



## MEMORANDUM

Missouri Department of Transportation  
Construction - Materials  
Central Laboratory

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**TO:** Jeffrey Gander-ne/cm

**FROM:** Ricardo N. Todd  
Sr. Geotechnical Specialist

**DATE:** April 15, 2020

**SUBJECT:** Foundation Investigation for  
Structure No. W0401  
Job No. J2S3318  
Route UU, Macon County

Attached are logs of borings for the subject project. Also attached is an aerial photo showing boring locations and a subsurface diagram. Coordinate and elevation data were obtained by our Geotechnical Section

RT/kb  
Attachments

**Missouri Department of Transportation  
Construction and Materials**

**BORING NO. O-20-13 (SW)**  
Page 1 of 2

Job No.: J2S3318-W0401  
Design: W0401  
Bent: 9  
Station: \_\_\_\_\_  
Offset: \_\_\_\_\_  
Elevation: 828.4  
Requested Station: \_\_\_\_\_  
Requested Offset: \_\_\_\_\_  
Requested Elevation: \_\_\_\_\_  
Drill No.: G-9462

County: Macon  
Skew: \_\_\_\_\_  
Logged By: Ricardo Todd  
Northing: 1430641.9  
Easting: 1599584.6  
Requested Northing: \_\_\_\_\_  
Requested Easting: \_\_\_\_\_  
Equipment: Acker Soil XLS ,Split-Spoon Sampler  
Location Note: \_\_\_\_\_  
Hammer Efficiency: 71%

Route: UU  
Location: Over BNSF Railroad  
Operator: Gary Degraffenreid  
Date of Work: 03/25/20-03/26/20  
Depth to Water: 48.2  
Depth Hole Open: 68.1  
Time Change: 1 hour  
Drilling Method: Hollow Stem Auger

| Depth (ft) | Graphic                                                                            | Description                                                                        | Elevation (ft) | Sample Type | REC % (RQD %) | Blow Counts (N <sub>60</sub> ) | Shear Data | Field Tests   | Index Tests                                                                   |
|------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------|-------------|---------------|--------------------------------|------------|---------------|-------------------------------------------------------------------------------|
| 0          |                                                                                    |                                                                                    |                |             |               |                                |            |               |                                                                               |
| 10         |  | 0.0-10.2' Reddish gray, LEAN CLAY, stiff, moist                                    | 820            | ⊗           | 67            | 0-3-5 (9)                      |            | PP = 1.00 tsf | MC = 26.4%<br>γ <sub>sat</sub> = 124 pcf <sup>(1)</sup><br>LL = 44<br>PL = 20 |
| 20         |                                                                                    | 10.2-26.1' Tannish gray, LEAN CLAY trace gravel, stiff to very stiff, moist        | 810            | ⊗           | 67            | 2-5-6 (13)                     |            | PP = 1.50 tsf | MC = 18.0%<br>γ <sub>sat</sub> = 133 pcf <sup>(1)</sup><br>LL = 38<br>PL = 24 |
|            |                                                                                    |                                                                                    |                | ⊗           | 73            | 3-6-8 (17)                     |            | PP = 2.25 tsf | MC = 16.0%<br>γ <sub>sat</sub> = 135 pcf <sup>(1)</sup>                       |
|            |                                                                                    |                                                                                    |                | ⊗           | 73            | 3-6-8 (17)                     |            | PP = 2.25 tsf | MC = 16.6%<br>γ <sub>sat</sub> = 135 pcf <sup>(1)</sup>                       |
| 30         |                                                                                    | 26.1-31.2' Tan mottled, LEAN CLAY trace gravel, stiff to very stiff, moist         | 800            | ⊗           | 73            | 2-6-7 (15)                     |            | PP = 2.00 tsf | MC = 18.3%<br>γ <sub>sat</sub> = 132 pcf <sup>(1)</sup><br>LL = 36<br>PL = 9  |
| 40         |                                                                                    | 31.2-55.1' Mottled grayish tan, LEAN CLAY trace gravel, very stiff, moist, (Till)  | 790            | ⊗           | 73            | 3-6-8 (17)                     |            | PP = 2.25 tsf | MC = 18.3%<br>γ <sub>sat</sub> = 133 pcf <sup>(1)</sup>                       |
|            |                                                                                    |                                                                                    |                | ⊗           | 73            | 5-10-13 (27)                   |            | PP = 3.50 tsf | MC = 18.5%<br>γ <sub>sat</sub> = 132 pcf <sup>(1)</sup>                       |
| 50         |                                                                                    |                                                                                    | 780            | ⊗           | 67            | 5-10-12 (26)                   |            | PP = 3.25 tsf | MC = 22.5%<br>γ <sub>sat</sub> = 128 pcf <sup>(1)</sup>                       |
|            |                                                                                    |                                                                                    |                | ⊗           | 67            | 6-9-12 (25)                    |            | PP = 3.00 tsf | MC = 20.4%<br>γ <sub>sat</sub> = 130 pcf <sup>(1)</sup>                       |
| 60         |                                                                                    | 51.5' Hit Water                                                                    |                | ⊗           | 67            | 3-8-9 (20)                     |            | PP = 2.00 tsf | MC = 21.2%<br>γ <sub>sat</sub> = 129 pcf <sup>(1)</sup>                       |
|            |                                                                                    | 55.1-80.4' Gray mottled, LEAN CLAY trace gravel, very stiff to hard, moist, (Till) | 770            | ⊗           | 73            | 8-10-14 (28)                   |            | PP = 3.50 tsf | MC = 18.3%<br>γ <sub>sat</sub> = 132 pcf <sup>(1)</sup><br>LL = 35<br>PL = 18 |

