Resource International, Inc.

# FRA-70-22.85 FAR EAST FREEWAY
# ROADWAY IMPROVEMENTS
# PID NO. 98232
# FRANKLIN COUNTY, OHIO

# DRAFT ROADWAY EXPLORATION REPORT

***Prepared For:***
**EMH&T**
**5500 New Albany Road**
**Columbus, OH 43054**

***Prepared By:***
**Resource International, Inc.**
**6350 Presidential Gateway**
**Columbus, OH 43231**

**Rii Project No. W-17-140**

**February 2023**

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April 8, 2022 (Revised February 7, 2023)

Mr. Steve Beal, P.E.
Senior Transportation Engineer
EMH&T
5500 New Albany Road
Columbus, Ohio 43054

**Re: Draft Roadway Exploration Report**
**FRA-70-22.85 Far East Freeway**
**Roadway Improvements**
**PID 98232**
**Franklin County, Ohio**
**Rii Project No. W-17-140 (Rev. 3)**

Mr. Beal:

Resource International, Inc. (Rii) is pleased to submit this revised Draft Roadway Exploration Report for the above referenced project. Engineering logs have been prepared and are attached to this report along with the results of laboratory testing. This report includes recommendations for the design and construction of the proposed subgrade improvements along Brice Road, Interstate Route 70 (I-70) westbound, and construction of a new collector distributor road to carry traffic from I-70 to Interstate Route 270 (I-270), as part of the FRA-70-22.85 project within the City of Columbus, in Franklin County, Ohio. In addition to the proposed subgrade exploration, this report covers the structure foundation exploration for five (5) proposed culverts along with the noise walls as part of the overall FRA-70-22.85. This revised report supersedes all previous submittals.

We sincerely appreciate the opportunity to be of continued service to you on this project. If you have any questions regarding the structure foundation exploration, or this report, please do not hesitate to contact us.

Sincerely,

**RESOURCE INTERNATIONAL, INC.**

Daniel E. Karch, P.E.
Project Manager

Jonathan P. Sterenberg, P.E.
Vice President – Geotechnical Services

Enclosure: DRAFT Roadway Exploration Report

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## APPENDICES

## EXECUTIVE SUMMARY

This report is a presentation of the subgrade exploration performed for the proposed improvements to Brice Road, along the westbound lanes of I-70, and construction of the proposed west bound collector distributor (WB-CD) road for I-70 westbound to I-270. It is understood that the proposed subgrade improvements along Brice Road consist of overlay from approximately Station 1+80 to Station 42+90, and that the construction of the proposed I-70 WB-CD road extends from approximately station 1540+00 to 1618+00. As part of the improvements along Brice Road, it is understood that widening is proposed for the majority of the alignment, and, therefore, sidehill embankment fill will be replaced that will require special benching.

In addition to the proposed subgrade exploration, this report covers the structure foundation exploration for five (5) proposed culverts, including a box culvert extension along I-70, culvert extension on the east and west side of Brice Road, north of I-70, a culvert realignment at the intersection of Brice Road and Tussing Road, south of I-70, a twin box culvert extension underneath I-70 and a box culvert underneath Chatford Drive. This report also includes drilled shaft foundation recommendations for the noise walls.

### Exploration and Findings

Between July 10 and October 30, 2020, a total of 75 borings were performed for the proposed roadway improvements, culvert structures and noise barriers. Additionally, a total of nine (9) pavement cores were performed for the project along I-70 westbound. An additional investigation was performed between November 18 and 31, 2021 consisting of five (5) soil borings, along with two (2) Wildcat dynamic cone penetrometer (DCP) tests along the midslope of the east embankment of Brice Road, south of I-70.

All borings except B-039-0-19, B-049-0-19, B-053-0-19, B-055-0-19, B-059-0-19 and B-060-0-19, encountered topsoil thicknesses between 2 inches and 10 inches. The remaining borings, noted above, encountered asphalt over aggregate base or concrete. Borings performed within the existing pavement encountered between 6 and 12 inches of asphalt overlying 4 inches to 10 inches of aggregate base, with the exception of boring B-055-0-19, which encountered 12 inches of concrete beneath the asphalt.

Below surface material, materials identified as existing fill was encountered in 19 of the borings at depths ranging from 1.5 feet to 15.5 feet below existing grade. In general, the fill was described as clay, silty clay, silt and clay, sandy silt, gravel with sand and silt and gravel with sand, silt and clay, and gravel with sand (ODOT A-7-6, A-6b, A-6a, A-4a, A-2-4, A-2-6, and A-1-b), and contained construction debris consisting of asphalt, concrete, rock fragments and other debris consisting of wood fibers and other organic material.

Underlying the surficial and existing fill materials, the natural soils were encountered, consisting of both cohesive and granular deposits. The natural cohesive soils were described as clay, silty clay, silt and clay, sandy silt and silt (ODOT A-7-6, A-6-b, A-6a, A-4a, and A-4b). The granular soils were described as sand and gravel, gravel with sand and silt, gravel with sand and silt and clay (ODOT A-1-a, A-1-b, A-2-4, and A-2-6).

Bedrock was encountered in borings B-009-0-19 and B-010-0-19 at a depth of 21.0 feet beneath the existing ground surface, or approximately elevation 758.8 and 757.8 feet msl, respectively. The bedrock was described as slightly to highly weathered black shale. Bedrock was not encountered in any of the remaining borings included with this roadway exploration report.

Groundwater seepage was encountered in 20 of the borings at depths ranging from 4.0 to 19.7 feet below the ground surface. More significant groundwater flow was encountered during drilling (initial water level) in 34 of the borings at depths ranging from 5.6 to 24.5 feet below the existing ground surface. Measurable groundwater was observed at the completion of drilling in 24 of the borings at depths ranging from 3.5 to 20.0 feet below existing grade.

## Analyses and Recommendations

Based on the results of the GB-1 analysis, the following subgrade stabilization and corresponding project limits presented in the following table are recommended.

**Spot Stabilization Recommendations**

| Alignment | Start | End | Recommended Subgrade Stabilization |
|---|---|---|---|
| IR-70 WB-CD Rd. | Sta. 1572+50 | Sta. 1576+00 | 12” Item 204 Excavate and Replace |
| Brice Rd. | Sta. 1+80 | Sta. 3+50 | 12” Item 204 Excavate and Replace |
| | Sta. 5+00 | Sta. 7+00 | 18” Item 204 Excavate and Replace |
| Chatford Dr. | Sta 62+97.32 | Sta. 65+00 | 14” Item 204 Excavate and Replace |

Based on the conditions encountered across the subject site, it is recommended that pavement design be based on a design CBR value of 6 for IR-70 WB-CD, a design CBR value of 7 for Brice Road, and a design CBR value of 6 for Chatford Drive.

Recommendations are provided herein for general embankment and subgrade preparation, including recommendations for special benching for the proposed roadway widening along Brice Road.

Shallow foundation recommendations are provided for the proposed culvert foundations based on the conditions encountered in the borings performed for each culvert extension. The following tables present a summary of the bearing resistance values provided.

**Culvert Headwall – IR-70 – Station 606+42.82**

| Effective Footing Width (feet) | Service Limit Bearing Pressure (ksf) | | | Bearing Resistance at Strength Limit (ksf) | |
|---|---|---|---|---|---|
| | 0.5 inch | 1.0 inch | 1.5 inch | Nominal | Factored |
| 6 | 1.3 | 4.3 | 6.0 | 11.9 | 6.5 |

**Culvert Headwall – Brice Road – Station 38+50.29**

| Effective Footing Width (feet) | Service Limit Bearing Pressure (ksf) | | | Bearing Resistance at Strength Limit (ksf) | |
|---|---|---|---|---|---|
| | 0.5 inch | 1.0 inch | 1.5 inch | Nominal | Factored |
| **6** | 1.0 | 4.0 | 5.5 | 11.8 | 6.5 |

**Culvert Headwall – Tussing Road**

| Effective Footing Width (feet) | Service Limit Bearing Pressure (ksf) | | | Bearing Resistance at Strength Limit (ksf) | |
|---|---|---|---|---|---|
| | 0.5 inch | 1.0 inch | 1.5 inch | Nominal | Factored |
| 8 | 0.4 | 1.3 | 2.7 | 11.7 | 6.4 |

**Culvert Wingwall – Chatford Drive – Station 64+75**

| Effective Footing Width (feet) | Service Limit Bearing Pressure (ksf) | | | Bearing Resistance at Strength Limit (ksf) | |
|---|---|---|---|---|---|
| | 0.5 inch | 1.0 inch | 1.5 inch | Nominal | Factored |
| 6 | 0.1 | 3.5 | 5.1 | 16.3 | 8.9 |

**Culvert Headwall/Wingwall – I-70 – Station 578+55.47**

| Effective Footing Width (feet) | Service Limit Bearing Pressure (ksf) | | | Bearing Resistance at Strength Limit (ksf) | |
|---|---|---|---|---|---|
| | 0.5 inch | 1.0 inch | 1.5 inch | Nominal | Factored |
| 6 | 0.7 | 1.7 | 3.7 | 16.1 | 8.8 |

The required shaft embedment for the proposed Noise Barriers 1, 2 ad 4 was determined in accordance with Section 802.1.2 of the ODOT Bridge Design Manual (BDM). In general, the analysis indicates that 2.5-foot diameter drilled shafts excavated to depths ranging from 7.5 to 15 feet for Noise Barrier 1, from 9.0 to 15.0 for Noise Barrier 2, and from 10.5 to 22 feet for Noise Barrier 4 will be required for the support of the noise wall. The following tables detail the required minimum drilled shaft depth for each panel along each of the proposed noise barrier wall alignment.

**Noise Barrier 1 Foundation Depth Requirements**

| From Panel | To Panel | Length (feet) | Representative Boring | Post Spacing (feet) | Barrier Height (feet) | Transverse Ground Slope | Proposed Shaft Depth (feet) |
|---|---|---|---|---|---|---|---|
| 1 | 3 | 24 | B-004-0-19 | 8 | 13-14 | Level | 7.5 |
| 4 | 8 | 120 | B-004-0-19 | 24 | 15-16 | Level | 9.0 |
| 9 | 17 | 216 | B-003-0-19 | 24 | 16 | Level | 9.0 |
| 18 | 25 | 192 | B-002-0-19 | 24 | 16 | Level | 9.0 |
| 26 | 33 | 192 | B-001-7-19 | 24 | 16 | Level | 9.0 |
| 34 | 42 | 216 | B-001-6-19 | 24 | 16 | Level | 9.0 |
| 43 | 50 | 192 | B-001-5-19 | 24 | 16 | Level | 9.0 |
| 51 | 58 | 192 | B-001-4-19 | 24 | 16 | Level | 9.0 |
| 59 | 67 | 216 | B-001-3-19 | 24 | 16 | Level | 9.0 |
| 68 | 75 | 192 | B-001-2-19 | 24 | 16-17 | Level | 13.0 |
| 76 | 78 | 72 | B-001-1-19 | 24 | 16-17 | 3:1 | 15.0 |
| 79 | 87 | 128 | B-001-1-19 | 16 | 16-20 | 3:1 | 15.0 |
| 88 | 91 | 24 | B-001-1-19 | 8 | 19-20 | 2:1 | 10.0 |

## Noise Barrier 2 Foundation Depth Requirements

| From Panel | To Panel | Length (feet) | Representative Boring | Post Spacing (feet) | Barrier Height (feet) | Transverse Ground Slope | Proposed Shaft Depth (feet) |
|---|---|---|---|---|---|---|---|
| 1 | 8 | 192 | B-010-0-19 | 24 | 15-16 | 5:1 | 11.0 |
| 9 | 9 | 12 | B-010-0-19 | 12 | 15 | 5:1 | 11.0 |
| 10 | 10 | 24 | B-010-0-19 | 24 | 15 | 5:1 | 11.0 |
| 11 | 13 | 72 | B-011-0-19 | 24 | 15-16 | 5:1 | 9.0 |
| 14 | 15 | 28 | B-011-0-19 | 14 | 15 | 5:1 | 9.0 |
| 16 | 18 | 72 | B-011-0-19 | 24 | 16 | 5:1 | 9.0 |
| 18 | 20 | 72 | B-011-0-19 | 24 | 15 | 5:1 | 9.0 |
| 21 | 28 | 312 | B-013-0-19 | 24 | 15-17 | 3:1 | 12.5 |
| 29 | 29 | 12 | B-013-0-19 | 12 | 15 | 3:1 | 12.5 |
| 30 | 30 | 24 | B-014-0-19 | 24 | 17 | 2:1 | 10.0 |
| 31 | 31 | 12 | B-014-0-19 | 12 | 15 | 2:1 | 10.0 |
| 32 | 33 | 24 | B-014-0-19 | 24 | 15 | 2:1 | 10.0 |
| 34 | 34 | 12 | B-014-0-19 | 12 | 15 | 2:1 | 10.0 |
| 35 | 35 | 24 | B-014-0-19 | 24 | 15 | 2:1 | 10.0 |
| 36 | 36 | 12 | B-014-0-19 | 12 | 15 | 2:1 | 10.0 |
| 37 | 38 | 48 | B-014-0-19 | 24 | 15 | 2:1 | 10.0 |
| 39 | 46 | 192 | B-016-0-19 | 24 | 15 | 3:1 | 9.5 |
| 47 | 54 | 192 | B-018-0-19 | 24 | 15 | 3:1 | 9.5 |
| 55 | 62 | 192 | B-020-0-19 | 24 | 15 | 2:1 | 16.0 |
| 63 | 71 | 216 | B-021-0-19 | 24 | 15 | 2:1 | 10.0 |
| 72 | 79 | 192 | B-022-0-19 | 24 | 15 | 2:1 | 14.0 |
| 80 | 86 | 168 | B-024-0-19 | 24 | 15 | 2:1 | 14.0 |
| 87 | 87 | 16 | B-025-0-19 | 24 | 15 | 2:1 | 14.0 |
| 88 | 96 | 192 | B-025-0-19 | 24 | 15 | 2:1 | 14.0 |

**Noise Barrier 4 Foundation Depth Requirements**

| From Panel | To Panel | Length (feet) | Representative Boring | Post Spacing (feet) | Barrier Height (feet) | Transverse Ground Slope | Proposed Shaft Depth (feet) |
|---|---|---|---|---|---|---|---|
| 1 | 5 | 120 | B-095-0-19 | 24 | 15 | 3:1 | 15.0 |
| 6 | 13 | 192 | B-096-0-19 | 24 | 15 | 3:1 | 22.0 |
| 14 | 21 | 192 | B-098-0-19 | 24 | 15-16 | 3:1 | 15.0 |
| 22 | 28 | 144 | B-099-0-19 | 24 | 15-16 | 3:1 | 15.0 |
| 29 | 29 | 12 | B-099-0-19 | 12 | 15 | 3:1 | 10.5 |
| 30 | 32 | 24 | B-099-0-19 | 8 | 17-18 | 3:1 | 10.5 |
| 33 | 33 | 12 | B-099-0-19 | 12 | 19 | 3:1 | 10.5 |

Please note that this executive summary does not contain all the information presented in the report. The unabridged subsurface exploration report should be read in its entirety to obtain a more complete understanding of the information presented.

## 1.0 INTRODUCTION

The overall purpose of this project is to provide detailed subsurface information and recommendations for the Phase 2 and 3 of the FRA-70-022.85 project. The project's proposed improvements include the reconfiguration of the north half of the Brice Road interchange and westbound ramps to the Interstate 270 (I-270) interchange, replacement of the Brice Road Bridge over Interstate 70 (I-70), a proposed bridge over a new collector-distributer road (IR-70 CD-WB), three (3) noise barriers, twelve (12) retaining walls, and five (5) culvert extensions.

