammer Efficiency:** 79% **Drilling Method:** Mud Rotary

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Data	Field Tests	Index Tests
0		0-4.5' Olive gray, SILTY LEAN CLAY, stiff, moist	770						
				X	80	4-3-4 (9)		PP = 2.00 tsf	
5		4.5-9.5' Reddish brown, FAT CLAY trace sand, moist		X	93	3-3-3 (8)		PP = 1.50 tsf	
			765	X	100	2-2-4 (8)		PP = 1.50 tsf	
10		9.5-11.5' Reddish brown, FAT CLAY with sand, and gravel, very stiff to very hard, moist, coarse grained, poorly graded		X	93	3-11-26 (49)			
		Bottom of borehole at 11.5 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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KEY TO SYMBOLS

MoDOT Geotechnical Section
1617 Missouri Boulevard
Jefferson City, Missouri 65101

CLIENT _____ **PROJECT NAME** Fredericktown Mainrenance shed

PROJECT NUMBER R35G-Fi2300 **PROJECT LOCATION** Madison County

LITHOLOGIC SYMBOLS
(Unified Soil Classification System)


CH: USCS High Plasticity Clay


CHG: USCS High Plasticity Gravelly Clay


CHS: USCS High Plasticity Sandy Clay


CL: USCS Low Plasticity Clay


GP-GC: USCS Poorly-graded Gravel with Clay


SP-SC: USCS Poorly-graded Sand with Clay

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

Figure 1: Boring Locations
New Maintenance Building
Fredericktown Maintenance Facility
Madison County