MEMORANDUM

Missouri Department of Transportation
Construction - Materials
Central Laboratory

TO: Aaron Chambers-gs

CC/ATT: Dan Tucker-sl/mt
Allen Lane-sl/gs
Mark Simon-sl/cm

FROM: Ricardo N. Todd
Senior Geotechnical Specialist

DATE: February 24, 2016

SUBJECT: Materials
Geotechnical Section
Foundation Investigation for
Structure No. FI2377
Festus Maintenance Facility
Jefferson County

As requested in a letter dated January 13, 2016, from St. Louis District Geologist Mark Simon, a foundation investigation has been conducted for a new maintenance building in Jefferson County.

Existing Conditions

The soil encountered at the four (4) borings primarily included asphalt and base material that extended to a depth of approximately 1.5 feet. The soil beneath the asphalt and base material consists of about 16.5 feet of low plasticity clay, which classifies as CL by ASTM classification methods. The pocket penetrometer readings of the soil generally indicate a stiff to very still soil.

Free ground water was not observed in the borings upon completion. Further information on the subsurface materials encountered and their properties is presented on the attached boring logs.

Recommendations

The following recommendations are made based upon information provided regarding the proposed building and conditions observed during the foundation investigation.

- Remove any asphalt pavement, concrete pavement, foundations and any other existing surface or subsurface features from the proposed construction area. After making any grading excavation and before any fill placement, proof roll all cut and fill areas with a fully loaded tandem axle dump truck. Any areas exhibiting pumping or rutting should be undercut and backfilled with compacted granular fill. Prior to placement of any new fill, scarify the surface of any areas to be filled.

- It is recommended that any new fill material be lean clay or better. However, use of granular fill material is preferred if feasible. Fill should be 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 areas should be constructed to slope and drain away from the proposed building.

- An allowable bearing pressure of 2500 psf or less may be used for the design of shallow foundations constructed on or in properly compacted fill or natural soils at this site. Shallow foundations shall be embedded a minimum of 20 inches below finished grade for frost protection. Individual spread footings shall have a minimum width of 2.5 feet while strip footings shall have a minimum width of 1.5 feet.

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j:\sublec\ricardo\fi2377 festus maint jefferson co ltr.doc
Attachments

Missouri Department of Transportation
Construction and Materials

BORING NO. T-16-01

Job No.: R35G-FI2377 **County:** Miller **Route:** 67
Design: Fi2377 **Skew:** Right Angle **Location:** Festus
Bent: Southeast Corner **Logged By:** Alan Miller **Operator:** Ray Murray
Station: **Northing:** **Date of Work:** 01/28/16-01/28/16
Offset: **Easting:** **Depth to Water:**
Elevation: 123.0 **Requested Northing:** **Depth Hole Open:**
Requested Station: **Requested Easting:** **Time Change:**
Requested Offset: **Equipment:** CME 45 ,Split-Spoon Sampler, NQ
Requested Elevation: **Location Note:** Festus Maintenance Facitity
Drill No.: G-9577 **Hammer Efficiency:** 84% **Drilling Method:** Hollow Stem Auger

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Data	Field Tests	Index Tests
0		0.0-1.5' Base Rock							
		1.5-5.0' Brown, LEAN CLAY, stiff, moist	120	X	67	1-4-6 (13)		PP = 1.50 tsf	
5		5.0-10.0' Grayish brown, LEAN CLAY, very stiff, moist		X	67	3-4-8 (16)		PP = 2.00 tsf	
			115	X	67	1-4-4 (11)		PP = 1.75 tsf	
10		10.0-16.5' Reddish brown, FAT CLAY, very stiff, moist		X	67	1-3-4 (9)		PP = 1.50 tsf	
			110	X	67	1-3-6 (12)		PP = 2.50 tsf	
15				X	67	2-4-6 (13)		PP = 2.50 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

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. T-16-02

Job No.: R35G-FI2377 **County:** Miller **Route:** 67
Design: Fi2377 **Skew:** Right Angle **Location:** Festus
Bent: Northeast Corner **Logged By:** Alan Miller **Operator:** Ray Murray
Station: **Northing:** **Date of Work:** 01/28/16-01/28/16
Offset: **Easting:** **Depth to Water:**
Elevation: 125.0 **Requested Northing:** **Depth Hole Open:**
Requested Station: **Requested Easting:** **Time Change:**
Requested Offset: **Equipment:** CME 45 ,Split-Spoon Sampler, NQ
Requested Elevation: **Location Note:** Festus Maintenance Facitity
Drill No.: G-9577 **Hammer Efficiency:** 84% **Drilling Method:** Hollow Stem Auger

