May 19, 2017

Carpenter Marty Transportation, Inc.
6612 Singletree Drive
Columbus, OH 43229

Attention: Mr. Kevin P. Carpenter, P.E., P.S.

Reference: Preliminary Summary - Subgrade Exploration
Morse Road/Kitzmiller Road Intersection Improvements
Franklin County, Ohio
S&ME Project No. 1117-17-007

Mr. Carpenter:

In accordance with your request, S&ME is herewith presenting a preliminary summary of the findings of the Subgrade Exploration performed for the Morse Road and Kitzmiller Road Intersection Improvement project in Franklin County, Ohio.

Scope of Project

S&ME understands that intersection improvements are proposed for the Morse Road and Kitzmiller Road intersection in Franklin County. The bridge carrying Morse Road over Blacklick Creek is also to be replaced as part of this project.

Field Exploration and Laboratory Testing

S&ME performed 5 roadway borings and 1 structure boring on March 23 and 24, 2017. The roadway borings were performed at approximate 400 foot intervals along the length of the project, were advanced to depths of 6 to 7.5 feet below the existing roadway subgrade, and were continuously sampled in accordance with ODOT specifications. The structure boring was terminated after coring 10 feet into the bedrock.

The recovered soil and rock samples were returned to our laboratory, and in accordance with ODOT specifications, moisture content, Atterberg limit, and grain size analyses tests being performed on at least 2 samples recovered from just below the subgrade level in each boring. Sulfate content testing was also performed on a subgrade level soil sample from four of the roadway borings.

Preliminary Geotechnical Information

Preliminary copies of the boring logs, a plan of borings, and a subgrade analysis spreadsheet are included in the Appendix at the rear of this submission. Additionally, copies of the logs of historic borings drilled for the current bridge and provided by the Franklin County Engineer’s office the available in the project area are included in the Appendix. A copy of a boring log from a 2002 subsurface investigation for a
A water line located just south of Morse Road is also included. The approximate locations of these historic explorations are included on the Plan of Borings at the rear of this submission.

**Closing**

S&ME is proceeding with preparation of our Subgrade and structure Exploration report and will complete the report after receiving all required information.

If you have any questions regarding this preliminary submission, please do not hesitate to contact our office.

Respectfully,

S&ME, Inc.

Nathan D. Abele, P.E.
Project Manager

Richard S. Weigand, P.E.
Senior Engineer/Senior Reviewer

Attachments: Appendix (11 sheets)
Submitted: Email (kcarpenter@cmtran.com, kmessaros@cmtran.com, and gjohnson@cmtran.com)
NOTES:
The above boring location data is estimated and not based on survey data.

Legend

- RESOURCE INTERNATIONAL, INC. 1982 APPROXIMATE BORING LOCATIONS
- BBC&M 2002 APPROXIMATE BORING LOCATION
- APPROXIMATE BORING LOCATIONS

PLAN OF BORINGS

MORSE RD & KITZMILLER RD
FRA-CR71-10.43
FRANKLIN COUNTY, OHIO
### Material Description and Notes

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>SPT</th>
<th>REC (%)</th>
<th>SAMPLE ID</th>
<th>HP (tsf)</th>
<th>Gradation (%)</th>
<th>Atterberg</th>
<th>ODOT Class (GI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1022.0</td>
<td>5</td>
<td>16</td>
<td>SS-1</td>
<td>2.0-2.5</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1020.5</td>
<td>6</td>
<td>56</td>
<td></td>
<td>9</td>
<td>15 17 23 36 42 20 22 21</td>
<td>A-7-6 (10)</td>
<td></td>
</tr>
<tr>
<td>1019.0</td>
<td>5</td>
<td>14</td>
<td>SS-2</td>
<td>2.0-3.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1017.5</td>
<td>5</td>
<td>100</td>
<td></td>
<td>6</td>
<td>17 19 22 36 46 21 25 22</td>
<td>A-7-6 (11)</td>
<td></td>
</tr>
<tr>
<td>1016.0</td>
<td>7</td>
<td>23</td>
<td>SS-3</td>
<td>1.5-3.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1017.5</td>
<td>9</td>
<td>22</td>
<td>SS-4</td>
<td>- - - - - - - - - - - -</td>
<td>A-6a (V)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Notes:
- No seepage noted.
- Dry at completion.
- Sample SS-1: Sulfate content = 200 ppm.
**TOPSOIL / ROOTMAT - 7 INCHES**

