



MEMORANDUM

Missouri Department of Transportation
Construction - Materials
Central Laboratory

TO: Paul Huskey-se/gs

CC/ATT: Joe Crader-se/cm

FROM: Sheri J. Lamberson
Senior Geotechnical Specialist

DATE: November 19, 2014

SUBJECT: Materials
Geotechnical Section
Foundation Investigation for
Structure No. FI2229
Summersville Salt Storage & Pole Barn Buildings
Job No. R35G
Route 17, Texas County

Attached are logs of borings for the above noted structures, a proposed dry storage building and a pole barn/cold storage building, as well as an aerial photo of boring locations as Figure 1.

Based on borings taken in the vicinity of the dry storage structure, the allowable bearing of the foundation soils was 6000 psf and will be adequate for your building.

Based on borings in the vicinity of the pole barn, the allowable bearing of the foundation soil below a depth of 4 feet is 3000 psf and will be adequate for your building.

If the building is to be used for salt storage, the Salt Institute recommends a low permeability pad and base to prevent downward seepage of brine to ground water. The dead load from the salt stockpile is not significant, but to allow for the constant placement and removal of material with a front end loader, John Donahue of the Construction & Materials Field Office recommends a 6-inch asphalt pad. Our 401 mixes (full-depth BP1 or BP1 on PMBB) would be of sufficient quality. Achieving density is important to ensure a low permeability surface.

cs
j:\sublec\sheri\fi2229 rte 17 texas co ltr.doc
Attachments



1 inch = 100 feet

DENT AVE

17

TEXAS

A-14-47

A-14-48

A-14-46

A-14-49

B-14-54 B-14-55

A-14-51

A-14-50

BANDY DR

Figure 1
Salt & Cold Storage Buildings
Summersville Maintenance Facility
Route 17, Texas County

**Missouri Department of Transportation
Construction and Materials**

BORING NO. A-14-46
Page 1 of 1

Job No.: R35G
 Design: Fi2229
 Bent: 1000
 Station: _____
 Offset: _____
 Elevation: 1214
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-7887

County: Texas
 Skew: _____
 Logged By: Ricardo Todd
 Northing: 487972.4
 Easting: 1885744.74
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Failing 1500 ,Split-Spoon Sampler
 Location Note: Summersville Maintenance Shed
 Hammer Efficiency: 60%

Route: 17
 Location: Summersville
 Operator: Mike Donahoe
 Date of Work: 10/22/14-10/22/14
 Depth to Water: _____
 Depth Hole Open: _____
 Time Change: _____
 Drilling Method: Mud Rotary

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N ₆₀)	Shear Strength Data	Field Tests	Index Tests
0									
0-6.5'		0-6.5' Tannish red, GRAVELLY LEAN CLAY, very stiff, moist	1210	X	100	19-25-26 (51)			MC = 26.5%
5				X	100	15-19-16 (35)			MC = 21.4%
6.5-16.5'		6.5-16.5' Reddish gray, GRAVELLY FAT CLAY trace cobbles, very stiff to hard, moist	1205	X	100	8-18-10/0.3', 10/0'			MC = 35.5% LL = 76 PL = 33
10				X	100	28-31-41 (72)			
15			1200	X	100	13-19-17 (36)			
				X	100	17-26-31 (57)			
		Bottom of borehole at 16.5 feet.							

LETTER BOREHOLE - R35G-S2109.GPJ - 11/18/14 16:37 - J:\SG\GINT\PROJECT FILES\R35G-Fi2229.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 East Coordinate Proj. Factor: 1.000050958597
 Coordinate Datum: _____ 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. A-14-47
Page 1 of 1

Job No.: R35G
 Design: Fi2229
 Bent: 1001
 Station: _____
 Offset: _____
 Elevation: 1213.5
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-7887

County: Texas
 Skew: _____
 Logged By: Ricardo Todd
 Northing: 488032.59
 Easting: 1885746.31
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Failing 1500 ,Split-Spoon Sampler
 Location Note: Summersville Maintenance Shed
 Hammer Efficiency: 60%