This report is a presentation of the subgrade exploration performed for the proposed improvements to Brice Road, along the westbound lanes of I-70, and construction of the proposed west bound collector distributor (WB-CD) road for I-70 westbound to I-270. It is understood that the proposed subgrade improvements along Brice Road consist of overlay from approximately Station 1+80 to Station 42+90, and that the construction of the proposed I-70 WB-CD road extends from approximately station 1540+00 to 1618+00. As part of the improvements along Brice Road, it is understood that widening is proposed for the majority of the alignment, and, therefore, sidehill embankment fill will be replaced that will require special benching.

This report also contains preliminary recommendations for the proposed realignment and improvements along Chatford Drive. It is understood that the profile of Chatford Drive will be raised by approximately 3 feet at Station 64+75 to accommodate a proposed box culvert.

In addition to the proposed subgrade exploration, this report covers the structure foundation exploration for five (5) proposed culverts, including a box culvert extension along I-70, culvert extension on the east and west side of Brice Road, north of I-70, a culvert realignment at the intersection of Brice Road and Tussing Road, south of I-70, a twin box culvert extension underneath I-70 and a box culvert underneath Chatford Drive. This report also includes drilled shaft foundation recommendations for the noise walls.

The exploration was performed within general accordance of the Ohio Department of Transportation's (ODOT) Specifications for Geotechnical Explorations (SGE), dated July 2020. The project site and general location of the proposed retaining walls are as shown on the vicinity map and boring plan presented in Appendix I.

## 2.0 RECONNAISSANCE AND PLANNING

### 2.1 Site Geology

Physiographically, the site lies within the Columbus Lowland District of the Southern Ohio Loamy Till Plain Region. This region is characterized by relatively flat-lying silty loam till ground moraine, interspersed with end and recessional moraines, outwash and alluvial deposits. Ground moraines are deposited during the retreat of a glacier, resulting in an

undifferentiated mixture of clay, silt, sand and gravel. End moraines are normally associated with ice melting that is neither advancing nor retreating for a period of time. Recessional moraines are deposited when the ice sheet is retreating. Both end and recessional moraines are commonly associated with boulder belts. Outwash deposits consist of undifferentiated sand and gravel deposited by meltwater in front of glacial ice, and often occurs as valley terraces or low plains. Alluvium and alluvial terrace deposits range from silty clay to cobble sized deposits, usually deposited in present and former floodplain areas, such as the Big Walnut Creek and its tributaries.

Based on the Bedrock Geology and Bedrock Topography maps of the Columbus area, obtained from Ohio Department of Natural Resources (ODNR), the bedrock at the proposed project site consists of the Upper Devonian-aged Ohio Shale Formation. The Ohio Shale Formation is further subdivided into three primary members, in descending order: the Cleveland, Chagrin, and Huron Members. The Cleveland Member consists of black shale and is thickest in the north-central portion of the state but thins out to the south and east. The Huron Member consists of gray to greenish gray interbedded shale, siltstone, and very fine-grained sandstone, and is thickest in the northeastern portion of the state, thinning out to the southwest. The Chagrin Member grades into the overlying and underlying members and consists of black, carbonaceous shale. The entire Ohio Shale formation ranges from 250 to over 500 feet thick, with generally laminated to thin bedding and fissile partings, and is characterized by such features as having a petroliferous odor and carbonate/siderite concretions.

According to bedrock topography mapping from ODNR, the top of bedrock forms a ridge to the north of the site, generally lying just outside of the I-270 loop, and roughly underlying the cities of Gahanna and Reynoldsburg. The bedrock surface forms a narrow plateau that extends southwest from the south end of this ridge, which projects beneath the I-270 and I-70 interchange. The bedrock surface slopes down to the northwest and to the southeast from this plateau near the interchange, then generally slopes downward to the south and southeast. The bedrock near the interchange and northward along I-270 and eastward along I-70, lies at an approximate elevation of 750 feet mean sea level (msl), or approximately 27 to 33 feet below the ground surface. The bedrock surface gets only slightly deeper moving northward and approximately 50 feet deeper eastward from the interchange near the Brice Road overpass over I-70. The bedrock surface slopes upward moving northward along Brice Road from the Brice Road overpass over I-70.

## 2.2 Observations of the Project

The site of the proposed FRA-70-22.85 project is located along the east side of Columbus, in Franklin County, Ohio, with the project limits stretching from the east side approximately 1,400 feet east of the existing I-70 exit ramp to Brice Road, westward along I-70 to the I-270 northbound ramp. On the north side, the project extends along Brice Road to the first intersection north of the bridge, and on the south side, the project extends along Brice Road to the intersection of Chantry Drive and Brice Road. Land use surrounding the majority of the project vicinity is predominantly commercial and residential units.

## 3.0 EXPLORATION

A total of 75 borings were performed for the proposed roadway improvements, culvert structures and noise barriers as part of the overall FRA-70-22.85 project. The borings were performed between the dates of July and October 30, 2020. An additional investigation was performed between November 18 and 31, 2021, consisting of five (5) soil borings, along with two (2) Wildcat dynamic cone penetrometer (DCP) tests along the midslope of the east embankment of Brice Road, south of I-70. A schedule of the borings performed is provided in Appendix II. The roadway borings were advanced to depths ranging between 6 and 10 below the existing ground surface. The remaining borings performed for the roadway embankment, culverts and noise barriers were advanced to depths ranging from 25 to 40 feet. It should be noted that borings B-005-0-19 through B-008-0-19 were eliminated due to the removal of the portion of Noise Wall 2 in the area of these borings.

Boring locations were determined and field located by Rii personnel prior to drilling operations. Coordinates and ground surface elevations of the as drilled boring locations were provided by the EMH&T survey team. Isolated borings were not able to be surveyed due to the period between final survey and completion of drilling; therefore, approximate information from the handheld GPS locations are provided on the individual boring logs.

In addition to the borings performed, a total of nine (9) pavement cores were performed along I-70 and Brice Road. A summary of the locations of the pavement cores is presented in Table 1 below.

**Table 1. Summary of FRA-70-22.85 Pavement Cores**

| Pavement Core | Alignment | Station | Offset | | Latitude [1] | Longitude [1] | Ground Elevation (feet) [1] |
|---|---|---|---|---|---|---|---|
| X-017-0-19 | I-70 | 548+64 | 30.3 | LT | 39.9336471 | -82.8444080 | 784.8 |
| X-027-0-19 | I-70 | 562+00 | 17.4 | LT | 39.9333469 | -82.8396627 | 793.2 |
| X-035-0-19 | I-70 | 573+02 | 35.1 | LT | 39.9331766 | -82.8357381 | 794.1 |
| X-052-0-19 | Brice Road | 8+08 | 35.2 | LT | 39.9265351 | -82.8314636 | 785.9 |
| X-056-0-19 | Brice Road | 14+27 | 14.0 | RT | 39.9282213 | -82.8311316 | 786.0 |
| X-058-0-19 | Brice Road | 19+50 | 48.6 | LT | 39.9296647 | -82.8312206 | 797.8 |
| X-064-0-19 | Brice Road | 27+67 | 16.7 | LT | 39.9318958 | -82.8308982 | 819.2 |
| X-082-0-19 | Brice Road | 37+29 | 30.5 | LT | 39.9345323 | -82.8307015 | 813.6 |
| X-093-0-19 [2] | I-70 | 597+31 | 41.6 | LT | 39.9329097 | -82.8264189 | 806.0 |

1. *Ground surface elevations and coordinates were provided by EMH&T survey.*
2. *Pavement core location was not able to be surveyed. Coordinates and elevation are approximate based on handheld GPS.*

The borings performed were drilled with either an all-terrain vehicle (ATV) or truck-mounted rotary drilling machine, utilizing 3.25-inch inside diameter hollow-stem augers to advance the holes between sampling attempts. Standard penetration testing (SPT) and split spoon sampling were performed continuously and 2.5-foot intervals to a depth of 25 feet below the existing ground surface and at 5.0-foot intervals thereafter to the boring completion depths.

The SPT, per the American Society for Testing and Materials (ASTM) designation D1586, is conducted using a 140-pound hammer falling 30.0 inches to drive a 2.0-inch outside diameter split spoon sampler 18.0 inches. Driving resistance is recorded on the boring logs in terms of blows per 6-inch interval of the driving distance. The second and third intervals are added to obtain the number of blows per foot (N). Standard penetration blow counts aid in determining soil properties applicable in foundation system design. Measured blow count ($N_m$) values are corrected to an equivalent (60%) energy ratio, $N_{60}$, by the following equation. Both values are represented on boring logs presented in Appendix IV.

$$N_{60} = N_m*(ER/60)$$

Where:
$N_m$ = measured N value
ER = drill rod energy ratio, expressed as a percent, for the system used

The hammers for the CME-55, Mobile B53 and CME-750X drill rigs operated by Rii on this project were calibrated on September 4, 2018 and have drill rod energy ratios of 91.2, 80.7, and 79.5 percent, respectively. Borings performed on or after August 31,2020 were performed based on rig calibrations performed on August 31, 2020, and have drill rod energy ratios of 84.2, 83.6 and 86.2 percent for the CME-55, Mobile B53, and the CME-750X, respectively.

Hand penetrometer readings, which provide a rough estimate of the unconfined compression strength (UCS) of the soil, were reported on the boring logs in units of tons per square foot (tsf) and were utilized to classify the consistency of the cohesive soil in each layer. An indirect estimate of the unconfined compressive strength of the cohesive split spoon samples can also be made from a correlation with the blow counts ($N_{60}$). Please note that split spoon samples are considered to be disturbed and the laboratory determination of their shear strengths may vary from undisturbed conditions.

The Wildcat DCP test is a lift and drop that allows for the calibration of blow counts to that of equivalent SPT $N_{60}$ values. The Wildcat uses a 35-pound hammer raised to a height of 15 inches to drive a 2.75-centimeter diameter rod and 3.59-centimeter diameter point into the ground. Blow counts are logged every 10 centimeters and correlations are made to equivalent $N_{60}$ values. The tip resistance and equivalent $N_{60}$ values are used to infer the consistency of cohesive and granular soils within the strata.

Upon completion of field work, the borings were backfilled with bentonite chips and soil cuttings. Where borings penetrated the existing pavement, an equivalent thickness of cold patch asphalt was used to repair the pavement surface.

During drilling, field personnel prepared field logs showing the encountered subsurface conditions. Soil samples obtained from the drilling operation were preserved and sealed in glass jars and delivered to the soil laboratory. In the laboratory, the recovered soil and rock samples were visually classified, and select samples from the borings performed for the subject structures were tested, as noted in Table 2.

**Table 2. Laboratory Test Schedule**

| Laboratory Test | Test Designation | Number of Tests Performed |
|---|---|---|
| Natural Moisture Content | ASTM D 2216 | 617 |
| Plastic and Liquid Limits | AASHTO T89, T90 | 150 |
| Gradation – Sieve/Hydrometer | AASHTO T88 | 154 |
| Sulfate Content | ODOT Supplement 1122 | 27 |

The tests performed are necessary to classify existing soil according to the ODOT classification system and to estimate engineering properties of importance in determining foundation design and construction recommendations. Results of the laboratory testing are presented on the individual boring logs in Appendix IV. A description of the soil and rock terms used throughout this report is presented in Appendix III.

## 4.0 FINDINGS

Interpreted engineering logs have been prepared based on the field logs, visual examination of samples and laboratory test results. Classification follows the respective version of the ODOT Specifications for Geotechnical Explorations (SGE) at the time the exploration borings were performed. The following is a summary of what was found in the test borings and what is represented on the boring logs.

### 4.1 Surface Materials

The borings were generally performed in the vicinity of the proposed roadway alignment. All borings except B-039-0-19, B-049-0-19, B-053-0-19, B-055-0-19, B-059-0-19 and B-060-0-19, encountered topsoil thicknesses between 2 inches and 10 inches. The remaining borings, noted above, encountered asphalt over aggregate base or concrete. Borings performed within the existing pavement encountered between 6 and 12 inches of asphalt overlying 4 inches to 10 inches of aggregate base, with the exception of boring B-055-0-19, which encountered 12 inches of concrete beneath the asphalt.

Findings of the pavement cores performed are summarized in Table 3 below. Details of the surface findings are provided on the individual boring logs in Appendix III and pavement core data sheets in Appendix V.

**Table 3. Pavement Core Data**

| Core ID | Asphalt Thickness by Composition | | | Total Asphalt Thickness (in) | Concrete Thickness (in) | Aggregate Base Thickness (in) |
|---|---|---|---|---|---|---|
| | Surface (in) | Intermediate (in) | Base (in) | | | |
| X-017-0-19 | 5.00 | 13.00 | -- | 18.00 | -- | 6.50 |
| X-027-0-19 | 2.50 | 16.75 | -- | 19.25 | -- | 7.00 |
| X-035-0-19 | 3.50 | 8.00 | 6.00 | 17.50 | -- | 7.00 |
| X-052-0-19 | 7.75 | 3.00 | -- | 10.75 | -- | -- |
| X-056-0-19 | 3.00 | 9.75 | -- | 12.75 | -- | -- |
| X-058-0-19 | 1.00 | 8.50 | -- | 9.50 | -- | 4.00 |
| X-064-0-19 | 4.00 | 2.50 | 5.25 | 11.75 | -- | 5.00 |
| X-082-0-19 | 5.50 | -- | 3.50 | 9.00 | 3.00 | 5.00 |
| X-093-0-19 | 4.25 | 13.75 | -- | 18.00 | -- | 6.00 |

## 4.2 Subsurface Soils

Below surface material, materials identified as existing fill was encountered in 19 of the borings at depths ranging from 1.5 feet to 15.5 feet below existing grade. In general, the fill was described as clay, silty clay, silt and clay, sandy silt, gravel with sand and silt and gravel with sand, silt and clay, and gravel with sand (ODOT A-7-6, A-6b, A-6a, A-4a, A-2-4, A-2-6, and A-1-b), and contained construction debris consisting of asphalt, concrete, rock fragments and other debris consisting of wood fibers and other organic material.

Underlying the surficial and existing fill materials, the natural soils were encountered, consisting of both cohesive and granular deposits. The natural cohesive soils were described as clay, silty clay, silt and clay, sandy silt and silt (ODOT A-7-6, A-6-b, A-6a, A-4a, and A-4b). The granular soils were described as sand and gravel, gravel with sand and silt, gravel with sand and silt and clay (ODOT A-1-a, A-1-b, A-2-4, and A-2-6).

The shear strength and consistency of the cohesive soils are primarily derived from the hand penetrometer values (HP). The cohesive soils encountered ranged from medium stiff ($0.5 < HP \leq 1.0$ tsf) to hard ($HP > 4.0$ tsf). The unconfined compressive strength of the cohesive soil samples tested, obtained from the hand penetrometer, ranged from 0.5 to over 4.5 tsf (limit of instrument). The relative density of granular soils is primarily derived from SPT blow counts ($N_{60}$). Based on the SPT blow counts obtained, the granular soils

encountered ranged from loose ($5 < N_{60} \leq 10$ blows per foot [bpf]) to very dense ($N_{60} > 50$ bpf). Blow counts recorded from the SPT sampling within the granular soil deposits ranged from 7 to 66 bpf.

Natural moisture contents of the soil samples tested ranged from 3 to 32 percent. The natural moisture contents of the cohesive soil samples tested for plasticity ranged from 14 percent below to 11 percent above their corresponding plastic limits. In general, the soil exhibited natural moisture contents considered to be significantly below to moderately above optimum moisture levels.