**Probable Fill:** Very-stiff brown with gray SANDY SILT, some clay, trace to little fine to coarse gravel, damp.

**Possible Fill:** Loose brown GRAVEL WITH SAND, SILT, AND CLAY, roots, damp.

Very-stiff brown mottled with gray SILT AND CLAY, some clay, little fine to coarse gravel, damp.

Hard brown SILT AND CLAY, some fine to coarse sand, some fine to coarse gravel, moist.

- No seepage noted.
- Dry at completion.
**Possible Fill:** Very-stiff brown **Silty Clay**, "and" fine to coarse sand, little fine gravel, moist.  
**Very-loose brown and gray Sandy Silt,** some clay, trace fine gravel, moist.  
**Sandstone,** brown highly to severely weathered, very-weak to weak, few gray shale fragments.  
**Interbedded Sandstone (55%) and Shale (45%).** REC = 95%, RQD=18%; Sandstone, gray, moderately weathered, slightly strong to strong, fine-grained, thin to medium bedding, few highly weathered zones, fractured to moderately fractured, few vertical fractures;  
Shale, gray, highly to severely weathered, very-weak to weak, laminated to very-thin bedded, friable, highly fractured, few diagonal to near vertical fractures.  
- From 10.3’-15.7’ Unconfined Compressive Strength = 9,424 psi

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- No seepage noted prior to coring.
### Material Description

#### Asphalt - 7 Inches

- 1020.1
- 1019.4
- Fill: Very-stiff to hard brown sandy silt, some clay, little fine to coarse gravel, contains brick fragments, moist.
- Possible Fill: Very-stiff to hard brown and gray sandy silt, little clay, little fine to coarse gravel, moist.

#### Granular Base - 8 Inches

- 1017.7
- 1014.3
- Very-stiff to hard brown mottled with gray silt and clay, some fine to coarse sand, little fine gravel, moist.

- No seepage noted.
- Dry at completion.
- Sample SS-1: Sulfate Content = 174 ppm.

### SAMPLING METHOD:

- SPT

### Drilling Method:

- 3.25" HSA

### Elevation:

- 1020.7 (MSL)

### DRILLING FIRM / OPERATOR:

- S&ME / C. Brumage

### Sampling Firm / Logger:

- S&ME / D. Godwin

### Sampling Method:

- SPT

### Station / Offset:

- 408+98.5 0' LT

### Exploration ID:

- B-004-0-17

### Drilling Rig:

- S&ME ATV D50

### Hammer:

- CME Automatic

### Calibration Date:

- 9/28/15

### Alignment:

- CR 17 CL

### PID:

- CR 17 CL

### Elev.

- 1020.7

### Elev. Depths

<table>
<thead>
<tr>
<th></th>
<th>1020.7</th>
<th>1019.4</th>
<th>1017.7</th>
<th>1014.3</th>
<th>1013.2</th>
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<tbody>
<tr>
<td>SPT</td>
<td>REC (%)</td>
<td>SAMPLE ID</td>
<td>HP (tsf)</td>
<td>GR</td>
<td>CS</td>
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<tr>
<td>3</td>
<td>4</td>
<td>11</td>
<td>56</td>
<td>SS-1</td>
<td>2.2</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>20</td>
<td>39</td>
<td>SS-2</td>
<td>4.0</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>14</td>
<td>61</td>
<td>SS-3</td>
<td>2.7</td>
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<tr>
<td>6</td>
<td>6</td>
<td>18</td>
<td>78</td>
<td>SS-4A</td>
<td>3.5</td>
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<tr>
<td>7</td>
<td>7</td>
<td>6</td>
<td>89</td>
<td>SS-4B</td>
<td>3.5</td>
</tr>
</tbody>
</table>

### Notes:

- See notes.

