MEMORANDUM

Missouri Department of Transportation
Construction - Materials
Central Laboratory

TO: Larry Carver-ne/gs

CC/ATT: Lydia Brownell-ne/cm

FROM: Alan Miller
Geotechnical Engineer

DATE: October 28, 2013

SUBJECT: Materials
Geotechnical Section
Foundation Investigation for
Structure Design No. FI2106 Building Addition
Job No. R35G
Route I-70, Warren County

Attached are logs of borings for the above noted structure, a proposed Mechanics and Cold Storage Building at the Warrenton Maintenance Shed.

An allowable bearing of 2000 psf may be used for the foundation soil below a depth of 3 feet.

An unmarked sewer line was encountered at a depth of 4 feet while drilling the boring on the northwest corner.

cs
j:\sublec\alan\fi2106 storage bldg ltr.doc
Attachments

Missouri Department of Transportation
Construction and Materials

BORING NO. T-13-48
Page 1 of 1

Job No.: R35G-FI2106	**County:** Warren	**Route:** I-70
Design: FI2106	**Skew:**	**Location:**
Bent:	**Logged By:** George Davis	**Operator:** Raymond Murray
Station:	**Northing:** 1085923.9	**Date of Work:** 10/15/13-10/15/13
Offset:	**Easting:** 631991.4	**Depth to Water:**
Elevation: 851.1	**Requested Northing:**	**Depth Hole Open:**
Requested Station:	**Requested Easting:**	**Time Change:** 0 hours
Requested Offset:	**Equipment:** CME 45 ,Split-Spoon Sampler	
Requested Elevation:	**Location Note:** NE Corner	
Drill No.: G-9577	**Hammer Efficiency:** 87%	**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		0-4.2' GRAVEL and sand, loose to medium dense, moist	850						
				X	27	4-1-3 (6)			
5		4.2-6.8' Brown, FAT CLAY scattered gray mottles, medium stiff, moist							
			845	X	87	2-3-5 (12)		PP = 1.50 tsf	
		6.8-14' Gray, FAT CLAY trace sand, scattered brown mottles, hard, moist							
				X	100	2-3-4 (10)		PP = 2.50 tsf	
10									
			840	X	100	3-4-7 (16)		PP = 1.75 tsf	
				X	93	4-6-7 (19)		PP = 3.25 tsf	
15		14-18.2' Brown, LEAN CLAY, medium stiff, moist							
			835	X	100	3-2-3 (7)		PP = 0.50 tsf	
				X	100	3-6-7 (19)		PP = 0.75 tsf PP = 2.10 tsf	
20		18.2-21.5' Gray, FAT CLAY scattered sand, trace gravel, hard, moist							
			830	X	100	5-5-7 (17)		PP = 3.75 tsf	
		Bottom of borehole at 21.5 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.

LETTER BOREHOLE - MODOT_07-29-11.GDT - 10/28/13 13:15 - J:\SG\GINT\PROJECT FILES\R35G-FI2106.GPJ

Missouri Department of Transportation
Construction and Materials

BORING NO. T-13-47

Job No.: R35G-FI2106	**County:** Warren	**Route:** I-70
Design: FI2106	**Skew:**	**Location:**
Bent:	**Logged By:** George Davis	**Operator:** Raymond Murray
Station:	**Northing:** 1085899.8	**Date of Work:** 10/15/13-10/15/13
Offset:	**Easting:** 631936.4	**Depth to Water:**
Elevation: 850.2	**Requested Northing:**	**Depth Hole Open:**
Requested Station:	**Requested Easting:**	**Time Change:** 0 hours
Requested Offset:	**Equipment:** CME 45 ,Split-Spoon Sampler	
Requested Elevation:	**Location Note:** NW Corner	
Drill No.: G-9577	**Hammer Efficiency:** 87%	**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			850						
		0-1.7' Brown, GRAVEL and sand, medium dense, moist							
		1.7-5' Brown, LEAN CLAY trace sand, few gray mottles, hard, moist		X	93	4-6-7 (19)		PP = 3.90 tsf	
5			845						
		5-15' Gray and dark orangish brown, FAT CLAY, stiff to very hard, moist		X	67	2-3-4 (10)		PP = 2.20 tsf	
				X	93	2-4-5 (13)		PP = 1.20 tsf	
10			840						
				X	100	0-6-8 (20)		PP = 4.40 tsf	
				X	100	4-6-8 (20)		PP = 3.20 tsf	
15			835						
		15-21.5' Brown, FAT CLAY trace sand, trace gravel, with gray mottles, very stiff to hard, moist		X	100	4-3-5 (12)		PP = 3.70 tsf	
				X	100	5-7-10 (25)		PP = 1.50 tsf	
20			830						
				X	100	5-7-13 (29)		PP = 3.30 tsf	
		Bottom of borehole at 21.5 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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Coordinate Datum: NAD 83 (CONUS) **Coordinate Units:** U.S. Survey Feet