### 4.3 Bedrock

Bedrock was encountered in borings B-009-0-19 and B-010-0-19 at a depth of 21.0 feet beneath the existing ground surface, or approximately elevation 758.8 and 757.8 feet msl, respectively. The bedrock was described as slightly to highly weathered black shale.

Bedrock was not encountered in any of the remaining borings included with this roadway exploration report. However, shale fragments were encountered in various borings across the overall project site.

### 4.4 Groundwater

Groundwater seepage was encountered in 20 of the borings at depths ranging from 4.0 to 19.7 feet below the ground surface. More significant groundwater flow was encountered during drilling (initial water level) in 34 of the borings at depths ranging from 5.6 to 24.5 feet below the existing ground surface. Measurable groundwater was observed at the completion of drilling in 24 of the borings at depths ranging from 3.5 to 20.0 feet below existing grade.

Please note that short-term water level readings, especially in cohesive soils, are not necessarily an accurate indication of the actual groundwater level. In addition, groundwater levels or the presence of groundwater are considered to be dependent on seasonal fluctuations in precipitation.

A more comprehensive description of what was encountered during the drilling process may be found on the individual boring logs in Appendix IV.

## 5.0 ANALYSES AND RECOMMENDATIONS

Data obtained from the drilling and testing program have been used to determine the shear strength parameters for the soil encountered at the site. These parameters have been used to provide recommendations for the design of the proposed roadway improvements and culvert structures and general earthwork recommendations, which are discussed in the following paragraphs.

Design details of the proposed roadway improvements were provided by EMH&T. It is understood that the proposed roadway improvements include Brice Road overlay from approximately Station 1+80 to Station 42+90 and construction of the proposed I-70 WB-CD road extends from approximately station 1540+00 to 1618+00. Additionally, it is understood that the proposed improvements will include widening of Brice Road for construction of a shared use path and to accommodate the proposed bridge structure widening and interchange reconstruction.

Based on information provided by the Rii design team, it is understood that five (5) culvert improvements are proposed as part of this project, including a box culvert extension along I-70, culvert extension on the east and west side of Brice Road, north of I-70, and a culvert realignment at the intersection of Brice Road and Tussing Road, south of I-70, a twin box culvert extension underneath I-70 and a box culvert underneath Chatford Drive. This report also includes drilled shaft foundation recommendations for the noise walls.

### 5.1 General Embankment and Subgrade Preparation

Embankment construction and subgrade preparation should be performed in accordance with the ODOT CMS Items 203 and 204. Prior to embankment construction or subgrade preparation, perform clearing and grubbing, in accordance with Item 201 and remove existing pavement and base materials, as well as other structures or obstructions, as necessary, in accordance with Item 202. The site should be stripped of any topsoil, organics, or other deleterious, or unsuitable materials within the footprint of the proposed embankment and subgrade. It is anticipated that areas within the ditch lines of I-70 and Brice Road, as well as near the toe of the existing embankments will have greater topsoil thicknesses than encountered in the borings.

Material to be utilized as borrow should be restricted to conform to Item 203 for embankment and Item 204 for subgrade. All embankment material should be spread and compacted in accordance with Item 204. Frozen material should not be incorporated into any new fill or built upon with new fill or pavement materials.

### 5.2 Pavement Subgrade Recommendations

The subgrade soils along the alignment, within the project corridor, are anticipated to consist of predominantly cohesive materials comprised of medium stiff to hard clay, silty

clay, silt and clay, and sandy silt (ODOT A-7-6, A-6b, A-6a, A-4a). Based on the soil conditions encountered during the drilling phase, it is estimated that the subgrade soils within the upper portions of the proposed subgrade will require some level of stabilization under ODOT GB1.

Based on information provided by EMH&T, it is understood that the proposed cut and fill along the alignment of Brice Road varies between approximately 2 feet of cut to approximately 6 feet of fill, with the exception of the vicinity of the proposed CD road culvert under Brice Road and in the vicinity of Ramps M and N of the overall project, where significantly more cut is anticipated. It is also understood that the proposed cut and fill along the alignment of Brice Road varies between approximately 2.5 feet of cut to approximately 4 feet of fill. Furthermore, it is understood that the proposed improvements within the existing pavement limits of I-70 consist of a pavement overlay with negligible cut or fill.

Finally, it is understood that approximately 3 feet of fill is planned along Chatford Drive to accommodate the proposed box culvert. The subgrade recommendations for Chatford Drive should be considered **preliminary** pending the results of any necessary additional borings, as the borings in this area were intended to evaluate the subsurface conditions of the proposed box culvert and CIP Walls 2A and 2B. Also, no borings were performed along the northern end of the proposed improvements to Chatford Drive, which is approximately a length of 230 feet.

### *5.2.1 Subgrade Stabilization*

Based on the ODOT GB1 guidelines, when approximately 30 percent or more of the subgrade area requires stabilization, consideration should be given to utilizing a global stabilization option. For this project, approximately 20 percent of the subgrade area is anticipated to require stabilization based on the soil borings performed for the Brice Road alignment and proposed I-70 WB-CD road alignment. Therefore, global stabilization is not considered to be warranted for either the proposed Brice Road or the I-70 WB-CD alignments. However, approximately 33 percent of the subgrade area in the area of Chatford Drive is anticipated to require stabilization. Therefore, global stabilization should be considered for the proposed alignment of Chatford Drive. The overall average site parameters are presented in Table 4 below.

**Table 4. Average Site Parameters**

| Alignment | Average $N_{60L}$ | Average PI | Average Moisture | Average Optimum Moisture | Average Group Index | Average CBR |
|---|---|---|---|---|---|---|
| I-70 WB-CD Rd. | 12 | 16 | 16 | 14 | 9 | 6 |
| Brice Rd. | 14 | 14 | 15 | 14 | 8 | 7 |
| Chatford Dr. | 7 | 15 | 19 | 13 | 11 | 6 |

Based on the results of the GB-1 analysis, the following subgrade stabilization and corresponding project limits presented in Table 5 below are recommended.

**Table 5. Spot Stabilization Recommendations**

| Alignment | Start | End | Recommended Subgrade Stabilization |
|---|---|---|---|
| I-70 WB-CD Rd. | Sta. 1572+50 | Sta. 1576+00 | 12" Item 204 Excavate and Replace |
| Brice Rd. | Sta. 1+80 | Sta. 3+50 | 12" Item 204 Excavate and Replace |
| | Sta. 5+00 | Sta. 7+00 | 18" Item 204 Excavate and Replace |
| Chatford Dr. | Sta 62+97.32 | Sta. 65+00 | 14" Item 204 Excavate and Replace |

In accordance with ODOT GB-1, plan note G121 should be included in the project plan set. The actual depths and limits of Item 204 should be determined by the Project Engineer in the field based on the results of proof rolling and subgrade observations in accordance with ODOT CMS Item 204 and guidance provided under the ODOT Construction Administration Manual of Procedures (MOP) for Item 204. Where the Item 204 Excavate and Replace depth due to unstable subgrade is greater than 18 inches, based on the results of proof rolling, replacement using geogrid is recommended, where feasible. Undercuts should extend 18 inches beyond the edge of the surface of the pavement, paved shoulder, or paved medians. Upon completion of the stabilization, the entire subgrade should be proof rolled in accordance with Item 204 to verify that stability has been achieved.

### *5.2.2 Subgrade Design Considerations*

California Bearing Ratio (CBR) values for the entire project ranged from 3 to 12 for the I-70 WB-CD alignment and from 4 to 12 for the Brice Road alignment, with an average of 6 for I-70 WB-CD, an average of 7 for Brice Road, and an average of 6 for Chatford Drive. Based on the conditions encountered across the subject site, **it is recommended that pavement design be based on a design CBR value of 6 for I-70 WB-CD, a design CBR value of 7 for Brice Road, and a design CBR of 6 for Chatford Drive** with a corresponding resilient modulus, $M_R$, of 7,200, 8,400, and 7,200 psi, respectively. Correlation charts indicate a modulus of subgrade reaction (K) of 150 pounds per cubic inch (pci), 165 pci, and 150 pci and a soil support value (SSV) of 4.4, 4.9, and 4.4 for the I-70 WB-CD alignment, the Brice Road alignment, and the Chatford Road alignment, respectively.

It should be noted, per ODOT GB1, soils with sulfate content in excess of 5,000 parts per million (ppm) cannot be chemically stabilized due to the potential for sulfate heave in the soil. Based on the results of the testing, the sulfate contents of the subgrade soils range from less than 100 ppm to 1,800 ppm, with the exception of samples tested in boring

B-094-0-19, which indicated a concentration of 9,760 ppm. Therefore, in accordance with GB1, if chemical stabilization is considered as an alternative, the District Geotechnical Engineer should be informed prior to performing work. *It should be noted that sulfate testing was not performed on the samples recovered in the borings along Chatford Drive.*

Please note that the recommended CBR values assume that the materials utilized for the subgrade in fill areas are equivalent to, or better than materials at the existing subgrade elevation. Sources of borrow material should be designated in advance of construction. The material should be tested in the laboratory to verify the soil exhibits a minimum design CBR value as provided above.

Pavement design is dependent on the inclusion of adequate surface and subsurface drainage in order to maintain the compacted subgrade near optimum moisture conditions throughout the lifetime of the pavement. If underdrain systems are considered, they should be installed in accordance to the specifications presented in Item 204 of the ODOT CMS.

### 5.3 Embankment Recommendations

Based on the plans provided by EMH&T, it is understood that the Brice Road improvements include widening for construction of a shared use path along the east side of Brice Road, as well as widening along the west side to accommodate the proposed interchange improvements and bridge construction. It is understood that fill heights between 3 feet (as well as sidehill sliver fills) and up to approximately 15 feet of new fill is proposed within the proposed limits of widening. North of I-70, boring B-081-0-19 was performed for the proposed widening. Additionally, borings B-084-0-19 and B-085-0-19 were performed for proposed Retaining Wall No. 8, which was eliminated during the design process. South of I-70, borings B-058-1-21, B-058-2-21, B-059-1-21, and B-059-2-21 were performed for the proposed widening. Based on the proposed fill configuration and the subsurface soils, it is estimated that any settlement will range from less than 1 inch, to a total of 1.6 inches on the south side, east of Brice Road, due the existing pressures from the existing embankment, and will occur primarily during construction due to the granular nature of the foundation soils.

Considering the proposed widening will include new fill on the existing slopes, which are generally on the order of 3H:1V to 2H:1V, special benching will be required in accordance with ODOT GB-2 Special Benching. Proposed fill on existing slopes steeper than 8H:1V shall be benched into the existing slope and constructed in accordance with ODOT Items 201 and 203. Special benching is required for proposed fill on existing slopes steeper than 4H:1V to ensure the embankment is “knitted” together. Based on the plans available, it is anticipated that special benching will be required along Brice Road at the limits summarized in Table 6 below.

**Table 6. Special Benching Recommendations**

| Location | Limits of Stabilization | | Offset Direction |
|---|---|---|---|
| | Start | End | |
| Brice Road – South of I-70 | Sta. 18+50<br>Sta. 29+00 | Sta. 23+50<br>Sta.29+14.19 | East Side (Right) |
| | Sta. 18+00 | Sta. 29+14.19 | West Side (Left) |
| Brice Road – North of I-70 | Sta. 36+00 | Sta. 40+50 | East Side (Right) |
| | Sta. 37+00 | Sta. 39+50 | West Side (Left) |

Slope stability analysis were performed to check the stability of the proposed embankment widening on the south side of I-70. The computer software program Slide manufactured by Rocscience, Inc. was utilized to perform the analysis. Results of the analysis indicated a factor of safety greater than 1.5 for drained condition (long-term stability). The sections analyzed was selected at Brice Road in the vicinity of explorations D-058-1-21 and B-058-2-21 (Stations 19+50 to 20+50) along with B-059-1-21, D-059-2-21 and B-060-0-21 (Stations 22+50 to 24+00).

## 5.4 Culvert Foundation Recommendations

Based on plan information provided by the Rii design team, it is understood that five (5) culverts, as discussed in Section 5.0, are proposed for the project. It is understood that the proposed culverts include box culvert extensions and realignment of an existing culvert. The following subsections include recommendations for the nominal and factored bearing resistance, as well as the anticipated settlement resulting from the service limit bearing pressure based on the base width provided in the plan information provided.

### *5.4.1 Box Culvert at I-70 – Station 606+42.82*

Based on information provided, it is understood that the proposed culvert extension at Station 606+42.82 along I-70 is to accommodate construction of the proposed I-70 WB-CD road construction. The proposed culvert extension includes a 9-foot by 5-foot box culvert extension of approximately 38 feet in length, with a cast-in-place concrete full height head wall of approximately 9 feet. The proposed bearing elevation of the box culvert and head wall is reportedly at approximate elevation 799.0. Boring B-100-1-19 was performed for the proposed culvert, and extended to a depth of 40 feet. Based on the findings of the borings, the foundation soils consist of stiff to hard sandy silt (ODOT A-4a). Bearing capacity and settlement analyses were performed to determine the service limit bearing pressures based on total settlements of 0.5 inch, 1.0 inch, and 1.5 inches, as well as the strength limit bearing capacity. Results of the analysis are presented in the table below.

**Table 7. Culvert Headwall – I-70 – Station 606+42.82**

| Effective Footing Width (feet) | Service Limit Bearing Pressure (ksf) | | | Bearing Resistance at Strength Limit (ksf) | |
|---|---|---|---|---|---|
| | 0.5 inch | 1.0 inch | 1.5 inch | Nominal | Factored |
| 6 | 1.3 | 4.3 | 6.0 | 11.9 | 6.5 |

The service limit bearing pressure that results in a maximum total settlement of 0.5, 1.0 and 1.5 inches was calculated and presented in Table 7. A geotechnical resistance factor of $\varphi_b$ = 0.55 has been considered in calculating the factored bearing resistance at the strength limit state for the proposed foundation. Based on the bearing pressures calculated, and applying the geotechnical resistance factor to the nominal bearing resistance at the strength limit state, the service limit state should control the minimum footing dimensions.

### *5.4.2 Box Culvert at Brice Road – Station 38+50.29*

Based on information provided, it is understood that the proposed culvert extension at Station 38+50.29 along Brice Road is to accommodate construction of the proposed Brice Road widening. The proposed culvert extension includes a 7-foot box culvert extension of approximately 18 feet in length on the west side and 24 feet in length on the east side, with a cast-in-place concrete full height head wall of approximately 11 feet. The proposed bearing elevation of the box culvert and head wall is reportedly at approximate elevation 788.39 and 789.73 on the west and east side, respectively. Borings B-083-1-19 and B-083-2-19 were performed for the proposed culvert extensions, and extended to a depth of 40 feet each. Based on the findings of the borings, the foundation soils consist of medium stiff to very stiff sandy silt (ODOT A-4a) on the west side and medium dense to dense gravel with sand (ODOT A-1-b). Bearing capacity and settlement analyses were performed to determine the service limit bearing pressures based on total settlements of 0.5, 1.0 and 1.5 inches, as well as the strength limit bearing capacity. Results of the analysis are presented in the table below.