### Abandonment Methods, Materials, Quantities:

- Asphalt patch
- Soil cuttings mixed with bentonite

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PRELIMINARY
<table>
<thead>
<tr>
<th>ELEV.</th>
<th>DEPTHS</th>
<th>SPT</th>
<th>REC</th>
<th>HP</th>
<th>GR</th>
<th>FS</th>
<th>SI</th>
<th>CL</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>WC</th>
<th>ODOT CLASS (GI)</th>
</tr>
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<tbody>
<tr>
<td>1020.9</td>
<td>1020.9</td>
<td>5</td>
<td>13</td>
<td>39</td>
<td>SS-1</td>
<td>2.5</td>
<td>4.0</td>
<td></td>
<td>14</td>
<td>23</td>
<td>18</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>1018.4</td>
<td></td>
<td>3</td>
<td>18</td>
<td>78</td>
<td>SS-2</td>
<td>1.0</td>
<td>2.9</td>
<td></td>
<td>11</td>
<td>13</td>
<td>36</td>
<td>28</td>
<td>32</td>
</tr>
<tr>
<td>1016.9</td>
<td></td>
<td>4</td>
<td>14</td>
<td>61</td>
<td>SS-3</td>
<td>3.5</td>
<td>4.2</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

- No seepage noted.
- Dry at completion.
- Sample SS-1: Sulfate Content = 93 ppm.
<table>
<thead>
<tr>
<th>MATERIAL DESCRIPTION AND NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASPHALT - 5 1/2 INCHES</td>
</tr>
<tr>
<td>Fill: Very-stiff brown SANDY SILT, some clay, little fine gravel, damp.</td>
</tr>
<tr>
<td>1028.7 1028.4</td>
</tr>
<tr>
<td>GRANULAR BASE - 3 1/2 INCHES</td>
</tr>
<tr>
<td>Fill: Hard brown SILTY CLAY, some fine to coarse sand, some fine to coarse gravel, damp.</td>
</tr>
<tr>
<td>1024.6</td>
</tr>
<tr>
<td>Very-stiff to hard brown mottled with gray CLAY, some silt, little to some fine to coarse sand, trace fine to coarse gravel, contains iron oxide stains, dam.</td>
</tr>
<tr>
<td>1023.1</td>
</tr>
<tr>
<td>Medium-dense brown and gray GRAVEL WITH SAND, SILT AND CLAY, contains coarse gravel sized sandstone fragments, few iron oxide stains, damp.</td>
</tr>
<tr>
<td>1021.6</td>
</tr>
</tbody>
</table>

- No seepage noted.
- Dry at completion.
- Sample SS-1: Sulfate Content = 249 ppm.
### Subgrade Analysis

**Global Options**

<table>
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<tr>
<th>R</th>
<th>1a</th>
<th>1b</th>
<th>3a</th>
<th>2-4</th>
<th>2-5</th>
<th>2-6</th>
<th>2-7</th>
<th>4a</th>
<th>4b</th>
<th>5</th>
<th>6a</th>
<th>6b</th>
<th>7-5</th>
<th>7-6</th>
<th>8a</th>
<th>8b</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>9%</td>
<td>32%</td>
<td>36%</td>
<td>5%</td>
<td>14%</td>
<td>5%</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
</tr>
</tbody>
</table>

**Classification Counts by Sample**

- **Total Borings:** 5
- **Average Depth:** 17.13
- **Minimum Depth:** 7.25
- **Maximum Depth:** 25.17
- **Rig:** 8a
- **ML:** 105623
- **Location:** FRA-CR17-10.43

**Design CBR:** 12

**Classification Counts by Sample**

<table>
<thead>
<tr>
<th>Depth</th>
<th>2-5</th>
<th>0</th>
<th>&lt;=5</th>
<th>0%</th>
<th>&lt;=10</th>
<th>20%</th>
<th>Ns, N = &lt;=5</th>
<th>0%</th>
<th>&gt;=20</th>
<th>0%</th>
<th>Ns, N = 10-20</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Surface Class**