Route: 17
 Location: Summersville
 Operator: Mike Donahoe
 Date of Work: 10/22/14-10/22/14
 Depth to Water: _____
 Depth Hole Open: _____
 Time Change: _____
 Drilling Method: Mud Rotary

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N ₆₀)	Shear Strength Data	Field Tests	Index Tests
0									
0-5.1'		0-5.1' Tannish red, GRAVELLY LEAN CLAY, stiff, moist	1210	X	67	10-11-20 (31)			
5.1-10.1'		5.1-10.1' Reddish gray, GRAVELLY FAT CLAY trace cobbles, very stiff, moist	1205	X	100	9-24-28 (52)		PP = 4.00 tsf	MC = 30.9% LL = 79 PL = 33
10.1-16.5'		10.1-16.5' Reddish gray, FAT CLAY scattered gravel, very stiff, moist	1200	X	67	16-12-19 (31)			MC = 31.6%
				X	67	10-10-17 (27)		PP = 4.25 tsf	MC = 31.9%
				X	67	6-9-11 (20)		PP = 3.50 tsf	MC = 37.3% LL = 81 PL = 35
				X	67	7-6-11 (17)		PP = 2.75 tsf	
		Bottom of borehole at 16.5 feet.							

LETTER BOREHOLE - R35G-S2109.GPJ - 11/18/14 16:38 - J:\SG\GINT\PROJECT FILES\R35G-FI2229.GPJ

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**Missouri Department of Transportation
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BORING NO. A-14-48
Page 1 of 1

Job No.: R35G
 Design: Fi2229
 Bent: 1002
 Station: _____
 Offset: _____
 Elevation: 1212.7
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-7887

County: Texas
 Skew: _____
 Logged By: Ricardo Todd
 Northing: 488033.12
 Easting: 1885839.19
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Failing 1500 ,Split-Spoon Sampler
 Location Note: Summersville Maintenance Shed
 Hammer Efficiency: 60%

Route: 17
 Location: Summersville
 Operator: Mike Donahoe
 Date of Work: 10/23/14-10/23/14
 Depth to Water: _____
 Depth Hole Open: _____
 Time Change: _____
 Drilling Method: Mud Rotary

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N ₆₀)	Shear Strength Data	Field Tests	Index Tests
0									
0-8.1'		0-8.1' Red, GRAVELLY LEAN CLAY scattered cobbles, moist	1210	X	67	12-19-27 (46)		PP = 2.50 tsf	MC = 18.6%
5			X	67	36-35-40 (75)				
8.1-16.5'		8.1-16.5' Reddish gray, GRAVELLY LEAN CLAY scattered cobbles, moist	1205	X	67	16-27-29 (56)			
10			X	67	13-20-28 (48)				
15			X	67	12-10-16 (26)				
			Bottom of borehole at 16.5 feet.		X	67		15-19-29 (48)	

LETTER BOREHOLE - R35G-S2109.GPJ - 11/18/14 16:38 - J:\SG\GINT\PROJECT FILES\R35G-FI2229.GPJ

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**Missouri Department of Transportation
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BORING NO. A-14-49
Page 1 of 1

Job No.: R35G
 Design: Fi2229
 Bent: 1003
 Station: _____
 Offset: _____
 Elevation: 1212.7
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-7887

County: Texas
 Skew: _____
 Logged By: Ricardo Todd
 Northing: 487974.93
 Easting: 1885843.21
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Failing 1500 ,Split-Spoon Sampler
 Location Note: Summersville Maintenance Shed
 Hammer Efficiency: 60%

Route: 17
 Location: Summersville
 Operator: Mike Donahoe
 Date of Work: 10/23/14-10/23/14
 Depth to Water: _____
 Depth Hole Open: _____
 Time Change: _____
 Drilling Method: Mud Rotary

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N ₆₀)	Shear Strength Data	Field Tests	Index Tests
0									
0-5.1'		0-5.1' Red, GRAVELLY LEAN CLAY scattered cobbles, very stiff, moist	1210	X	67	13-17-18 (35)			MC = 27.5%
5.1-15.1'		5.1-15.1' Reddish gray, GRAVELLY LEAN CLAY trace cobbles, very stiff, moist	1205	X	67	16-20-15 (35)		PP = 4.00 tsf	MC = 24.4%
10			1200	X	67	10-17-28 (45)			
15				X	67	13-16-13 (29)		PP = 3.75 tsf	MC = 31.6%
15.1-16.5'		15.1-16.5' Tannish gray, LEAN CLAY scattered gravel, stiff, moist		X	67	6-6-19 (25)		PP = 1.25 tsf	
		Bottom of borehole at 16.5 feet.							