**Table 8. Culvert Headwall – Brice Road – Station 38+50.29**

| Effective Footing Width (feet) | Service Limit Bearing Pressure (ksf) | | | Bearing Resistance at Strength Limit (ksf) | |
|---|---|---|---|---|---|
| | 0.5 inch | 1.0 inch | 1.5 inch | Nominal | Factored |
| 6 | 1.0 | 4.0 | 5.5 | 11.8 | 6.5 |

The service limit bearing pressure that results in a maximum total settlement of 0.5, 1.0 and 1.5 inches was calculated and presented in Table 8. A geotechnical resistance factor of $\varphi_b$ = 0.55 has been considered in calculating the factored bearing resistance at the strength limit state for the proposed foundation. Based on the bearing pressures calculated, and applying the geotechnical resistance factor to the nominal bearing resistance at the strength limit state, the service limit state should control the minimum footing dimensions.

### *5.4.3 Box Culvert at Tussing Road – Station 10+64.16*

Based on information provided, it is understood that the proposed culvert at the intersection of Tussing Road and Brice Road consist of realignment the existing tributary to accommodate proposed widening along Tussing Road. Reportedly, the proposed work consists of removing the existing 18-foot by 7-foot box culvert and corrugated metal arch culvert system and replacing it with an 18-foot by 7-foot precast reinforced concrete box culvert with cast-in-place concrete full height headwalls. The proposed bearing elevation of the box culvert and head wall is reportedly at elevation 774.0. Boring B-054-0-19 was performed for the proposed culvert realignment, and extended to a depth of 40 feet. Based on the findings of the boring, the foundation soils consist of very stiff to hard silt and clay (ODOT A-6a). Bearing capacity and settlement analyses were performed to determine the service limit bearing pressures based on total settlements of 0.5, 1.0 and 1.5 inches, as well as the strength limit bearing capacity. Results of the analysis are presented in the table below.

**Table 9. Culvert Headwall – Tussing Road Station 10+64.16**

| Effective Footing Width (feet) | Service Limit Bearing Pressure (ksf) | | | Bearing Resistance at Strength Limit (ksf) | |
|---|---|---|---|---|---|
| | 0.5 inch | 1.0 inch | 1.5 inch | Nominal | Factored |
| 8 | 0.4 | 1.3 | 2.7 | 11.7 | 6.4 |

The service limit bearing pressure that results in a maximum total settlement of 0.5, 1.0 and 1.5 inches was calculated and presented in Table 9. A geotechnical resistance factor of $\varphi_b$ = 0.55 has been considered in calculating the factored bearing resistance at the strength limit state for the proposed foundation. Based on the bearing pressures calculated, and applying the geotechnical resistance factor to the nominal bearing resistance at the strength limit state, the service limit state should control the minimum footing dimensions. Additional capacity may be achieved by performing an undercut beneath the bearing elevation and replacing the material with compacted granular fill. Analysis was performed for a 3-foot undercut beneath the proposed bearing elevation, which provided a service limit bearing pressure of 2.6 kips per square foot (ksf) for 1.0 inch of settlement.

### *5.4.4 Box Culvert at Tussing Road (FRA-BPDRW-41.060) – Station 12+27.18*

Based on information provided, it is understood that the proposed culvert extension at Station 12+27.18 along Tussing Road is to accommodate the addition of a turn lane from Tussing Toad to northbound Brice Road.

Reportedly, the proposed work consists of removing the existing 20-foot by 7-foot corrugated metal arch culvert and replacing it with an 18-foot by 7-foot precast reinforced concrete 4-sided box culvert with cast-in-place reinforced concrete full height headwalls and wingwalls. The proposed bearing elevation of the box culvert and head wall is reportedly at elevation 774.0. Boring B-055-0-19 was performed for the proposed culvert, and extended to a depth of 40 feet. Based on the findings of the boring, the foundation soils consist of hard silt and clay and silty clay (ODOT A-6a and A-6b). Bearing capacity and settlement analyses were performed to determine the service limit bearing pressures based on total settlements of 0.5, 1.0 and 1.25 inches, as well as the strength limit bearing capacity. Results of the analysis are presented in the table below.

**Table 10. Culvert Headwall – Tussing Road Station 12+27.18**

| Effective Footing Width (feet) | Service Limit Bearing Pressure (ksf) | | | Bearing Resistance at Strength Limit (ksf) | |
|---|---|---|---|---|---|
| | 0.5 inch | 1.0 inch | 1.25 inch | Nominal | Factored |
| 8 | 0.7 | 2.8 | 3.8 | 6.9 | 3.8 |

The service limit bearing pressure that results in a maximum total settlement of 0.5, 1.0 and 1.25 inches was calculated and presented in Table 10. A geotechnical resistance factor of $\varphi_b$ = 0.55 has been considered in calculating the factored bearing resistance at the strength limit state for the proposed foundation. Based on the bearing pressures calculated, and applying the geotechnical resistance factor to the nominal bearing resistance at the strength limit state, the service limit state should control the minimum footing dimensions. Additional capacity may be achieved by performing an undercut beneath the bearing elevation and replacing the material with compacted granular fill. Analysis was performed for a 0.5-foot undercut beneath the proposed bearing elevation, which provided a service limit bearing pressure of 3.3 kips per square foot (ksf) for 1.0 inch of settlement.

### *5.4.5 Box Culvert at Chatford Drive – Station 64+75*

Based on information provided, it is understood that the proposed single box culvert at approximately Station 64+75 along Chatford Drive is to accommodate construction of the Chatford Drive. The proposed culvert extension includes a 14-foot by 6-foot box culvert of approximately 75 feet in length with wingwall. The elevation of bottom of foundation is planned to be 778.52 feet. Boring B-040-1-21 was performed for the proposed culvert, and extended to a depth of about 20 feet. Based on the findings of the boring, the foundation

soils are expected to consist of very stiff to hard sandy silt (ODOT A-4a). Bearing capacity and settlement analyses were performed to determine the service limit bearing pressures based on total settlements of 0.5 inches, 1.0 inch, and 1.5 inches, as well as the strength limit bearing capacity. Results of the analysis are presented in the table below.

**Table 11. Culvert Wingwall – Chatford Drive – Station 64+75**

| Effective Footing Width (feet) | Service Limit Bearing Pressure (ksf) | | | Bearing Resistance at Strength Limit (ksf) | |
|---|---|---|---|---|---|
| | 0.5 inch | 1.0 inch | 1.5 inch | Nominal | Factored |
| 6 | 0.1 | 3.5 | 5.1 | 16.3 | 8.9 |

The service limit bearing pressure that results in a maximum total settlement of 0.5, 1.0 and 1.5 inches was calculated and presented in Table 11. A geotechnical resistance factor of $\varphi_b$ = 0.55 has been considered in calculating the factored bearing resistance at the strength limit state for the proposed foundation. Based on the bearing pressures calculated, and applying the geotechnical resistance factor to the nominal bearing resistance at the strength limit state, the service limit state should control the minimum footing dimensions.

### *5.4.6 Box Culvert at I-70 – Station 578+55.47*

Based on information provided, it is understood that the proposed culvert extension at Station 578+55.47 along I-70 is to accommodate construction of the proposed I-70 WB-CD road over a drainage ditch. The proposed culvert extension includes a twin 22-foot by 8-foot precast reinforced concrete 4-sided box culvert extension of approximately 60 feet in length, with cast-in-place reinforced concrete headwalls and wingwalls. The bottom of foundation elevation is planned to be 778.52 feet. Boring B-040-0-19 was performed in proximity of the proposed culvert extension, and extended to a depth of about 25 feet. Based on the findings of the borings, the foundation soils are anticipated to consist of hard silt and clay (ODOT A-6a). Bearing capacity and settlement analyses were performed to determine the service limit bearing pressures based on total settlements of 0.5, 1.0 and 1.5 inches, as well as the strength limit bearing capacity. Results of the analysis are presented in the table below.

**Table 12. Culvert Headwall/Wingwall – I-70 – Station 578+55.47**

| Effective Footing Width (feet) | Service Limit Bearing Pressure (ksf) | | | Bearing Resistance at Strength Limit (ksf) | |
|---|---|---|---|---|---|
| | 0.5 inch | 1.0 inch | 1.5 inch | Nominal | Factored |
| 6 | 0.7 | 1.7 | 3.7 | 16.1 | 8.8 |

The service limit bearing pressure that results in a maximum total settlement of 0.5, 1.0 and 1.5 inches was calculated and presented in Table 12. A geotechnical resistance factor of $\varphi_b$ = 0.55 has been considered in calculating the factored bearing resistance at the strength limit state for the proposed foundation. Based on the bearing pressures calculated, and applying the geotechnical resistance factor to the nominal bearing resistance at the strength limit state, the service limit state should control the minimum footing dimensions.

## 5.5 CIP Culvert Headwall – Tussing Road Station 12+27.18

It is proposed to construct CIP wingwalls along the stream located north of Tussing Road beginning at approximately station 12+27.00.

For CIP walls bearing on earthen foundations, footings should be proportioned such that the factored equivalent bearing pressure exerted at the front of the wall will not exceed the factored bearing resistance at the strength limit state. Further, the footings should also be proportioned such that the entire footing width remains in compression (no tensile stresses form under the footing, pulling the footing up and away from the bearing surface) under service conditions. In general, the typical width of a CIP wall foundation (B) is equal to 50 to 70 percent the wall height.

Typical sections for the proposed CIP retaining walls were included in the design plans provided, which were used in the analysis of the proposed walls. Where analyses indicates that the base width needs modified to meet the external and global stability requirements, then the base width (toe and/or heel width) was increased or decreased to satisfy the stability requirements.

Boring B-055-0-19 was performed along or within the vicinity of the alignment the proposed wingwalls. In general, the subsurface profile along the wall alignments consists of stiff to very stiff sandy silt, silt and clay and silty clay (ODOT A-6a, A-6b) extending to the boring termination depth. These soils are suitable for support of the proposed CIP walls in their current condition.

### *5.5.1 Strength Parameters Utilized in External Stability Analyses*

The shear strength parameters utilized in the external stability analyses for the CIP walls are provided in Table 15.

**Table 13. Shear Strength Parameters Utilized in CIP Wall Stability Analyses**

| Material Type | $\gamma$ (pcf) | $\varphi'$ [1] (°) | $c'$ [2] (psf) | $S_u$ [3] (psf) |
|---|---|---|---|---|
| Item 203 Granular Embankment (Over excavation backfill) | 120 | 32 | 0 | N/A |
| Very Stiff Silty Clay (ODOT A-6b) | 120 to 125 | 26 to 27 | 0 to 50 | 1,625 to 4,250 |
| Very Stiff Silt and Clay (ODOT A-6a) | 120 to 130 | 27 to 28 | 0 to 100 | 1,750 to 5,000 |

1. *Per Figure 7-45, Section 7.6.9 of FHWA GEC 5 for cohesive soils and Table 10.4.6.2.4-1 of the 2020 AASHTO LRFS BDS for granular soils.*
2. *Estimated based on overconsolidated nature of soil.*
3. *$S_u = 125(N_{60})$, Terzaghi and Peck (1967).*

The shear strength parameters for the natural soils were assigned using correlations provided in FHWA Geotechnical Engineering Circular (GEC) No. 5 (FHWA-NHI-16-072) Evaluation of Soil and Rock Properties, the 2020 AASHTO LRFD BDS and based on past experience in the vicinity of the site with projects performed in similar subsurface profiles. A tabulation of the correlated shear strength parameters for each boring is provided in Appendix .

The typical section for the CIP retaining wall indicated that the backfill to be utilized above the heel of the wall will consist of standard embankment. A relatively thin section of drainage material is planned immediately behind the wall. The CIP wall has been calculated using the properties for both standard embankment and the in-situ soils. It should be noted that all stability calculations have been performed considering that the standard embankment will be placed as shown on the typical sections, and that the standard embankment will exhibit a minimum friction angle of 30 degrees when placed and compacted in accordance with ODOT Item 203.

### *5.5.1 Bearing Stability*

The bearing materials along the retaining wall alignment is anticipated to consist of stiff to very stiff silt and clay and silty clay (ODOT A-6a, A-6b). CIP wall foundations bearing on these natural soils or newly placed embankment fill may be proportioned for a factored bearing resistance as indicated in Table 14. A geotechnical resistance factor of $\varphi_b$=0.55 was considered in calculating the factored bearing resistance at the strength limit state. The foundation widths presented in the following table are based on the dimensions provided in the typical sections for the respective retaining wall, or the minimum width required to satisfy external and global stability requirements.

**Table 14. CIP Wall Design Parameters**

| Wall No. | Station Along Wall Alignment | Reference Boring | Wall Height Analyzed (feet) | Foundation Width Analyzed (feet) | Backslope Behind Wall | Bearing Resistance at Strength Limit (ksf) | | Strength Limit Equivalent Bearing Pressure [3] (ksf) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Nominal | Factored [2] | |
| FRA-BPDRW-41.060 | 12+27.18 | B-055-0-19 | 12.5 | 8.0 | Level | 6.94 | 3.82 | 2.44 |

1. *Station limits are referenced to the proposed baseline of the respective wall alignment.*
2. *A geotechnical resistance factor of $\varphi_b$=0.55 was considered in calculating the factored bearing resistance at the strength limit state.*
3. *The strength limit equivalent bearing pressure is the uniformly distributed pressure asserted by the wall over an effective base width based on the eccentricity of the wall system at the strength limit state.*

Rii performed a verification of the bearing pressure exerted on the subgrade material for the maximum specified wall height indicated in Table 14. Based on the minimum footing width presented, the factored equivalent bearing pressure exerted below the wall **will not exceed** the factored bearing resistance at the strength limit state.

### *5.5.2 Settlement Evaluation*

The proposed CIP walls will be supporting the proposed embankment for the widening of Tussing Road and the entrance drive over the stream, and the top of the proposed walls will be above existing grade which will result in an increased net load on the bearing soils. Therefore, settlement analysis was performed for these retaining walls. The compressibility parameters utilized in the settlement analyses for the CIP walls are provided in Table 15.

**Table 15. Compressibility Parameters Utilized in Settlement Analysis for CIP Walls**

| Material Type | $\gamma$ (pcf) | $LL$ (%) | $C_c$ [1] | $C_r$ [2] | $e_o$ [3] |
|---|---|---|---|---|---|
| Item 203 Embankment | 120 | 30 | 0.180 | 0.009 | 0.507 |
| Stiff to Very Stiff Silty and Clay (ODOT A-6a) | 120 to 125 | 33 to 34 | 0.065 to 0.078 | 0.010 to 0.078 | 0.407 to 0.418 |
| Very Stiff to Very Stiff Silty Clay (ODOT A-6b) | 115 | 35 | 0.060 to 0.069 | 0.006 to 0.007 | 0.402 to 0.410 |

1. *Per Table 6-9, Section 6.14.1 of FHWA GEC 5.*
2. *Estimated at 10% of $C_c$ per Section 8.11 of Holtz and Kovacs (1981).*
3. *Per Table 8-2 of Holtz and Kovacs (1981).*

The settlement analysis was performed considering that the bearing pressure is a uniformly distributed pressure asserted by the wall over an effective base width based on

the eccentricity of the wall system at the service limit state. Total settlements of up to 1.0 inch are anticipated along the alignments of the CIP walls.

Per Section 307.1.6 of the 2020 ODOT BDM, the maximum allowable differential settlement in the longitudinal direction is 1 in. / 500 ft. Based on the total anticipated settlement along the wall alignments, the maximum differential settlement in the longitudinal direction is anticipated to be less than 1 in. / 579 ft., which is within the tolerable limit of 1 in. / 500 ft. If the total or differential settlement values predicted for the proposed wall presents an issue with respect to the deformation tolerances that the wall can withstand, then measures should be taken to minimize the amount of settlement that will occur. This can be achieved by preloading the site using a surcharge and consolidating the underlying soils prior to constructing the walls. If preloading the site is not a desired option, then consideration could be given to ground improvement through the use of stone columns.