- **% Borings:** 40%
- **% Surface:** 5%

<table>
<thead>
<tr>
<th>Rig</th>
<th>ER</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>85</td>
</tr>
</tbody>
</table>

**Surface Class**

- **% Borings:** 40%
- **% Surface:** 5%

- **SI:** 0.0
- **M:** 0.0
- **MO:** 0.0
- **GI:** 0.0

**Physical Characteristics**

<table>
<thead>
<tr>
<th>Ns</th>
<th>Ns, N = &lt;=5</th>
<th>0%</th>
<th>Ns, N = 10-20</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Moisture Class**

- **% Borph:** 40%
- **% Surface:** 5%

**Problem**

- **Undercut:** 0.0

**Analysis / Comments**

- **Cut/Fill Depth anticipates a 1.2-foot-thick proposed pavement section.**
REPORT OF SOIL EXPLORATION  Sta. 10+42.7 ft. Rt.

Client  Sticklen-Belsheim & Associates  Boring Number  BL
Project  Morse Rd. over Blacklick Creek  Sheet 1 of 1
Job Number  RTT 82-700  Completion Depth 25 ft.

DRILLING AND SAMPLING INFORMATION

Date Started  8-19-82  Boring Method  CFA
Date Finished  8-19-82  Hammer Weight  140 lbs.
Drilled By  Mason, Sandefur & deVerteuil, Inc.  Hammer Drop  30 in.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Blows Per 6&quot;</th>
<th>Sample Type</th>
<th>Depth Ft.</th>
<th>Soil Description</th>
<th>Moisture Content</th>
<th>Atterberg LL</th>
<th>Atterberg PL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Mix</td>
<td>2.5</td>
<td>Silty Sand + Gravel Black</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>All</td>
<td>5</td>
<td>Damp Sandy Silt w/ Sandstone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>All</td>
<td>9.7</td>
<td>Wet Silty w/ Little Sand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Core</td>
<td>13.0</td>
<td>Sound Concrete</td>
<td></td>
<td>23.0</td>
<td>31.0</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Core</td>
<td>18.7</td>
<td>Bally Broken Sandy Shale</td>
<td>62 + 82</td>
<td>xx</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20.5</td>
<td>Broken Sandstone</td>
<td>62 + 82</td>
<td>xx</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25.0</td>
<td>Shale w/ Thin Sandstone Seams</td>
<td>62 + 82</td>
<td>xx</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lightly Weathered to 18.2' Depth</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SAMPLER TYPE
28-2"OD Split Spoon
35-3"OD Split Spoon
ST-Shelby Tube
RC-Rock Core

GROUND WATER READING
At Completion  11.1  Ft.
After 24 Hrs.  11.1  Ft.

BORING METHOD
HSA—Hollow Stem Augers
CFA—Continuous Flight Augers
MD—Mud Drilling
WD—Wash Drilling
# REPORT OF SOIL EXPLORATION

Sta. 11+12, 7′ Rt.

**Client** Sticklen-Belsheim & Associates  
**Project** Morse Rd. over Blacklick Creek  
**Subsurface Investigation**  
**Job Number** RIT 82-700  
**Boring Number** B2  
**Sheet** 1 of 1  
**Completion Depth** 28 ft. 