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BORING NO. T-13-51
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Job No.: R35G-FI2106	**County:** Warren	**Route:** I-70
Design: FI2106	**Skew:**	**Location:**
Bent:	**Logged By:** George Davis	**Operator:** Raymond Murray
Station:	**Northing:** 1085832.3	**Date of Work:** 10/16/13-10/16/13
Offset:	**Easting:** 632031.5	**Depth to Water:**
Elevation: 848.9	**Requested Northing:**	**Depth Hole Open:**
Requested Station:	**Requested Easting:**	**Time Change:** 0 hours
Requested Offset:	**Equipment:** CME 45 ,Split-Spoon Sampler	
Requested Elevation:	**Location Note:** SE Corner	
Drill No.: G-9577	**Hammer Efficiency:** 87%	**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		0-0.7' ASPHALT							
		0.7-1.4' GRAVEL and sand, medium dense, moist							
		1.4-5.5' Brown, LEAN CLAY, very stiff, moist	845	X	73	4-5-6 (16)		PP = 3.70 tsf	
5									
		5.5-7.5' Brown, FAT CLAY, hard, moist		X	80	3-5-5 (15)		PP = 2.70 tsf	
		7.5-21.5' Brown and gray, FAT CLAY scattered sand, trace gravel, hard to very hard, moist	840	X	100	2-3-5 (12)		PP = 2.20 tsf	
10				X	47	4-7-9 (23)		PP = 4.50 tsf	
			835	X	100	2-3-4 (10)		PP = 1.50 tsf	
15				X	100	1-3-5 (12)		PP = 2.20 tsf	
			830	X	80	5-6-12 (26)		PP = 2.70 tsf	
20				X	100	5-7-10 (25)		PP = 3.00 tsf	
		Bottom of borehole at 21.5 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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BORING NO. T-13-50
Page 1 of 1

Job No.: R35G-FI2106	**County:** Warren	**Route:** I-70
Design: FI2106	**Skew:**	**Location:**
Bent:	**Logged By:** George Davis	**Operator:** Raymond Murray
Station:	**Northing:** 1085808.2	**Date of Work:** 10/16/13-10/16/13
Offset:	**Easting:** 631976.6	**Depth to Water:**
Elevation: 846.7	**Requested Northing:**	**Depth Hole Open:**
Requested Station:	**Requested Easting:**	**Time Change:** 0 hours
Requested Offset:	**Equipment:** CME 45 ,Split-Spoon Sampler	
Requested Elevation:	**Location Note:** SW Corner	
Drill No.: G-9577	**Hammer Efficiency:** 87%	**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		0-1.2' GRAVEL and sand, loose, moist							
		1.2-4.8' Dark brown, LEAN CLAY, soft, moist	845						
				X	47	2-2-3 (7)		PP = 0.90 tsf	
5		4.8-7.5' Brown, FAT CLAY with gray mottles, medium stiff, moist		X	60	2-3-4 (10)		PP = 1.90 tsf	
			840						
		7.5-11.8' Gray, FAT CLAY scattered sand, scattered brown mottles, hard, moist		X	100	2-4-7 (16)		PP = 3.75 tsf	
10				X	100	3-5-6 (16)		PP = 2.80 tsf	
			835						
		11.8-21.5' Brown, FAT CLAY few gray mottles, scattered sand, trace gravel, very stiff to hard, moist		X	100	1-2-4 (9)		PP = 1.10 tsf	
15				X	100	4-5-6 (16)		PP = 2.50 tsf	
			830						
				X	27	4-6-8 (20)		PP = 1.20 tsf	
20				X	100	3-5-5 (15)		PP = 1.50 tsf	
		Bottom of borehole at 21.5 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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BORING NO. T-13-49
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Job No.: R35G-FI2106 | County: Warren | Route: I-70
Design: FI2106 | Skew: | Location:
Bent: | Logged By: George Davis | Operator: Raymond Murray
Station: | Northing: 1085866.1 | Date of Work: 10/16/13-10/16/13
Offset: | Easting: 631984 | Depth to Water:
Elevation: 848.9 | Requested Northing: | Depth Hole Open:
Requested Station: | Requested Easting: | Time Change: 0 hours
Requested Offset: | Equipment: CME 45 ,Split-Spoon Sampler
Requested Elevation: | Location Note: Center
Drill No.: G-9577 | Hammer Efficiency: 87% | 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		0-1.2' GRAVEL and sand, medium dense, moist							
		1.2-2' Gray, LEAN CLAY, moist							
		2-12.7' Brown, FAT CLAY few gray mottles, very stiff to hard, moist	845	X	87	2-4-6 (15)		PP = 2.25 tsf	
5				X	67	2-3-4 (10)		PP = 1.90 tsf	
			840	X	80	2-4-7 (16)		PP = 4.10 tsf	
10				X	93	2-4-7 (16)		PP = 2.75 tsf	
		12.7-14.4' Brown, SAND with lean clay, dense, moist, medium grained, well graded	835	X	100	7-8-7 (22)		PP = 4.30 tsf	
15		14.4-21.5' Gray, FAT CLAY trace sand, trace gravel, scattered brown mottles, hard, moist		X	100	1-3-6 (13)		PP = 2.80 tsf	
			830	X	100	2-4-5 (13)		PP = 2.20 tsf	
20				X	100	3-5-5 (15)		PP = 2.50 tsf	
		Bottom of borehole at 21.5 feet.							

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KEY TO SYMBOLS

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

CLIENT _____ PROJECT NAME Warrenton Mechanics and Cold Storage Building

PROJECT NUMBER R35G-FI2106 PROJECT LOCATION _____

LITHOLOGIC SYMBOLS
(Unified Soil Classification System)

- ASPHALT: Asphalt
- CH: USCS High Plasticity Clay
- CL: USCS Low Plasticity Clay
- GPS: USCS Poorly-graded Sandy Gravel
- GWS: USCS Well-graded Sandy Gravel
- SW: USCS Well-graded Sand
- SWG: USCS Well-graded Gravelly Sand

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