



MEMORANDUM

Missouri Department of Transportation Construction - Materials Central Laboratory

TO: Matthew Sonner-nw/gs

CC/ATT: Bret Davidson-nw/cm
Marty Liles-nw/mt
Alvin Peavler-nw/gs

FROM: Ricardo N. Todd
Senior Geotechnical Specialist

DATE: March 30, 2016

SUBJECT: Materials
Geotechnical Section
Foundation Investigation for
Structure No. FI2378
Milan Maintenance Facility
Sullivan County

As requested in a letter dated February 1, 2016, from Northwest District Facility Operations Supervisor Matthew Sonner, a foundation investigation has been conducted for a new maintenance building in Sullivan County. The layout of the bore holes for the proposed structure is shown in Figure 1.

Existing Conditions

The soil encountered at the four (4) borings primarily included base material that extended to a depth of approximately 0.5 feet. The soil beneath the base material consists of about 5.1 feet of high plasticity clay, which classifies as CH by ASTM classification methods. The pocket penetrometer readings of the soil generally indicate a stiff soil.

Recommendation

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

- An allowable bearing pressure of 2000 psf or less may be used for the design of shallow foundations constructed on properly compacted fill or natural soils at this site. Shallow foundations shall be embedded a minimum of 2 feet below finished grade for frost protection.

CS
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Attachments

Figure - 1
Foundation Investigation
Route 6



5

6

Northeast

Northwest

Southeast

Southwest

SULLIVAN

R35G - F12378

1:600 = 1" = 50'

Source: Esri, DigitalGlobe, GeoEye, EarthStar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

**Missouri Department of Transportation
Construction and Materials**

BORING NO. O-16-25
Page 1 of 1

Job No.: R35G-FI2378
 Design: FI2378
 Bent: Northeast Corner
 Station: _____
 Offset: _____
 Elevation: 836.9
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-9462

County: Sullivan
 Skew: Rightangle
 Logged By: Ricardo Todd
 Northing: 1594845.91
 Easting: 1468729.88
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Acker Soil XLS ,Split-Spoon Sampler, NQ
 Location Note: Milan Maintenance Building
 Hammer Efficiency: 61%

Route: 6
 Location: Milan
 Operator: Raymond Murray
 Date of Work: 02/08/16-02/08/16
 Depth to Water: _____
 Depth Hole Open: _____
 Time Change: _____
 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									
0.0-5.1'		0.0-5.1' Mottled brownish gray, FAT CLAY, stiff, moist	835	X	67	3-2-4 (6)		PP = 1.50 tsf	MC = 30.2% γ _{sat} = 120 pcf ⁽¹⁾
5.1-12.5'		5.1-12.5' Mottled brown, LEAN CLAY, stiff, moist	830	X	73	3-3-4 (7)		PP = 2.00 tsf	MC = 19.1% γ _{sat} = 132 pcf ⁽¹⁾
				X	73	2-3-4 (7)		PP = 1.75 tsf	MC = 24.1% γ _{sat} = 126 pcf ⁽¹⁾
10			825	X	73	3-5-7 (12)		PP = 2.25 tsf	MC = 22.5% γ _{sat} = 128 pcf ⁽¹⁾
12.5-16.5'		12.5-16.5' Brown, LEAN CLAY scattered sand, medium stiff, moist		X	67	2-4-3 (7)		PP = 1.00 tsf	MC = 24.0% γ _{sat} = 126 pcf ⁽¹⁾
15				X	67	2-3-3 (6)		PP = 1.25 tsf	
		Bottom of borehole at 16.5 feet.							

LETTER BOREHOLE - MODOT 20150728.GDT - 3/31/16 10:51 - J:\SG\GINT\PROJECT FILES\R35G-FI2378.GPJ

N₆₀ = (Em/60)Nm N₆₀ - 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 Central Coordinate Proj. Factor: 1.000067997
 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.