### *5.5.3 Eccentricity (Overturning Stability)*

The resistance of the CIP walls to overturning will be dependent on the on the location of the resultant force at the bottom of the wall due to the overturning and resisting moments acting on the wall. For CIP walls, overturning stability is determined by calculating the eccentricity of the resultant force from the midpoint of the base of the wall and comparing this value to a limiting eccentricity value. Per Section 11.6.3.3 of the 2020 AASHTO LRFD BDS, for foundations bearing on soil, the location of the resultant of the reaction forces shall be within the middle two-thirds ($^2/_3$) of the base width. Therefore, the limiting eccentricity is one-third ($^1/_3$) of the base width of the wall. Based on the required foundation width presented in Table 14 and utilizing the soil parameters listed in Section 5.5.1 for the retained embankment material, the calculated eccentricity of the resultant force **will not exceed** the limiting eccentricity at the strength limit state.

### *5.5.4 Sliding Stability*

The resistance of the CIP walls to sliding was evaluated per Section 11.6.3.6 of the 2020 AASHTO LRFD BDS. Given that the bearing soils along majority of the wall alignments consist of cohesive material, the sliding resistance was evaluated under both drained and undrained conditions. For drained conditions, the sliding resistance is determined by multiplying a coefficient of sliding friction “f” times the total vertical force at the base of the wall. The coefficient of sliding friction is determined based on the friction angle of the foundation soil. Based on the soil parameters listed in Section 5.5.1, a coefficient of sliding friction ranging from 0.53 was utilized for design. For undrained conditions, the sliding resistance is taken as the limiting value between the undrained shear strength of the bearing soil and half of the vertical stress applied by the wall multiplied by the width of the wall. Based on the soil parameters listed in Section 5.5.1, the undrained shear strength of the bearing material is estimated to range from 1.75 ksf.

A geotechnical resistance factor of $\varphi_\tau$=1.0 was considered in calculating the factored shear resistance along the base of the wall. Based on the foundation width presented in Table 14 and utilizing the soil parameters listed in Section 5.5.1 for the retained embankment material, the resultant horizontal forces on the back of the CIP wall **will not exceed** the factored shear resistance at the strength limit state under drained or undrained conditions.

### *5.5.5 Final CIP Wall Considerations*

Based on the results of the external analysis performed, all of the CIP wall sections analyzed meet all of the external and global stability requirements.

Calculations for external (bearing and sliding resistance and limiting eccentricity) and settlement of the CIP wall are provided in Appendix .

## 5.6 Drilled Shaft Foundations (Noise Barriers 1, 2 and 4)

The required shaft embedment for the proposed Noise Barriers 1, 2 ad 4 was determined in accordance with Section 802.1.2 of the ODOT Bridge Design Manual (BDM). Per ODOT BDM Section 802.1.2, the required embedment depth for the supporting drilled shafts is determined using energy and depth corrected SPT values and selecting the required embedment depth based on either the average or critical corrected SPT value from Table 802.1.2-1 for granular soils or 802.1.2-2 for cohesive soils. Based on the plans and profile information provided, the anticipated panel heights and spacing for each noise barrier are as follows:

**Table 16. Noise Walls 1, 2 and 4 – Panel Heights and Spacing Information**

| Noise Barrier | Noise Barrier 1 | Noise Barrier 2 | Noise Barrier 4 |
|---|---|---|---|
| Panel Heights (feet) | 13 to 20 | 15 to 20 | 15 to 19 |
| Maximum Panel Spacing Center-to-Center of the Drilled Shaft (feet) | 24 | 24 | 24 |

Based on cross section information provided, the transverse cross-slopes along the alignment of Noise Barrier 1 are generally level and transitions to 3:1 to 2:1 at about Sta. 29+44. Due to the shift in alignment of Noise Barrier 2, the transverse cross-slopes along this alignment between were not available at the time of this report. For the purposes of the analysis, the cross-slopes were estimated to be generally level to as steep as 2:1. The transverse cross-slopes along the alignment of Noise Barrier 4 are considered to be generally 3:1. In general, the analysis indicates that 2.5-foot diameter drilled shafts excavated to depths ranging from 7.5 to 15 feet for Noise Barrier 1, from 9.0 to 30.0 feet for Noise Barrier 2, and from 10.5 to 22 feet for Noise Barrier 4 will be required for the support of the noise wall. The following tables detail the required minimum drilled shaft

depth for each panel along each of the proposed noise barrier wall alignment. Calculations for the noise barrier foundation depths are provided in Appendix IX.

**Table 17. Noise Barrier 1 Foundation Depth Requirements**

| From Panel | To Panel | Length (feet) | Representative Boring | Post Spacing (feet) | Barrier Height (feet) | Transverse Ground Slope | Proposed Shaft Depth (feet) |
|---|---|---|---|---|---|---|---|
| 1 | 3 | 24 | B-004-0-19 | 8 | 13-14 | Level | 7.5 |
| 4 | 8 | 120 | B-004-0-19 | 24 | 15-16 | Level | 9.0 |
| 9 | 17 | 216 | B-003-0-19 | 24 | 16 | Level | 9.0 |
| 18 | 25 | 192 | B-002-0-19 | 24 | 16 | Level | 9.0 |
| 26 | 33 | 192 | B-001-7-19 | 24 | 16 | Level | 9.0 |
| 34 | 42 | 216 | B-001-6-19 | 24 | 16 | Level | 9.0 |
| 43 | 50 | 192 | B-001-5-19 | 24 | 16 | Level | 9.0 |
| 51 | 58 | 192 | B-001-4-19 | 24 | 16 | Level | 9.0 |
| 59 | 67 | 216 | B-001-3-19 | 24 | 16 | Level | 9.0 |
| 68 | 75 | 192 | B-001-2-19 | 24 | 16-17 | Level | 13.0 |
| 76 | 78 | 72 | B-001-1-19 | 24 | 16-17 | 3:1 | 15.0 |
| 79 | 87 | 128 | B-001-1-19 | 16 | 16-20 | 3:1 | 15.0 |
| 88 | 91 | 24 | B-001-1-19 | 8 | 19-20 | 2:1 | 10.0 |

## Table 18. Noise Barrier 2 Foundation Depth Requirements

| From Panel | To Panel | Length (feet) | Representative Boring | Post Spacing (feet) | Barrier Height (feet) | Transverse Ground Slope | Proposed Shaft Depth (feet) |
|---|---|---|---|---|---|---|---|
| 1 | 8 | 192 | B-010-0-19 | 24 | 15-16 | 5:1 | 11.0 |
| 9 | 9 | 12 | B-010-0-19 | 12 | 15 | 5:1 | 11.0 |
| 10 | 10 | 24 | B-010-0-19 | 24 | 15 | 5:1 | 11.0 |
| 11 | 13 | 72 | B-011-0-19 | 24 | 15-16 | 5:1 | 9.0 |
| 14 | 15 | 28 | B-011-0-19 | 14 | 15 | 5:1 | 9.0 |
| 16 | 18 | 72 | B-011-0-19 | 24 | 16 | 5:1 | 9.0 |
| 18 | 20 | 72 | B-011-0-19 | 24 | 15 | 5:1 | 9.0 |
| 21 | 28 | 312 | B-013-0-19 | 24 | 15-17 | 3:1 | 12.5 |
| 29 | 29 | 12 | B-013-0-19 | 12 | 15 | 3:1 | 12.5 |
| 30 | 30 | 24 | B-014-0-19 | 24 | 17 | 2:1 | 10.0 |
| 31 | 31 | 12 | B-014-0-19 | 12 | 15 | 2:1 | 10.0 |
| 32 | 33 | 24 | B-014-0-19 | 24 | 15 | 2:1 | 10.0 |
| 34 | 34 | 12 | B-014-0-19 | 12 | 15 | 2:1 | 10.0 |
| 35 | 35 | 24 | B-014-0-19 | 24 | 15 | 2:1 | 10.0 |
| 36 | 36 | 12 | B-014-0-19 | 12 | 15 | 2:1 | 10.0 |
| 37 | 38 | 48 | B-014-0-19 | 24 | 15 | 2:1 | 10.0 |
| 80 | 86 | 168 | B-024-0-19 | 24 | 15 | 2:1 | 14.0 |
| 87 | 87 | 16 | B-025-0-19 | 24 | 15 | 2:1 | 14.0 |
| 88 | 96 | 192 | B-025-0-19 | 24 | 15 | 2:1 | 14.0 |
| 1 | 8 | 192 | B-010-0-19 | 24 | 15-16 | 5:1 | 11.0 |
| 9 | 9 | 12 | B-010-0-19 | 12 | 15 | 5:1 | 11.0 |
| 10 | 10 | 24 | B-010-0-19 | 24 | 15 | 5:1 | 11.0 |
| 11 | 13 | 72 | B-011-0-19 | 24 | 15-16 | 5:1 | 9.0 |
| 14 | 15 | 28 | B-011-0-19 | 14 | 15 | 5:1 | 9.0 |

**Table 19. Noise Barrier 4 Foundation Depth Requirements**

| From Panel | To Panel | Length (feet) | Representative Boring | Post Spacing (feet) | Barrier Height (feet) | Transverse Ground Slope | Proposed Shaft Depth (feet) |
|---|---|---|---|---|---|---|---|
| 1 | 5 | 120 | B-095-0-19 | 24 | 15 | 3:1 | 15.0 |
| 6 | 13 | 192 | B-096-0-19 | 24 | 15 | 3:1 | 22.0 |
| 14 | 21 | 192 | B-098-0-19 | 24 | 15-16 | 3:1 | 15.0 |
| 22 | 28 | 144 | B-099-0-19 | 24 | 15-16 | 3:1 | 15.0 |
| 29 | 29 | 12 | B-099-0-19 | 12 | 15 | 3:1 | 10.5 |
| 30 | 32 | 24 | B-099-0-19 | 8 | 17-18 | 3:1 | 10.5 |
| 33 | 33 | 12 | B-099-0-19 | 12 | 19 | 3:1 | 10.5 |

The drilled shaft excavations should be carefully observed by a geotechnical engineering representative as soon as possible following excavation to assure adequacy. If inadequate bearing soil is encountered, the shaft excavations should be continued into more suitable end bearing soils or to bedrock. Since water has an adverse effect on cohesive soil, drilled shaft concrete should be placed as soon as possible following excavation, preferably the same day to reduce the potential for water related damage. Drilled shaft excavations should be kept dry and clean until concrete is placed to reduce damage to the bearing surfaces. For details about groundwater observations, refer to Section 4.4.

### *5.6.1 Drilled Shaft Considerations*

The minimum requirements for proper inspection of drilled shaft construction are as follows:

- A qualified inspector should record the material types being removed from the hole as excavation proceeds.
- The use of casing for drilled shafts is recommended if caving material and/or groundwater is encountered at any time during the drilling of the shaft, or if groundwater seepage occurs in the drilled shaft.
- The placement of all concrete for the drilled shafts shall follow the American Concrete Institute's Design and Construction of Drilled Piers (ACI 336.3R-93).
- Concrete placed freefall should not be allowed to hit the sidewalls of the excavation and should not pass through any water. Therefore, concrete should be placed by tremie method if groundwater is encountered during construction of the drilled shafts.

- If concrete is placed by tremie method, it must be done so with an adequate head to displace water or slurry if groundwater has entered the drilled shaft (all tremie procedures shall follow applicable ACI specifications).

- The volume of concrete should be checked to ensure voids did not result during extraction of the casing.

- Pulling casing with insufficient concrete inside should be restricted.

- The bottom of drilled shaft excavation should be clean and free of loose material. Any loose material observed should be removed using a clean-out bucket (muck bucket).

In addition, it is recommended that, if casing is used, it be pulled after the concrete is poured, allowing for reuse of the casing, and eliminating reduction of side resistance (between soil and concrete).

## 5.7 Lateral Earth Pressure Parameters

For the soil types encountered in the borings, the "in-situ" unit weight ($\gamma$), cohesion ($c$), effective angle of friction ($\varphi$'), and lateral earth pressure coefficients for at-rest conditions ($k_o$), active conditions ($k_a$), and passive conditions ($k_p$) have been estimated and are provided in Table 20 and Table 21.

**Table 20. Estimated Undrained Soil Parameters for Design**

| Soil Type | $\gamma$ (pcf) [1] | $c$ (psf) | $\varphi$ | $k_a$ | $k_o$ | $k_p$ |
|---|---|---|---|---|---|---|
| Soft to Medium Stiff Cohesive Soil | 115 | 750 | 0° | N/A | N/A | N/A |
| Stiff Cohesive Soil | 120 | 1,500 | 0° | N/A | N/A | N/A |
| Very Stiff to Hard Cohesive Soil | 125 | 3,000 | 0° | N/A | N/A | N/A |
| Loose Granular Soil | 120 | 0 | 28° | 0.32 | 0.53 | 5.07 |
| Medium Dense Granular Soil | 125 | 0 | 32° | 0.27 | 0.47 | 6.82 |
| Dense to Very Dense Granular Soil | 130 | 0 | 36° | 0.23 | 0.41 | 9.09 |
| Compacted Cohesive Engineered Fill | 120 | 2,000 | 0° | N/A | N/A | N/A |
| Compacted Granular Engineered Fill | 120 | 0 | 32° | 0.27 | 0.47 | 6.82 |

1. *When below groundwater table, use effective unit weight, $\gamma' = \gamma - 62.4$ pcf and add hydrostatic water pressure.*

**Table 21. Estimated Drained Soil Parameters for Design**

| Soil Type | $\gamma$ (pcf) [1] | $c$ (psf) | $\varphi$' | $k_a$ | $k_o$ | $k_p$ |
|---|---|---|---|---|---|---|
| Soft to Stiff Cohesive Soil | 115 | 0 | 26° | 0.35 | 0.56 | 4.53 |
| Very Stiff to Hard Cohesive Soil | 125 | 50 | 28° | 0.32 | 0.53 | 5.07 |
| Loose Granular Soil | 120 | 0 | 28° | 0.32 | 0.53 | 5.07 |
| Medium Dense Granular Soil | 125 | 0 | 32° | 0.27 | 0.47 | 6.82 |
| Dense to Very Dense Granular Soil | 130 | 0 | 36° | 0.23 | 0.41 | 9.09 |
| Compacted Cohesive Engineered Fill | 120 | 0 | 30° | 0.30 | 0.50 | 5.58 |
| Compacted Granular Engineered Fill | 120 | 0 | 32° | 0.27 | 0.47 | 6.82 |

1. *When below groundwater table, use effective unit weight, $\gamma' = \gamma - 62.4$ pcf and add hydrostatic water pressure.*

These parameters are considered appropriate for the design of all subsurface structures and any excavation support systems. Subsurface structures (where the top of the structure is restrained from movement) should be designed based on at-rest conditions ($k_o$). For proposed temporary retaining structures (where the top of the structure is allowed to move), earth pressure distributions should be based on active ($k_a$) and passive ($k_p$) conditions. Active earth pressure is developed as the structure moves away from the backfill or retained soil, while passive pressure is developed as the structure moves towards the backfill. A relatively small amount of lateral movement is needed to reach the active condition (≥ 0.1 percent of the height), whereas the movements required to engage the passive condition are approximately ten times greater than those required to develop active earth pressure. The values in this table have been estimated from correlation charts based on minimum standards specified for compacted engineered fill materials.