N<sub>60</sub> = (Em/60)N<sub>m</sub> N<sub>60</sub> - Corrected N value for standard 60% SPT efficiency; Em - Measured hammer efficiency in percent; N<sub>m</sub> - Observed N-value  
(1) = Assumed, (2) = Actual

Coordinate System: U.S. State Plane 1983      Coordinate Zone: Missouri Central      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 20150728.GDT - 4/13/20 15:35 - Z:\SG\GINT\PROJECT FILES\J2S3318-W0401.GPJ

**Missouri Department of Transportation  
Construction and Materials**

**BORING NO. O-20-13 (SW)**  
Page 2 of 2

Job No.: J2S3318-W0401  
Design: W0401  
Bent: 9  
Station: \_\_\_\_\_  
Offset: \_\_\_\_\_  
Elevation: 828.4  
Requested Station: \_\_\_\_\_  
Requested Offset: \_\_\_\_\_  
Requested Elevation: \_\_\_\_\_  
Drill No.: G-9462

County: Macon  
Skew: \_\_\_\_\_  
Logged By: Ricardo Todd  
Northing: 1430641.9  
Easting: 1599584.6  
Requested Northing: \_\_\_\_\_  
Requested Easting: \_\_\_\_\_  
Equipment: Acker Soil XLS ,Split-Spoon Sampler  
Location Note: \_\_\_\_\_  
Hammer Efficiency: 71%

Route: UU  
Location: Over BNSF Railroad  
Operator: Gary Degraffenreid  
Date of Work: 03/25/20-03/26/20  
Depth to Water: 48.2  
Depth Hole Open: 68.1  
Time Change: 1 hour  
Drilling Method: Hollow Stem Auger

| Depth (ft) | Graphic | Description                                                                                    | Elevation (ft) | Sample Type                         | REC % (RQD %) | Blow Counts (N <sub>60</sub> ) | Shear Data | Field Tests   | Index Tests                                             |
|------------|---------|------------------------------------------------------------------------------------------------|----------------|-------------------------------------|---------------|--------------------------------|------------|---------------|---------------------------------------------------------|
| 60         |         | 55.1-80.4' Gray mottled, LEAN CLAY trace gravel, very stiff to hard, moist, (Till) (continued) |                | <input checked="" type="checkbox"/> | 73            | 4-7-10 (20)                    |            | PP = 2.50 tsf | MC = 19.6%<br>γ <sub>sat</sub> = 131 pcf <sup>(1)</sup> |
| 70         |         |                                                                                                | 760            | <input checked="" type="checkbox"/> | 73            | 4-7-10 (20)                    |            | PP = 2.50 tsf | MC = 18.8%<br>γ <sub>sat</sub> = 132 pcf <sup>(1)</sup> |
| 80         |         | 80.4-90.4' Gray mottled, LEAN CLAY, hard, moist                                                | 750            | <input checked="" type="checkbox"/> | 67            | 17-22-25 (56)                  |            | PP = 7.50 tsf |                                                         |
| 90         |         | 90.4-101.5' Gray mottled, LEAN CLAY trace gravel, very stiff to hard, moist, (Till)            | 740            | <input checked="" type="checkbox"/> | 73            | 7-10-11 (25)                   |            | PP = 4.00 tsf | MC = 17.8%<br>γ <sub>sat</sub> = 133 pcf <sup>(1)</sup> |
| 100        |         |                                                                                                | 730            | <input checked="" type="checkbox"/> | 67            | 5-7-11 (21)                    |            | PP = 2.50 tsf | MC = 18.4%<br>γ <sub>sat</sub> = 132 pcf <sup>(1)</sup> |
|            |         | Bottom of borehole at 101.5 feet.                                                              |                |                                     |               |                                |            |               |                                                         |

N<sub>60</sub> = (Em/60)N<sub>m</sub>    N<sub>60</sub> - Corrected N value for standard 60% SPT efficiency; Em - Measured hammer efficiency in percent; N<sub>m</sub> - Observed N-value  
(1) = Assumed, (2) = Actual