**Missouri Department of Transportation
Construction and Materials**

BORING NO. O-16-26
Page 1 of 1

Job No.: R35G-FI2378
 Design: FI2378
 Bent: Southeast Corner
 Station: _____
 Offset: _____
 Elevation: 835.4
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-9462

County: Sullivan
 Skew: Rightangle
 Logged By: Ricardo Todd
 Northing: 1594804.25
 Easting: 1468758.44
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Acker Soil XLS ,Split-Spoon Sampler, NQ
 Location Note: Milan Maintenance Building
 Hammer Efficiency: 61%

Route: 6
 Location: Milan
 Operator: Raymond Murray
 Date of Work: 02/08/16-02/08/16
 Depth to Water: _____
 Depth Hole Open: _____
 Time Change: _____
 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									
0.0-0.4'		ASPHALT	835						
0.4-1.1'		Base Material							
1.1-2.5'	[Hatched Pattern]	Dark gray, FAT CLAY trace organics, medium stiff, moist		X	67	2-1-3 (4)		PP = 0.50 tsf	
2.5-7.6'		Tannish gray, FAT CLAY trace gravel, stiff, moist		X	73	1-2-3 (5)		PP = 1.25 tsf	MC = 24.6% γ _{sat} = 125 pcf ⁽¹⁾
7.6-10.1'	[Diagonal Pattern]	Tannish brown, LEAN CLAY, stiff, moist		X	67	1-3-4 (7)		PP = 1.25 tsf	MC = 22.5% γ _{sat} = 128 pcf ⁽¹⁾
10.1-15.1'		Mottled tannish brown, LEAN CLAY scattered fine gravel, stiff, moist	825	X	73	2-6-6 (12)		PP = 2.00 tsf	MC = 20.0% γ _{sat} = 130 pcf ⁽¹⁾
15.1-19.0'	[Diagonal Pattern]	Mottled tannish gray, LEAN CLAY, medium stiff to stiff, moist	820	X	67	2-2-4 (6)		PP = 1.50 tsf	MC = 30.9% γ _{sat} = 120 pcf ⁽¹⁾
					X	73	1-2-4 (6)		PP = 1.00 tsf
				X	73	1-3-3 (6)		PP = 1.25 tsf	MC = 22.5% γ _{sat} = 128 pcf ⁽¹⁾
		Bottom of borehole at 19.0 feet.							

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**Missouri Department of Transportation
Construction and Materials**

BORING NO. O-16-27
Page 1 of 1

Job No.: R35G-FI2378
 Design: FI2378
 Bent: Northwest Corner
 Station: _____
 Offset: _____
 Elevation: 834.6
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-9462

County: Sullivan
 Skew: Rightangle
 Logged By: Ricardo Todd
 Northing: 1594809.27
 Easting: 1468624.4
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Acker Soil XLS ,Split-Spoon Sampler, NQ
 Location Note: Milan Maintenance Building
 Hammer Efficiency: 61%

Route: 6
 Location: Milan
 Operator: Raymond Murray
 Date of Work: 02/08/16-02/08/16
 Depth to Water: _____
 Depth Hole Open: _____
 Time Change: _____
 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									
0.0-7.6'		Mottled dark gray, FAT CLAY trace organics, and fine gravel, stiff, moist							
5			830	X	73	2-4-6 (10)		PP = 2.00 tsf	MC = 18.0% γ _{sat} = 133 pcf ⁽¹⁾
				X	73	2-3-5 (8)		PP = 1.75 tsf	MC = 24.1% γ _{sat} = 126 pcf ⁽¹⁾
7.6-16.5'		Mottled brownish gray, LEAN CLAY, stiff, moist							
10			825	X	67	1-3-3 (6)		PP = 1.25 tsf	MC = 23.7% γ _{sat} = 126 pcf ⁽¹⁾
				X	73	1-3-4 (7)		PP = 1.50 tsf	MC = 23.3% γ _{sat} = 127 pcf ⁽¹⁾
15			820	X	73	1-3-3 (6)		PP = 1.00 tsf	MC = 28.4% γ _{sat} = 122 pcf ⁽¹⁾
				X	67	1-2-3 (5)		PP = 1.00 tsf	MC = 28.5% γ _{sat} = 122 pcf ⁽¹⁾
		Bottom of borehole at 16.5 feet.							