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BORING NO. A-14-50
Page 1 of 1

Job No.: R35G
 Design: Fi2229
 Bent: 1004
 Station: _____
 Offset: _____
 Elevation: 1208.2
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-7887

County: Texas
 Skew: _____
 Logged By: Ricardo Todd
 Northing: 488293.9
 Easting: 1885870.51
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Failing 1500 ,Split-Spoon Sampler
 Location Note: Summersville Maintenance Shed
 Hammer Efficiency: 60%

Route: 17
 Location: Summersville
 Operator: Michael Donahoe
 Date of Work: 10/23/14-10/23/14
 Depth to Water: _____
 Depth Hole Open: _____
 Time Change: _____
 Drilling Method: Mud Rotary

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N ₆₀)	Shear Strength Data	Field Tests	Index Tests
0									
0-7.6'		0-7.6' Brownish tan, GRAVELLY LEAN CLAY, stiff, moist	1205	X	67	7-9-13 (22)			
5				X	67	22-23-24 (47)		PP = 4.00 tsf	MC = 21.9%
7.6-10.1'		7.6-10.1' Red, GRAVELLY LEAN CLAY trace cobbles, very stiff, moist	1200	X	67	20-26-16 (42)		PP = 4.00 tsf	MC = 31.8% LL = 48 PL = 24
10.1-16.5'		10.1-16.5' Reddish gray, FAT CLAY scattered gravel, very stiff, moist	1195	X	67	6-8-14 (22)		PP = 3.50 tsf	MC = 39.3% LL = 75 PL = 37
15				X	67	6-13-13 (26)			
				X	67	3-19-13 (32)			
		Bottom of borehole at 16.5 feet.							

LETTER BOREHOLE - R35G-S2109.GPJ - 11/18/14 16:38 - J:\SG\GINT\PROJECT FILES\R35G-FI2229.GPJ

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BORING NO. A-14-51
Page 1 of 1

Job No.: R35G
 Design: Fi2229
 Bent: 1005
 Station: _____
 Offset: _____
 Elevation: 1207.2
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-7887

County: Texas
 Skew: _____
 Logged By: Ricardo Todd
 Northing: 488287.15
 Easting: 1885820.4
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Failing 1500 ,Split-Spoon Sampler
 Location Note: Summersville Maintenance Shed
 Hammer Efficiency: 60%

Route: 17
 Location: Summersville
 Operator: Michael Donahoe
 Date of Work: 10/23/14-10/23/14
 Depth to Water: _____
 Depth Hole Open: _____
 Time Change: _____
 Drilling Method: Mud Rotary

Depth (ft)	Graphic	Description	Elevation (ft)	Sample Type	REC % (RQD %)	Blow Counts (N ₆₀)	Shear Strength Data	Field Tests	Index Tests
0									
0-5		0-6.5' Brownish tan, FAT CLAY trace gravel, stiff, moist	1205	X	67	5-5-6 (11)		PP = 1.25 tsf	MC = 23.2%
5-10		6.5-10.1' Red, GRAVELLY LEAN CLAY scattered cobbles, very stiff, moist	1200	X	73	6-12-19 (31)		PP = 3.50 tsf	MC = 21.5% LL = 51 PL = 27
10-15		10.1-12.5' Grayish red, LEAN CLAY scattered gravel, stiff, moist	1195	X	67	11-12-18 (30)		PP = 3.25 tsf	MC = 21.8%
15-16.5		12.5-16.5' Red, LEAN CLAY trace gravel, stiff, moist		X	67	4-7-11 (18)		PP = 1.75 tsf	MC = 21.4%
				X	67	5-6-10 (16)		PP = 1.25 tsf	
				X	67	4-6-5 (11)		PP = 1.00 tsf	
		Bottom of borehole at 16.5 feet.							