**DRILLING AND SAMPLING INFORMATION**

**Date Started** 8-19-82  
**Date Finished** 8-19-82  
**Boring Method** CFA  
**Hammer Weight** 140 lbs.  
**Drilled By** Mason, Sandefur & deVenteuil, Inc.  
**Hammer Drop** 30 in.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Blows Per 8″</th>
<th>Sample Type</th>
<th>Depth FT.</th>
<th>Soil Description</th>
<th>Moisture Content</th>
<th>Atterberg LL</th>
<th>Atterberg PL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ave.</td>
<td>Sample</td>
<td>2.5</td>
<td>FULL W/ A.C. SURFACE BLACK MOIST SILT W/LITTLE SEDIMIENT EDDITION AND SHALE FRAGS.</td>
<td>16.0</td>
<td>23.0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3/4/7</td>
<td>Ave.</td>
<td>5</td>
<td>Silt W/Little Sand</td>
<td>20.0</td>
<td>28.0</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4/5/6</td>
<td>Ave.</td>
<td>10</td>
<td>Silt And Clay And Some Gravel</td>
<td>17.0</td>
<td>31.0</td>
<td>19.0</td>
</tr>
<tr>
<td>4</td>
<td>7/4/5</td>
<td>Ave.</td>
<td>14.3</td>
<td>Silty Clayey Gravel W/ Little Sand</td>
<td>16.0</td>
<td>26.0</td>
<td>22.0</td>
</tr>
<tr>
<td>5</td>
<td>7/4/3</td>
<td>Ave.</td>
<td>19.8</td>
<td>Broken Sandstone W/ Broken Shale</td>
<td>25.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>8/7/4</td>
<td>Ave.</td>
<td>22.0</td>
<td>Badly Broken Shale Gray</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>25</td>
<td>Ave.</td>
<td>23.8</td>
<td>Massive Sandstone Gray</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>30</td>
<td>Ave.</td>
<td>27.0</td>
<td>Broken Shale W/ Thin Sandstone Seams</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GROUND WATER READING**

At Completion 12.6 Ft.  
After 24 Hrs. ——— Ft.

**BORING METHOD**

HSA—Hollow Stem Augers  
CFA—Continuous Flight Augers  
MD—Mud Drilling  
WD—Wash Drilling

**SAMPLER TYPE**

2S—2″ OD Split Spoon  
3S—3″ OD Split Spoon  
ST—Shelby Tube  
RC—Rock Core

**DRILLING WATER**
LOG OF BORING NO. B-2  
MORSE ROAD AREA WATER LINE  
COLUMBUS, OHIO

LOCATION: See Plate 2 (Water Line Sta. 19+50, 74' Rt.)  
ELEVATION: 1024.0  
DATE: 1/18/02

DRILLING METHOD: 4-1/2" O.D. Continuous-flight Auger  
COMPLETION DEPTH: 30.0'

SAMPLER(S): 2" O.D. Split-barrel Sampler

<table>
<thead>
<tr>
<th>DEPTH, FEET</th>
<th>SAMPLE NUMBER</th>
<th>SAMPLE EFFORT</th>
<th>DESCRIPTION</th>
<th>NATURAL CONSISTENCY INDEX</th>
<th>TEST RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 1           | 4/5/6        |               | FILL: Fine to coarse gravel.  
POSSIBLE FILL: Very-stiff to hard brown silty clay,  
"and" fine to coarse sand, trace fine to coarse gravel. | H=4.0-4.5+ |              |
| 2           | 3/3          |               | Very-dense brown fine to coarse gravel, little fine to  
coarse sand, little clayey silt. | H=3.0-4.5+ |              |
| 3           | 50-6"R       |               | Medium-hard brown fine-grained sandstone and  
siltstone. |              |              |
| 4           | 50-1"R       |               | Soft to medium-hard gray shale, nearly horizontally  
bedded. |              |              |
| 5           | 50-4"R       |               |              |              |              |
| 6           | 50-3"R       |               |              |              |              |
| 7           | 50-4"R       |               |              |              |              |
| 35          |               |               |              |              |              |
| WATER LEVEL:  |               |               |              |              |              |
| "Dry"       |               |               |              |              |              |

WATER NOTE:  
DATE: 1/18/02

SYMBOLS USED TO INDICATE TEST RESULTS:
G - GRADATION  
Q - UNCONFINED COMPRESSIBILITY
T - TRIAXIAL COMPRESSIBILITY  
C - CONSOLIDATION  
S - SEEPAGE  
H - PENETROMETER (tsf)  
W - UNIT DRY WEIGHT (pcf)  
D - RELATIVE DENSITY (%)