These recommendations do not take into consideration the effect of any surcharge loading or a sloped ground surface (a flat surface is assumed). Earth pressures on excavation support systems will be dependent on the type of sheeting and method of bracing or anchorage. Surcharge loads, such as that imposed by traffic loading, will create additional lateral loading on the subsurface structures and excavation support systems. The resulting lateral earth pressure should be evaluated based on active ($k_a$) and at-rest ($k_o$) conditions and the anticipated magnitude of the loading.

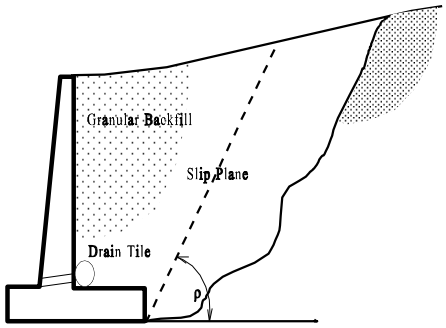
Temporary retaining structures should be designed using the undrained soil parameters provided in Table 20, and the design should follow all applicable guidelines for the type of retaining structure utilized. Permanent retaining structures should be design using the drained soil parameters provided in Table 21. Regardless of whether the retaining structure is temporary or permanent, the effective unit weight ($\gamma' = \gamma - 62.4$ pcf) plus the hydrostatic water pressure ($\gamma_w * h_w$, where $h_w$ is the height of water behind the wall above the base of the wall) should be utilized below the design groundwater level. The lateral

earth pressure coefficients should only be applied to the horizontal pressure resulting from the effective overburden pressure, and should not be applied to the hydrostatic water pressure.

In order to alleviate the build-up of hydrostatic pressure behind the walls, a minimum of 2.0 feet of clean free-draining granular fill (i.e., No. 57 gravel) should be placed full depth behind the walls. If granular fill other than No. 57 gravel is used, it should not have more than 8 percent (by weight) passing the No. 200 screen, and should be compacted to 95 percent of the maximum dry density as determined by the Standard Proctor Test (ASTM D698). A perforated, corrugated drain tile, wrapped with filter fabric, should be placed along the perimeter at the base of the wall for drainage purposes. A clay cap (minimum 1.0-foot thick) should be placed overtop the granular backfill to deter inflow of the surface water. The drainage system should properly outlet to a sewer or to a properly sized sump pump system.

The 2.0 feet of free draining material placed behind the wall prevents the formation of hydrostatic pressures as noted above. However, unless the free draining granular backfill is placed beyond the slip plane (see Figure 1), it has no influence on the equivalent fluid weight of the soil. If free-draining granular fill (meeting the requirements listed above) is to be placed beyond the slip plane ($\rho$=45˚ for at-rest conditions; $\rho$=45°+$\varphi$/2 for active conditions), the values presented for the compacted granular engineered fill can be employed, consequently lowering the pressures on the wall.

**Figure 1. Slip Plane**




Backfill Rankine Zone with Select Backfill

## 5.8 Construction Considerations

All site work shall conform to local codes, and to the latest ODOT CMS, including that all excavation and embankment preparation and construction should follow ODOT Item 200 (Earthwork).

### *5.8.1 Excavation Considerations*

All excavations should be shored / braced or laid back at a safe angle in accordance to Occupational Safety and Health Administration (OSHA) guidelines. During excavation, if slopes cannot be laid back to OSHA Standards due to adjacent structures or other obstructions, temporary shoring may be required. The following table should be utilized as a general guide for implementing OSHA guidelines when estimating excavation back slopes at the various boring locations. Actual excavation back slopes must be field verified by qualified personnel at the time of excavation in strict accordance with OSHA guidelines.

**Table 22. Excavation Back Slopes**

| Soil | Maximum Back Slope | Notes |
|---|---|---|
| Soft to Medium Stiff Cohesive | 1.5 : 1.0 | Above Ground Water Table and No Seepage |
| Stiff Cohesive | 1.0 : 1.0 | Above Ground Water Table and No Seepage |
| Very Stiff to Hard Cohesive | 0.75 : 1.0 | Above Ground Water Table and No Seepage |
| All Granular & Cohesive Soil Below Ground Water Table or with Seepage | 1.5 : 1.0 | None |
| Rock to 3.0' +/- below Auger Refusal | 0.75 : 1.0 | Above Ground Water Table and No Seepage |
| Stable Rock | Vertical | Above Ground Water Table and No Seepage |

### *5.8.2 Groundwater Considerations*

Based on the groundwater observations made during drilling, groundwater seepage may be encountered during construction. Where groundwater is encountered, proper groundwater control should be employed and maintained to prevent disturbance to excavation bottoms consisting of cohesive soil, and to prevent the possible development of a quick or "boiling" condition where soft silts and/or fine sands are encountered. It is preferable that the groundwater level, if encountered, be maintained at least 36 inches below the deepest excavation. Any seepage or groundwater encountered at this site should be able to be controlled by pumping from temporary sumps. Additional measures may be required depending on seasonal fluctuations of the groundwater level. Note that determining and maintaining actual groundwater levels during construction is the responsibility of the contractor.

## 6.0 LIMITATIONS OF STUDY

The above recommendations are predicated upon construction inspection by a qualified soil technician under the direct supervision of a professional geotechnical engineer. Adequate testing and inspection during construction are considered necessary to assure an adequate foundation system and are part of our recommendations.

The recommendations for this project were developed utilizing soil and bedrock information obtained from the test borings that were made at the proposed site. At this time we would like to point out that soil borings only depict the soil and bedrock conditions at the specific locations and time at which they were made. The conditions at other locations on the site may differ from those occurring at the boring locations.

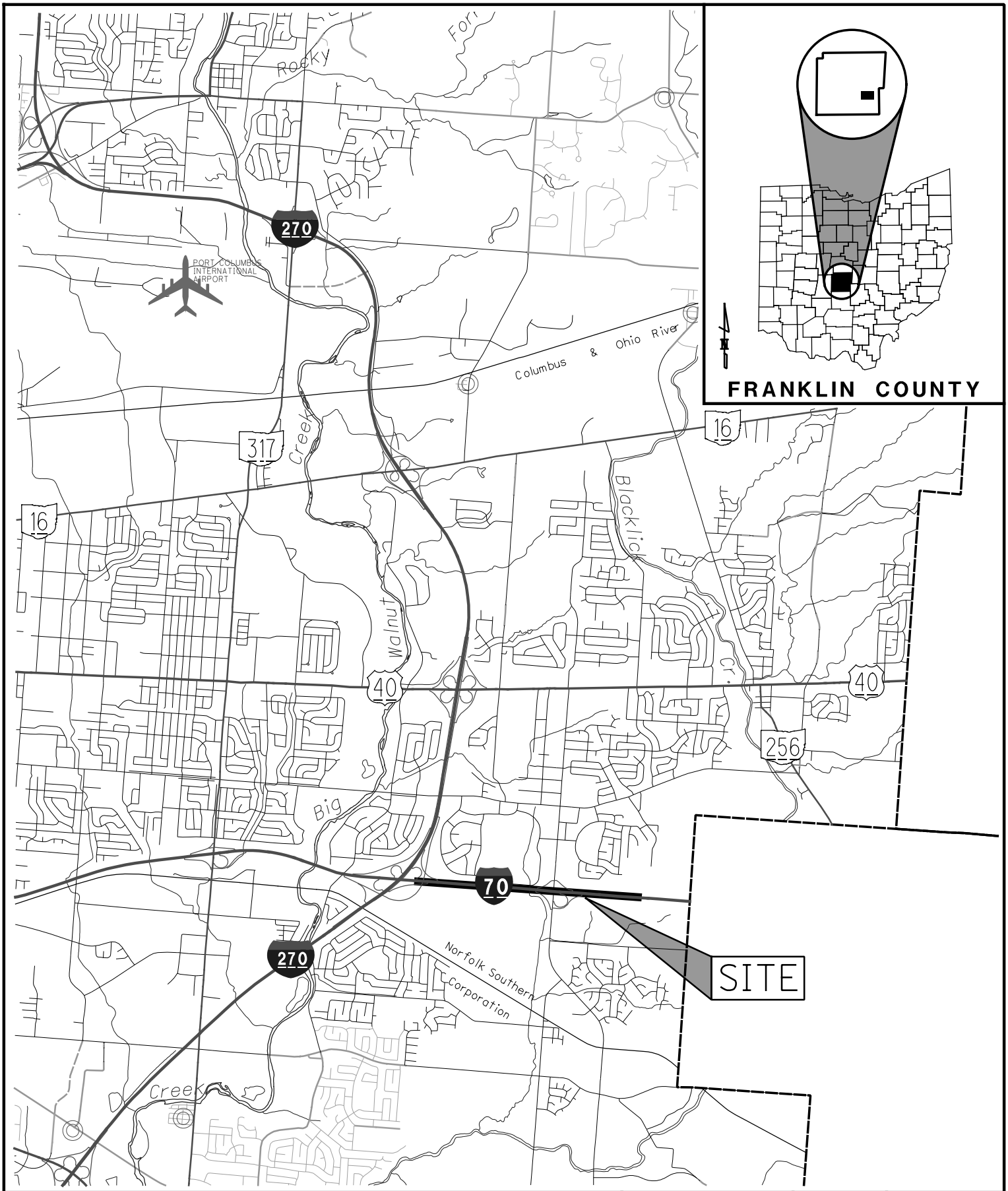
The conclusions and recommendations herein have been based upon the available soil information and the preliminary design details furnished by a representative of the owner of the proposed project. Any revision in the plans for the proposed construction from those anticipated in this report should be brought to the attention of the geotechnical engineer to determine whether any changes in the foundation or earthwork recommendations are necessary. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to the attention of the geotechnical engineer.

The scope of our services does not include any environmental assessment or investigation for the presence or absence or hazardous or toxic materials in the soil, groundwater or surface water within or beyond the site studied. Any statements in this report or on the test boring logs regarding odors, staining of soils or other unusual conditions observed are strictly for the information of our client.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. Resource International is not responsible for the conclusions, opinions or recommendations made by others based upon the data included.

# APPENDIX I

VICINITY MAP AND BORING PLAN



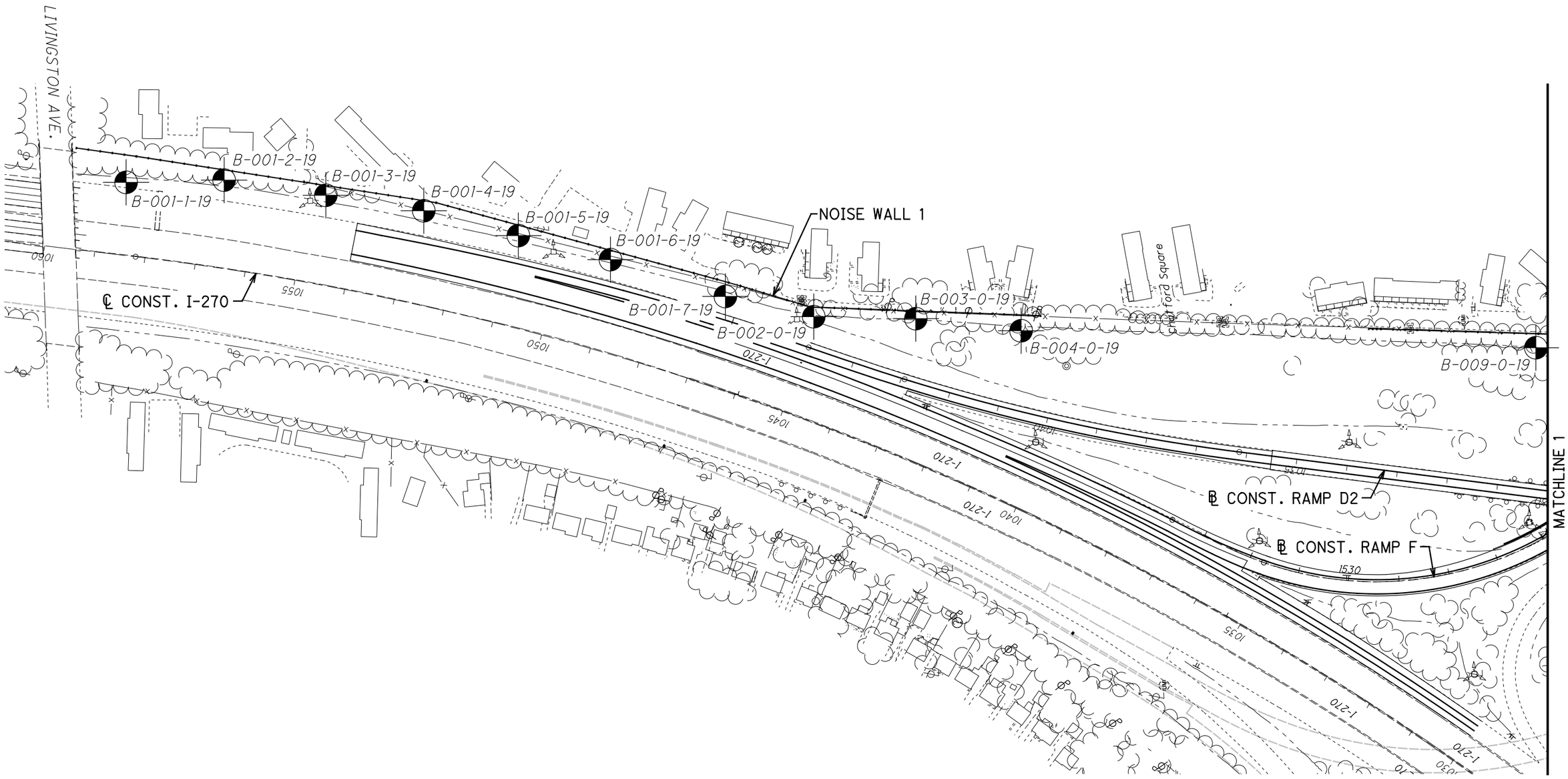

# VICINITY MAP

## FRA-70-22.85

## COLUMBUS, OHIO

| | |
|---|---|
| RII PROJECT NO. W-17-140 | DRAWN JAS |
| SCALE: 1"=5000' (0, 2500, 5000) | REVIEWED PPM |
| | DATE 1/15/2021 |