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**BORING NO. V-20-27 (NW)**  
Page 1 of 2

Job No.: J2S3318-W0401  
Design: W0401  
Bent: 1  
Station: \_\_\_\_\_  
Offset: \_\_\_\_\_  
Elevation: 830.9  
Requested Station: \_\_\_\_\_  
Requested Offset: \_\_\_\_\_  
Requested Elevation: \_\_\_\_\_  
Drill No.: G-9667

County: Macon  
Skew: \_\_\_\_\_  
Logged By: Matthew Kraus  
Northing: 1430836.2  
Easting: 1599598.1  
Requested Northing: \_\_\_\_\_  
Requested Easting: \_\_\_\_\_  
Equipment: Acker Renegade Split-Spoon Sampler  
Location Note: \_\_\_\_\_  
Hammer Efficiency: 76%

Route: UU  
Location: Over BNSF Railroad  
Operator: Kenny Mathews  
Date of Work: 03/25/20-03/26/20  
Depth to Water: 50.2  
Depth Hole Open: \_\_\_\_\_  
Time Change: At Time of Drilling  
Drilling Method: Hollow Stem Auger

| Depth (ft) | Graphic | Description                                                                         | Elevation (ft) | Sample Type | REC % (RQD %) | Blow Counts (N <sub>60</sub> ) | Shear Data | Field Tests   | Index Tests                                                                   |
|------------|---------|-------------------------------------------------------------------------------------|----------------|-------------|---------------|--------------------------------|------------|---------------|-------------------------------------------------------------------------------|
| 0          |         |                                                                                     |                |             |               |                                |            |               |                                                                               |
| 0.0-34.7'  |         | Grayish tan, LEAN CLAY, stiff to very stiff, moist                                  | 830            |             |               |                                |            |               |                                                                               |
|            |         |                                                                                     |                | X           | 100           | 1-3-6 (11)                     |            | PP = 3.00 tsf | MC = 20.9%<br>γ <sub>sat</sub> = 129 pcf <sup>(1)</sup><br>LL = 40<br>PL = 17 |
| 10         |         |                                                                                     | 820            | X           | 100           | 2-5-8 (16)                     |            | PP = 4.25 tsf | MC = 15.4%<br>γ <sub>sat</sub> = 136 pcf <sup>(1)</sup>                       |
|            |         |                                                                                     |                | X           | 100           | 3-4-8 (15)                     |            | PP = 3.25 tsf | MC = 15.4%<br>γ <sub>sat</sub> = 136 pcf <sup>(1)</sup>                       |
| 20         |         |                                                                                     | 810            | X           | 100           | 2-6-8 (18)                     |            | PP = 2.50 tsf | MC = 14.4%<br>γ <sub>sat</sub> = 138 pcf <sup>(1)</sup>                       |
|            |         |                                                                                     |                | X           | 100           | 2-4-7 (14)                     |            | PP = 2.50 tsf | MC = 17.2%<br>γ <sub>sat</sub> = 134 pcf <sup>(1)</sup>                       |
| 30         |         |                                                                                     | 800            | X           | 7             | 5-7-8 (19)                     |            |               |                                                                               |
| 34.7-38.9' |         | Brown, LEAN CLAY, stiff, moist                                                      |                | X           | 100           | 2-5-6 (14)                     |            | PP = 2.50 tsf | MC = 18.6%<br>γ <sub>sat</sub> = 132 pcf <sup>(1)</sup><br>LL = 37<br>PL = 16 |
| 40         |         | Grayish tan, LEAN CLAY, very stiff, moist, Till                                     | 790            | X           | 100           | 5-10-12 (28)                   |            | PP = 4.50 tsf | MC = 18.4%<br>γ <sub>sat</sub> = 132 pcf <sup>(1)</sup><br>LL = 41<br>PL = 16 |
|            |         |                                                                                     |                | X           | 100           | 3-7-9 (20)                     |            | PP = 3.50 tsf | MC = 19.6%<br>γ <sub>sat</sub> = 131 pcf <sup>(1)</sup>                       |
| 50         |         | 48.9-51.1' Brown, SAND, dense, moist to wet, fine and coarse grained, poorly graded | 780            | X           | 100           | 14-19-13 (41)                  |            |               |                                                                               |
|            |         | 51.1-101.5' Dark gray, LEAN CLAY with fine sand, very stiff to very hard, wet, Till |                | X           | 100           | 6-8-12 (25)                    |            | PP = 3.75 tsf | MC = 17.8%<br>γ <sub>sat</sub> = 133 pcf <sup>(1)</sup><br>LL = 36<br>PL = 17 |
| 60         |         |                                                                                     |                |             |               |                                |            |               |                                                                               |