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**Missouri Department of Transportation
Construction and Materials**

BORING NO. B-14-54
Page 1 of 1

Job No.: R35G
 Design: Fi2229
 Bent: 1006
 Station: _____
 Offset: _____
 Elevation: 1208.2
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-8690

County: Texas
 Skew: _____
 Logged By: Ricardo Todd
 Northing: 488389.23
 Easting: 1885815.37
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Simco 4000 ,Split-Spoon Sampler
 Location Note: Summersville Maintenance Shed
 Hammer Efficiency: 70%

Route: 17
 Location: Summersville
 Operator: Rick Fredrick
 Date of Work: 10/26/14-10/26/14
 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 Strength Data	Field Tests	Index Tests
0									
0-5.1'		0-5.1' Tan, LEAN CLAY scattered gravel, stiff to hard, moist	1205	X	67	3-5-9 (16)		PP = 2.00 tsf	MC = 21.8%
5.1-10.8'		5.1-10.8' Grayish red, GRAVELLY LEAN CLAY trace cobbles, hard, moist	1200	X	67	4-7-12 (22)		PP = 4.00 tsf	MC = 29.0%
10.8-11.2'		10.8-11.2' Boulder		X	67	7-12-8 (23)			
11.2-16.5'		11.2-16.5' Tan, FAT CLAY, stiff, moist	1195	X	67	2-3-8 (13)		PP = 2.00 tsf	MC = 39.3% LL = 82 PL = 37
16.5'		Bottom of borehole at 16.5 feet.		X	67	3-4-6 (12)		PP = 1.50 tsf	

LETTER BOREHOLE - R35G-S2109.GPJ - 11/18/14 16:38 - J:\SG\GINT\PROJECT FILES\R35G-FI2229.GPJ

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 (1) = Assumed, (2) = Actual

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**Missouri Department of Transportation
Construction and Materials**

BORING NO. B-14-55
Page 1 of 1

Job No.: R35G
 Design: Fi2229
 Bent: 1007
 Station: _____
 Offset: _____
 Elevation: 1208.2
 Requested Station: _____
 Requested Offset: _____
 Requested Elevation: _____
 Drill No.: G-8690

County: Texas
 Skew: _____
 Logged By: Ricardo Todd
 Northing: 488389.39
 Easting: 1885866.95
 Requested Northing: _____
 Requested Easting: _____
 Equipment: Simco 4000 ,Split-Spoon Sampler
 Location Note: Summersville Maintenance Shed
 Hammer Efficiency: 70%

Route: 17
 Location: Summersville
 Operator: Rick Fredrick
 Date of Work: 10/26/14-10/26/14
 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 Strength Data	Field Tests	Index Tests
0									
0-5.4'		0-5.4' Tan, GRAVELLY LEAN CLAY, very stiff, moist	1205	X	67	4-8-10 (21)			
5-5.4-9'		5.4-9' Grayish red, GRAVELLY LEAN CLAY trace cobbles, very stiff, moist	1200	X	67	5-11-12 (27)		PP = 4.00 tsf	MC = 28.5%
9-12.5'		9-12.5' Tan, LEAN CLAY trace gravel, stiff, moist	1195	X	73	4-7-16 (27)		PP = 4.00 tsf	MC = 35.5%
12.5-16.5'		12.5-16.5' Reddish tan, GRAVELLY LEAN CLAY, very stiff, moist	1195	X	67	2-3-5 (9)		PP = 1.25 tsf	MC = 49.2%
15-16.5'				X	67	4-11-9 (23)			
16.5'		Bottom of borehole at 16.5 feet.				11-7-9 (19)			

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

KEY TO SYMBOLS

CLIENT _____ PROJECT NAME Salt Storage
PROJECT NUMBER R35G PROJECT LOCATION Summersville

LITHOLOGIC SYMBOLS (Unified Soil Classification System)

-  BLDRCBBL: Boulders and cobbles
-  CH: USCS High Plasticity Clay
-  CHG: USCS High Plasticity Gravelly Clay
-  CL: USCS Low Plasticity Clay
-  CLG: USCS Low Plasticity Gravelly Clay

SAMPLER SYMBOLS

-  Split-Spoon Sampler

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 |