RESOURCE INTERNATIONAL Rii



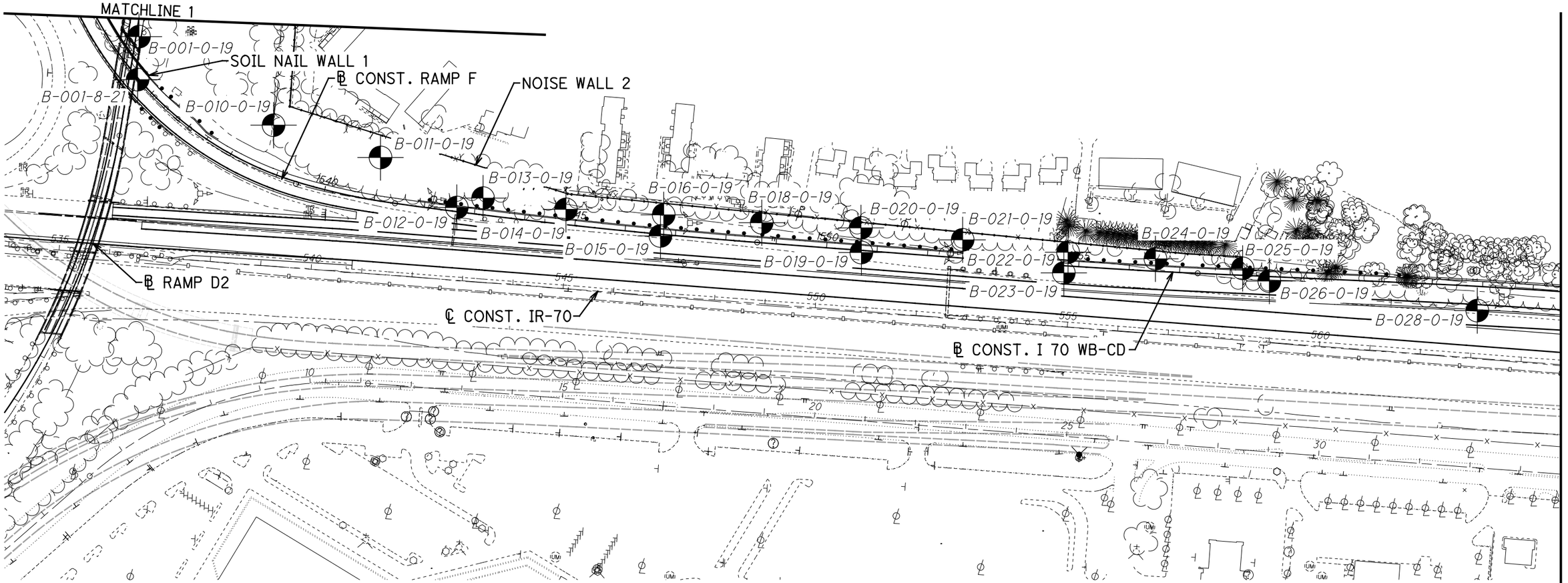

# BORING PLAN

## FRA-70-22.85

## FRANKLIN COUNTY, OHIO

| | |
|---|---|
| RII PROJECT NO. W-17-140 | DRAWN RRM |
| SCALE: 1"=200' (0 100 200) | REVIEWED BRT |
| | DATE 4/02/22 |

RESOURCE INTERNATIONAL Rii



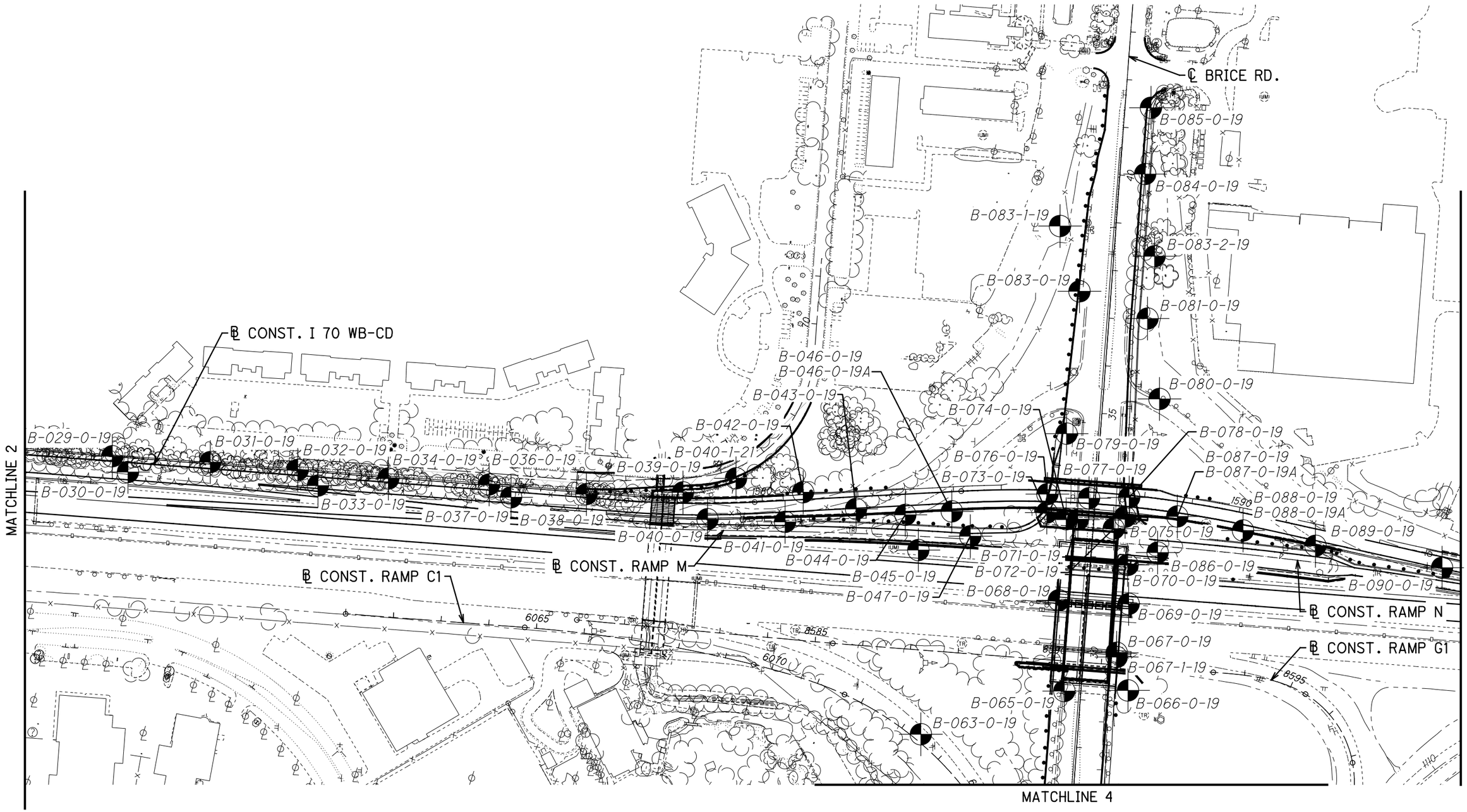

# BORING PLAN

## FRA-70-22.85

## FRANKLIN COUNTY, OHIO

| | | |
|---|---|---|
| RII PROJECT NO. W-17-140 | | DRAWN RRM |
| SCALE: 1"=200' 0 100 200 | N | REVIEWED BRT |
| | | DATE 4/02/22 |

RESOURCE INTERNATIONAL Rii



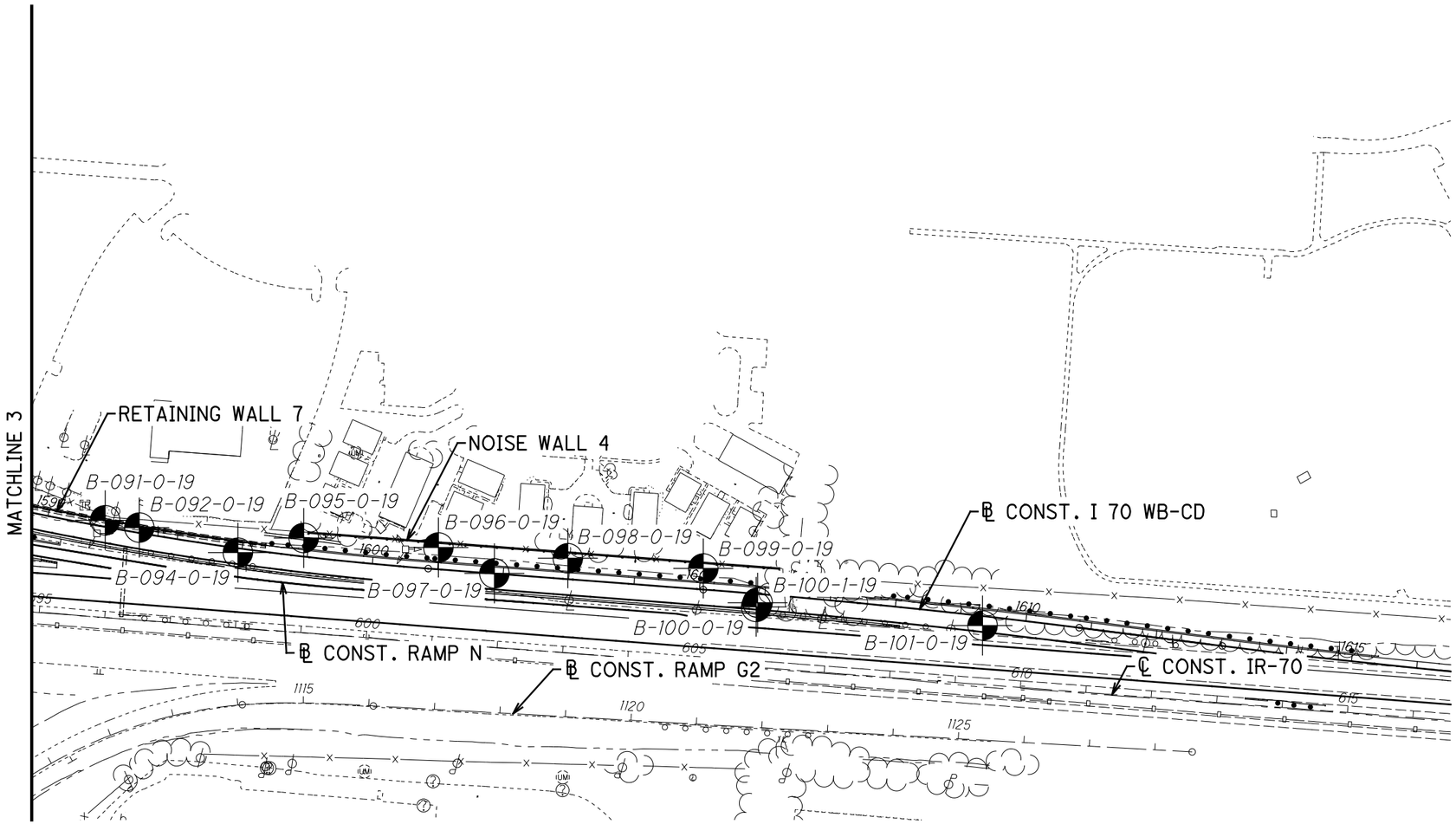

# BORING PLAN

## FRA-70-22.85

## FRANKLIN COUNTY, OHIO

| | | |
|---|---|---|
| RII PROJECT NO. W-17-140 | | DRAWN RRM |
| SCALE: 1"=200' 0 100 200 | N | REVIEWED BRT |
| | | DATE 4/02/22 |

RESOURCE INTERNATIONAL Rii



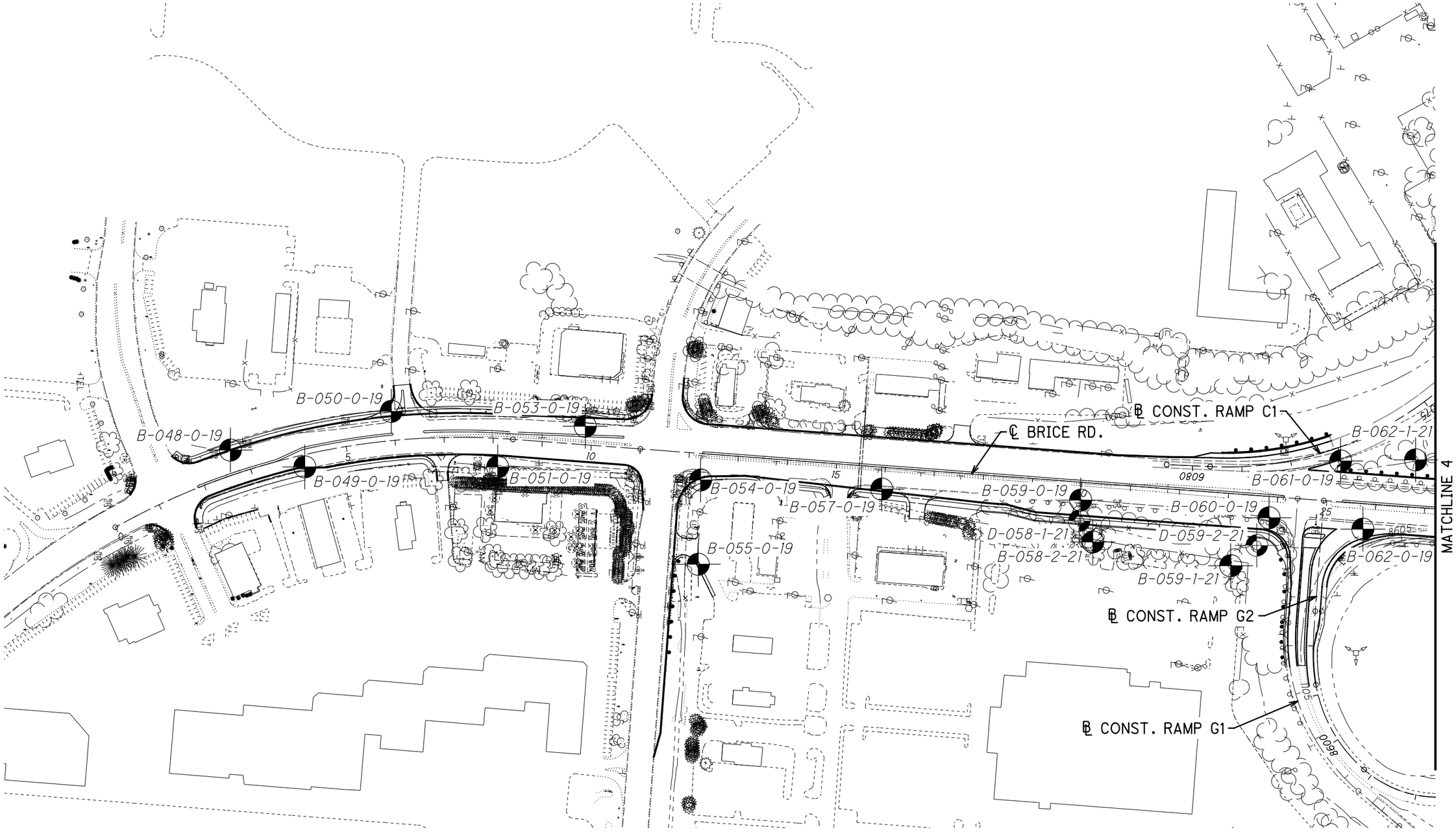

# BORING PLAN

## FRA-70-22.85

## FRANKLIN COUNTY, OHIO

| | | |
|---|---|---|
| RII PROJECT NO. W-17-140 | | DRAWN RRM |
| SCALE: 1″=200′ 0 100 200 | N | REVIEWED BRT |
| | | DATE 4/02/22 |

RESOURCE INTERNATIONAL Rii




# BORING PLAN

## FRA-70-22.85

## FRANKLIN COUNTY, OHIO

| | | |
|---|---|---|
| RII PROJECT NO. W-17-140 | | DRAWN RRM |
| SCALE: 1"=200' 0 100 200 | N | REVIEWED BRT |
| | | DATE 4/02/22 |