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**Missouri Department of Transportation
Construction and Materials**

BORING NO. O-16-28
Page 1 of 1

Job No.: R35G-FI2378
 Design: FI2378
 Bent: Southwest Corner
 Station: _____
 Offset: _____
 Elevation: 835.5
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-9462

County: Sullivan
 Skew: Rightangle
 Logged By: Ricardo Todd
 Northing: 1594763.43
 Easting: 1468646.52
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Acker Soil XLS ,Shelby Tube, NQ
 Location Note: Milan Maintenance Building
 Hammer Efficiency: 61%

Route: 6
 Location: Milan
 Operator: Raymond Murray
 Date of Work: 02/09/16-02/09/16
 Depth to Water: _____
 Depth Hole Open: _____
 Time Change: _____
 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									
0.0-0.5'		Base Material	835						
0.5-7.8'		Mottled dark gray, FAT CLAY trace gravel, stiff, moist			44		Qu Test Results UCS = 2.43 ksf MC = 25% γ _{moist} = 122.7 pcf	PP = 2.00 tsf Torvane = 0.80 tsf	MC = 24.3% γ _{sat} = 126 pcf ⁽¹⁾ LL = 51 PL = 20
7.8-14.7'		Mottled tannish gray, LEAN CLAY trace gravel, stiff, moist	830		40		Qu Test Results UCS = 2.30 ksf MC = 22.2% γ _{moist} = 126.3 pcf	PP = 1.25 tsf Torvane = 0.40 tsf	MC = 24.1% γ _{sat} = 126 pcf ⁽¹⁾ LL = 40 PL = 17
14.7-17.5'		Greenish gray, LEAN CLAY, soft, moist	825		80		Qu Test Results UCS = 1.04 ksf MC = 27.5% γ _{moist} = 122.3 pcf	PP = 1.25 tsf Torvane = 0.40 tsf	MC = 24.1% γ _{sat} = 126 pcf ⁽¹⁾ MC = 26.2% LL = 32 PL = 16
			820		60			PP = 1.25 tsf Torvane = 0.40 tsf	MC = 24.9% γ _{sat} = 125 pcf ⁽¹⁾
					80			PP = 1.25 tsf Torvane = 0.40 tsf	MC = 28.1% γ _{sat} = 122 pcf ⁽¹⁾ LL = 39 PL = 14
					80			PP = 0.25 tsf Torvane = 0.10 tsf	MC = 27.4% γ _{sat} = 123 pcf ⁽¹⁾
		Bottom of borehole at 17.5 feet.							

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

KEY TO SYMBOLS

CLIENT _____

PROJECT NAME Maintenance Shed

PROJECT NUMBER R35G-FI2378

PROJECT LOCATION Milan

LITHOLOGIC SYMBOLS (Unified Soil Classification System)

-  ASPHALT: Asphalt
-  CH: USCS High Plasticity Clay
-  CL: USCS Low Plasticity Clay
-  CL-ML: USCS Low Plasticity Silty Clay
-  GP: USCS Poorly-graded Gravel

SAMPLER SYMBOLS

-  Split-Spoon Sampler
-  Shelby Tube

WELL CONSTRUCTION SYMBOLS

ABBREVIATIONS

- | | |
|--------------------------------------------|-----------------------------------|
| LL - LIQUID LIMIT (%) | TV - TORVANE |
| PI - PLASTIC INDEX (%) | PID - PHOTOIONIZATION DETECTOR |
| W - MOISTURE CONTENT (%) | UC - UNCONFINED COMPRESSION |
| DD - DRY DENSITY (PCF) | ppm - PARTS PER MILLION |
| NP - NON PLASTIC | ▽ Water Level at Time of Drilling |
| -200 - PERCENT PASSING NO. 200 SIEVE | ▼ Water Level at End of Drilling |
| PP - POCKET PENETROMETER (TSF) | ▽ Water Level after Drilling |
| Qu - UNCONFINED COMPRESSIVE STRENGTH (PSF) | |