N<sub>60</sub> = (Em/60)N<sub>m</sub>    N<sub>60</sub> - Corrected N value for standard 60% SPT efficiency; Em - Measured hammer efficiency in percent; N<sub>m</sub> - Observed N-value  
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**BORING NO. V-20-27 (NW)**  
Page 2 of 2

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Design: W0401  
Bent: 1  
Station: \_\_\_\_\_  
Offset: \_\_\_\_\_  
Elevation: 830.9  
Requested Station: \_\_\_\_\_  
Requested Offset: \_\_\_\_\_  
Requested Elevation: \_\_\_\_\_  
Drill No.: G-9667

County: Macon  
Skew: \_\_\_\_\_  
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Northing: 1430836.2  
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Location Note: \_\_\_\_\_  
Hammer Efficiency: 76%

Route: UU  
Location: Over BNSF Railroad  
Operator: Kenny Mathews  
Date of Work: 03/25/20-03/26/20  
Depth to Water: 50.2  
Depth Hole Open: \_\_\_\_\_  
Time Change: At Time of Drilling  
Drilling Method: Hollow Stem Auger

| Depth (ft) | Graphic | Description                                                                                     | Elevation (ft) | Sample Type | REC % (RQD %) | Blow Counts (N <sub>60</sub> ) | Shear Data | Field Tests   | Index Tests                                             |
|------------|---------|-------------------------------------------------------------------------------------------------|----------------|-------------|---------------|--------------------------------|------------|---------------|---------------------------------------------------------|
| 60         |         |                                                                                                 |                |             |               |                                |            |               |                                                         |
|            |         | 51.1-101.5' Dark gray, LEAN CLAY with fine sand, very stiff to very hard, wet, Till (continued) | 770            | ⊗           | 100           | 6-8-11 (24)                    |            | PP = 2.75 tsf | MC = 19.8%<br>γ <sub>sat</sub> = 131 pcf <sup>(1)</sup> |
|            |         |                                                                                                 |                | ⊗           | 100           | 6-7-9 (20)                     |            | PP = 2.50 tsf | MC = 20.9%<br>γ <sub>sat</sub> = 129 pcf <sup>(1)</sup> |
| 70         |         |                                                                                                 | 760            | ⊗           | 100           | 3-8-8 (20)                     |            | PP = 2.75 tsf | MC = 20.7%<br>γ <sub>sat</sub> = 130 pcf <sup>(1)</sup> |
|            |         |                                                                                                 |                | ⊗           | 100           | 4-8-8 (20)                     |            | PP = 2.50 tsf | MC = 19.5%<br>γ <sub>sat</sub> = 131 pcf <sup>(1)</sup> |
| 80         |         |                                                                                                 | 750            | ⊗           | 100           | 5-8-8 (20)                     |            | PP = 2.50 tsf | MC = 19.6%<br>γ <sub>sat</sub> = 131 pcf <sup>(1)</sup> |
|            |         |                                                                                                 |                | ⊗           | 100           | 5-23-26 (62)                   |            | PP = 4.00 tsf | MC = 22.8%<br>γ <sub>sat</sub> = 127 pcf <sup>(1)</sup> |
| 90         |         |                                                                                                 | 740            | ⊗           | 100           |                                |            |               |                                                         |
| 100        |         |                                                                                                 | 730            | ⊗           | 100           |                                |            |               |                                                         |
|            |         | Bottom of borehole at 101.5 feet.                                                               |                |             |               |                                |            |               |                                                         |

N<sub>60</sub> = (Em/60)N<sub>m</sub>    N<sub>60</sub> - Corrected N value for standard 60% SPT efficiency; Em - Measured hammer efficiency in percent; N<sub>m</sub> - Observed N-value  
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Missouri Department of Transportation

## KEY TO SYMBOLS

CLIENT \_\_\_\_\_

PROJECT NAME Bridge Replacement

PROJECT NUMBER J2S3318-W0401

PROJECT LOCATION Over BNSF Railroad

### LITHOLOGIC SYMBOLS (Unified Soil Classification System)



CL: USCS Low Plasticity Clay



SP: USCS Poorly-graded Sand

### SAMPLER SYMBOLS



Standard Penetration Test

### 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  
Drilling, or as Shown  
▼ Water Level at End of  
Drilling, or as Shown  
▽ Water Level After 24  
Hours, or as Shown

# J2S3318 - W0401

Boring Locations, Route UU, Macon County

## Legend

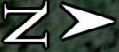
 Boring Locations

V-20-27 (NW)



 O-20-13 (SW)

100 ft





MDOT - Geotechnical Section

### SUBSURFACE DIAGRAM

PROJECT NAME Bridge Replacement

PROJECT LOCATION Over BNSF Railroad

CLIENT

PROJECT NUMBER J2S3318-W0401



USCS Low Plasticity Clay



USCS Poorly-graded Sand