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Data	Field Tests	Index Tests
0			125						
		0.0-1.6' Base Rock							
		1.6-15.0' Purplish brown, FAT CLAY, stiff, moist		X	67	2-2-5 (9)		PP = 1.50 tsf	
5			120	X	67	1-5-7 (16)		PP = 2.50 tsf	
				X	67	1-5-5 (13)		PP = 1.50 tsf	
10			115	X	67	2-2-4 (8)		PP = 1.25 tsf	
				X	67	3-4-7 (14)			
15			110						
		15.0-15.9' Limestone, highly weathered		X	55	4-40/0.4'		PP = 2.50 tsf	
		Bottom of borehole at 15.9 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. T-16-03

Job No.: R35G-FI2377 **County:** Miller **Route:** 67
Design: Fi2377 **Skew:** Right Angle **Location:** Festus
Bent: Southwest Corner **Logged By:** Alan Miller **Operator:** Ray Murray
Station: **Northing:** **Date of Work:** 01/28/16-01/28/16
Offset: **Easting:** **Depth to Water:**
Elevation: 125.0 **Requested Northing:** **Depth Hole Open:**
Requested Station: **Requested Easting:** **Time Change:**
Requested Offset: **Equipment:** CME 45 ,Split-Spoon Sampler, NQ
Requested Elevation: **Location Note:** Festus Maintenance Facitity
Drill No.: G-9577 **Hammer Efficiency:** 84% **Drilling Method:** Hollow Stem Auger

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Data	Field Tests	Index Tests
0			125						
		0.0-0.9' ASPHALT							
		0.9-1.4' Base Rock							
		1.4-2.5' Dark gray, LEAN CLAY, stiff, moist							
		2.5-16.5' Reddish brown, LEAN CLAY, very stiff, moist		X	67	3-5-10 (20)		PP = 3.00 tsf	
5			120						
				X	67	2-5-6 (14)		PP = 3.00 tsf	
				X	67	3-4-5 (12)		PP = 2.00 tsf	
10			115						
				X	67	3-4-7 (14)		PP = 2.50 tsf	
				X	67	3-5-7 (16)		PP = 2.75 tsf	
15			110						
				X	67	2-4-5 (12)		PP = 1.75 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

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. T-16-04

Job No.: R35G-FI2377 **County:** Miller **Route:** 67
Design: Fi2377 **Skew:** Right Angle **Location:** Festus
Bent: Northwest Corner **Logged By:** Alan Miller **Operator:** Ray Murray
Station: **Northing:** **Date of Work:** 01/28/16-01/28/16
Offset: **Easting:** **Depth to Water:**
Elevation: 125.0 **Requested Northing:** **Depth Hole Open:**
Requested Station: **Requested Easting:** **Time Change:**
Requested Offset: **Equipment:** CME 45 ,Split-Spoon Sampler, NQ
Requested Elevation: **Location Note:** Festus Maintenance Facitity
Drill No.: G-9577 **Hammer Efficiency:** 84% **Drilling Method:** Hollow Stem Auger

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N_{60})	Shear Data	Field Tests	Index Tests
0			125						
		0.0-0.9' ASPHALT							
		0.9-1.2' Base Rock							
		1.2-16.3' Reddish brown, LEAN CLAY, very stiff, moist		X	67	3-5-9 (18)		PP = 3.50 tsf	
5			120						
				X	67	3-6-7 (17)		PP = 2.00 tsf	
				X	67	2-4-5 (12)		PP = 1.75 tsf	
10			115						
				X	67	2-4-5 (12)		PP = 2.00 tsf	
				X	67	3-5-9 (18)		PP = 3.50 tsf	
15			110						
				X	67	3-6-10 (21)		PP = 3.00 tsf	
		16.3-16.5' Limestone, highly weathered, Shaley							
		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:**
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KEY TO SYMBOLS

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

CLIENT _____ **PROJECT NAME** Maintenance Facility

PROJECT NUMBER R35G-FI2377 **PROJECT LOCATION** Festus

LITHOLOGIC SYMBOLS
(Unified Soil Classification System)

- ASPHALT: Asphalt
- CH: USCS High Plasticity Clay
- CL: USCS Low Plasticity Clay
- GP: USCS Poorly-graded Gravel
- HIWEA LIMESTONE: HIWEA LIMSTONE

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)
Qu - UNCONFINED COMPRESSIVE STRENGTH (PSF)

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