RESOURCE INTERNATIONAL Rii

# APPENDIX II

SCHEDULE OF BORINGS

# Schedule of Borings
# FRA-70-22.85 Far East Freeway
# Roadway, Culverts and Noise Barriers

| Boring Number | Alignment | Station | Offset | Latitude [1] | Longitude [1] | Ground Elevation [1] (feet) | Boring Depth (feet) |
|---|---|---|---|---|---|---|---|
| B-001-1-19 | CL Const. IR-270 | 1058+55 | 143.9' Rt. | 39.942745 | -82.846180 | 783.7 | 25.0 |
| B-001-2-19 | CL Const. IR-270 | 1056+67 | 173.2' Rt. | 39.942213 | -82.846189 | 784.1 | 25.0 |
| B-001-3-19 | CL Const. IR-270 | 1054+70 | 176.3' Rt. | 39.941664 | -82.846321 | 785.6 | 25.0 |
| B-001-4-19 | CL Const. IR-270 | 1052+80 | 183.9' Rt. | 39.941136 | -82.846455 | 786.6 | 25.0 |
| B-001-5-19 | CL Const. IR-270 | 1050+92 | 178.8' Rt. | 39.940627 | -82.846653 | 785.6 | 25.0 |
| B-001-6-19 | CL Const. IR-270 | 1049+10 | 179.8' Rt. | 39.940133 | -82.846846 | 785.2 | 25.0 |
| B-001-7-19 | CL Const. IR-270 | 1046+78 | 176.9' Rt. | 39.939516 | -82.847134 | 784.8 | 25.0 |
| B-002-0-19 | CL Const. IR-270 | 1045+06 | 196.2' Rt. | 39.939040 | -82.847300 | 783.6 | 25.0 |
| B-003-0-19 | BL Ramp D2 | 1043+08 | 121.0' Rt. | 39.938487 | -82.847339 | 783.5 | 25.0 |
| B-004-0-19 | BL Ramp D2 | 1040+94 | 155.2' Rt. | 39.937918 | -82.847451 | 784.1 | 25.0 |
| B-009-0-19 | BL Ramp D2 | 1030+59 | 278.0' Rt. | 39.935128 | -82.847700 | 779.8 | 23.9 |
| B-010-0-19 | BL Ramp F | 1538+53 | 93.1' Lt. | 39.934517 | -82.847759 | 778.8 | 24.3 |
| B-011-0-19 | BL IR 70 WB-CD | 1541+00 | 85.7' Lt. | 39.934344 | -82.847004 | 782.7 | 23.7 |
| B-012-0-19 | BL IR 70 WB-CD | 1542+64 | 8.1' Lt. | 39.934074 | -82.846464 | 784.8 | 10.0 |
| B-013-0-19 | BL IR 70 WB-CD | 1543+13 | 33.0' Lt. | 39.934125 | -82.846279 | 781.9 | 25.0 |
| B-014-0-19 | BL IR 70 WB-CD | 1544+79 | 30.1' Lt. | 39.934066 | -82.845694 | 781.4 | 25.0 |
| B-015-0-19 | BL IR 70 WB-CD | 1546+71 | 3.4' Rt. | 39.933924 | -82.845027 | 788.3 | 10.0 |
| B-016-0-19 | BL IR 70 WB-CD | 1546+73 | 38.9' Lt. | 39.934038 | -82.845005 | 782.1 | 25.0 |
| B-018-0-19 | BL IR 70 WB-CD | 1548+68 | 39.5' Lt. | 39.933997 | -82.844313 | 784.6 | 25.0 |
| B-019-0-19 [2] | BL IR 70 WB-CD | 1550+69 | 4.3' Rt. | 39.933838 | -82.843610 | 788.9 | 10.0 |
| B-020-0-19 | BL IR 70 WB-CD | 1550+65 | 44.3' Lt. | 39.933972 | -82.843613 | 786.1 | 25.0 |
| B-021-0-19 | BL IR 70 WB-CD | 1552+67 | 36.1' Lt. | 39.933909 | -82.842896 | 786.4 | 25.0 |
| B-022-0-19 | BL IR 70 WB-CD | 1554+77 | 27.1' Lt. | 39.933844 | -82.842152 | 785.6 | 25.0 |
| B-023-0-19 | BL IR 70 WB-CD | 1554+72 | 14.4' Rt. | 39.933731 | -82.842182 | 789.5 | 10.0 |
| B-024-0-09 | BL IR 70 WB-CD | 1556+51 | 24.6' Lt. | 39.933810 | -82.841536 | 787.6 | 25.0 |
| B-025-0-19 | BL IR 70 WB-CD | 1558+24 | 13.7' Lt. | 39.933760 | -82.840921 | 789.1 | 25.0 |
| B-026-0-19 | BL IR 70 WB-CD | 1558+78 | 9.0' Rt. | 39.933691 | -82.840732 | 786.6 | 10.0 |
| B-028-0-19 [2] | BL IR 70 WB-CD | 1562+92 | 47.9' Rt. | 39.933535 | -82.839265 | 792.3 | 10.0 |
| B-029-0-19 | BL IR 70 WB-CD | 1566+37 | 10.7' Lt. | 39.933633 | -82.838025 | 790.6 | 25.0 |
| B-030-0-19 [2] | BL IR 70 WB-CD | 1566+73 | 19.5' Rt. | 39.933544 | -82.837907 | 790.3 | 10.0 |
| B-031-0-19 | BL IR 70 WB-CD | 1568+43 | 14.0' Lt. | 39.933602 | -82.837294 | 793.9 | 25.0 |
| B-032-0-19 | BL IR 70 WB-CD | 1570+26 | 11.8' Lt. | 39.933559 | -82.836642 | 795.1 | 25.0 |
| B-033-0-19 [2] | BL IR 70 WB-CD | 1570+71 | 17.7' Rt. | 39.933470 | -82.836491 | 794.9 | 10.0 |
| B-034-0-19 | BL IR 70 WB-CD | 1572+16 | 8.0' Lt. | 39.933511 | -82.835968 | 793.0 | 25.0 |
| B-036-0-19 | BL IR 70 WB-CD | 1574+27 | 11.7' Lt. | 39.933480 | -82.835216 | 791.6 | 25.0 |
| B-037-0-19 [2] | BL IR 70 WB-CD | 1574+75 | 11.4' Rt. | 39.933407 | -82.835052 | 790.7 | 10.0 |
| B-038-0-19 | BL IR 70 WB-CD | 1576+31 | 7.1' Lt. | 39.933426 | -82.834491 | 788.1 | 25.0 |
| B-039-0-19 | BL IR 70 WB-CD | 1578+33 | 22.6' Lt. | 39.933438 | -82.833771 | 788.6 | 25.0 |
| B-040-0-19 | BL IR 70 WB-CD | 1578+85 | 32.8' Rt. | 39.933285 | -82.833587 | 788.6 | 25.0 |
| B-040-1-21 [2] | BL IR 70 WB-CD | 1579+47 | 51.3' Lt. | 39.933520 | -82.833376 | 788.7 | 20.0 |
| B-042-0-19 | BL IR 70 WB-CD | 1580+86 | 15.2' Lt. | 39.933442 | -82.832876 | 790.0 | 25.0 |
| B-048-0-19 | CL Const. Brice Rd | 2+73 | 49.4' Lt. | 39.925040 | -82.831246 | 787.0 | 6.0 |
| B-049-0-19 | CL Const. Brice Rd | 4+09 | 24.5' Rt. | 39.925456 | -82.831126 | 784.6 | 7.5 |
| B-050-0-19 | CL Const. Brice Rd | 5+98 | 59.4' Lt. | 39.925938 | -82.831531 | 785.0 | 6.0 |
| B-051-0-19 | CL Const. Brice Rd | 8+12 | 58.3' Rt. | 39.926532 | -82.831130 | 783.5 | 6.0 |
| B-053-0-19 | CL Const. Brice Rd | 9+85 | 37.5' Lt. | 39.927020 | -82.831428 | 786.4 | 7.5 |

## Schedule of Borings
## FRA-70-22.85 Far East Freeway
## Roadway, Culverts and Noise Barriers

| Boring Number | Alignment | Station | Offset | Latitude [1] | Longitude [1] | Ground Elevation [1] (feet) | Boring Depth (feet) |
|---|---|---|---|---|---|---|---|
| B-054-0-19 | CL Const. Brice Rd | 12+27 | 53.7' Rt. | 39.927665 | -82.831041 | 784.9 | 40.0 |
| B-055-0-19 | CL Const. Brice Rd | 12+35 | 225.0' Rt. | 39.927654 | -82.830430 | 788.9 | 40.0 |
| B-057-0-19 | CL Const. Brice Rd | 15+96 | 44.6' Rt. | 39.928677 | -82.830980 | 788.1 | 6.0 |
| D-058-1-21 [2] | CL Const. Brice Rd | 20+01 | 78.3' Rt. | 39.929781 | -82.830756 | 788.8 | 10.0 |
| B-058-2-21 [2] | CL Const. Brice Rd | 20+32 | 119.3' Rt. | 39.929857 | -82.830603 | 792.3 | 10.0 |
| B-059-0-19 | CL Const. Brice Rd | 20+01 | 36.3' Rt. | 39.929788 | -82.830906 | 799.5 | 7.5 |
| B-059-1-21 [2] | CL Const. Brice Rd | 23+15 | 146.3' Rt. | 39.930627 | -82.830434 | 790.9 | 15.0 |
| D-059-2-21 [2] | CL Const. Brice Rd | 23+65 | 101.1' Rt. | 39.930772 | -82.830582 | 802.5 | 13.0 |
| B-060-0-19 | CL Const. Brice Rd | 23+86 | 43.2' Rt. | 39.930840 | -82.830783 | 810.8 | 7.5 |
| B-061-0-19 | BL Ramp C1 | 6077+04 | 27.1' Lt. | 39.931239 | -82.831196 | 809.4 | 6.5 |
| B-062-0-19 | CL Const. Brice Rd | 25+78 | 51.9' Rt. | 39.931364 | -82.830703 | 814.5 | 6.0 |
| B-062-1-21 | CL Const. Brice Rd | 26+74 | 96.5' Lt. | 39.931657 | -82.831206 | 795.0 | 15.0 |
| B-063-0-19 [2] | BL Ramp C1 | 6073+39 | 14.7' Lt. | 39.932055 | -82.831992 | 798.3 | 6.0 |
| B-079-0-19 | CL Const. Brice Rd | 34+53 | 70.4' Lt. | 39.933784 | -82.830914 | 818.6 | 10.0 |
| B-080-0-19 [2] | CL Const. Brice Rd | 35+39 | 117.7' Rt. | 39.933984 | -82.830223 | 816.0 | 25.0 |
| B-081-0-19 [2] | CL Const. Brice Rd | 37+05 | 80.1' Rt. | 39.934446 | -82.830314 | 798.9 | 25.0 |
| B-083-0-19 [2] | CL Const. Brice Rd | 37+51 | 65.9' Lt. | 39.934600 | -82.830822 | 811.7 | 6.0 |
| B-083-1-19 [2] | CL Const. Brice Rd | 38+84 | 116.9' Lt. | 39.934975 | -82.830969 | 797.5 | 40.0 |
| B-083-2-19 [2] | CL Const. Brice Rd | 38+36 | 85.1' Rt. | 39.934804 | -82.830263 | 793.9 | 40.0 |
| B-084-0-19 | CL Const. Brice Rd | 40+06 | 52.4' Rt. | 39.935275 | -82.830336 | 805.3 | 25.0 |
| B-085-0-19 | CL Const. Brice Rd | 41+45 | 54.1' Rt. | 39.935656 | -82.830294 | 802.4 | 25.0 |
| B-090-0-19 [2] | BL IR 70 WB-CD | 1594+39 | 22.4' Rt. | 39.933022 | -82.828113 | 800.5 | 10.0 |
| B-094-0-19 | BL IR 70 WB-CD | 1597+94 | 6.8' Rt. | 39.932898 | -82.826851 | 803.3 | 10.0 |
| B-095-0-19 | BL IR 70 WB-CD | 1598+91 | 28.2' Lt. | 39.932960 | -82.826493 | 799.6 | 25.0 |
| B-096-0-19 | BL IR 70 WB-CD | 1600+98 | 33.1' Lt. | 39.932922 | -82.825762 | 800.9 | 25.0 |
| B-097-0-19 | BL IR 70 WB-CD | 1601+87 | 0.3' Lt. | 39.932815 | -82.825457 | 806.1 | 10.0 |
| B-098-0-19 | BL IR 70 WB-CD | 1602+96 | 31.8' Lt. | 39.932879 | -82.825058 | 802.6 | 25.0 |
| B-099-0-19 | BL IR 70 WB-CD | 1605+03 | 32.0' Lt. | 39.932839 | -82.824321 | 805.4 | 25.0 |
| B-100-0-19 | BL IR 70 WB-CD | 1605+88 | 19.8' Rt. | 39.932679 | -82.824034 | 809.1 | 10.0 |
| B-100-1-19 [2] | BL IR 70 WB-CD | 1605+90 | 13.3' Rt. | 39.932697 | -82.824026 | 808.5 | 40.0 |
| B-101-0-19 | BL IR 70 WB-CD | 1609+35 | 14.2' Rt. | 39.932604 | -82.822802 | 811.2 | 10.0 |

1. *Ground surface elevations and coordinates were provided by EMH&T survey.*
2. *Borings were not able to be surveyed. Coordinates based on handheld GPS. Elevations and stationing based on basemapping information provided by EMH&T.*

# APPENDIX III

DESCRIPTION OF SOIL

# CLASSIFICATION OF SOILS

Ohio Department of Transportation

(The classification of a soil is found by proceeding from top to bottom of the chart.
The first classification that the test data fits is the correct classification.)

| SYMBOL | DESCRIPTION | Classifcation | | $LL_O/LL$ x 100* | % Pass #40 | % Pass #200 | Liquid Limit (LL) | Plastic Index (PI) | Group Index Max. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | AASHTO | OHIO | | | | | | | |
|  | Gravel and/or Stone Fragments | A-1-a | | | 30 Max. | 15 Max. | | 6 Max. | 0 | Min. of 50% combined gravel, cobble and boulder sizes |
|  | Gravel and/or Stone Fragments with Sand | A-1-b | | | 50 Max. | 25 Max. | | 6 Max. | 0 | |
|  | Fine Sand | A-3 | | | 51 Min. | 10 Max. | NON-PLASTIC | | 0 | |
|  | Coarse and Fine Sand | -- | A-3a | | | 35 Max. | | 6 Max. | 0 | Min. of 50% combined coarse and fine sand sizes |
|  | Gravel and/or Stone Fragments with Sand and Silt | A-2-4 | | | | 35 Max. | 40 Max. | 10 Max. | 0 | |
| | | A-2-5 | | | | | 41 Min. | | | |
|  | Gravel and/or Stone Fragments with Sand, Silt and Clay | A-2-6 | | | | 35 Max. | 40 Max. | 11 Min. | 4 | |
| | | A-2-7 | | | | | 41 Min. | | | |
|  | Sandy Silt | A-4 | A-4a | 76 Min. | | 36 Min. | 40 Max. | 10 Max. | 8 | Less than 50% silt sizes |
|  | Silt | A-4 | A-4b | 76 Min. | | 50 Min. | 40 Max. | 10 Max. | 8 | 50% or more silt sizes |
|  | Elastic Silt and Clay | A-5 | | 76 Min. | | 36 Min. | 41 Min. | 10 Max. | 12 | |
|  | Silt and Clay | A-6 | A-6a | 76 Min. | | 36 Min. | 40 Max. | 11 - 15 | 10 | |
|  | Silty Clay | A-6 | A-6b | 76 Min. | | 36 Min. | 40 Max. | 16 Min. | 16 | |
|  | Elastic Clay | A-7-5 | | 76 Min. | | 36 Min. | 41 Min. | $\leq$LL-30 | 20 | |
|  | Clay | A-7-6 | | 76 Min. | | 36 Min. | 41 Min. | >LL-30 | 20 | |
|  | Organic Silt | A-8 | A-8a | 75 Max. | | 36 Min. | | | | W/o organics would classify as A-4a or A-4b |
|  | Organic Clay | A-8 | A-8b | 75 Max. | | 36 Min. | | | | W/o organics would classify as A-5, A-6a, A-6b, A-7-5 or A-7-6 |

MATERIAL CLASSIFIED BY VISUAL INSPECTION

 Sod and Topsoil

 Pavement or Base

 Uncontrolled Fill (Describe)

 Bouldery Zone

Peat

* Only perform the oven-dried liquid limit test and this calculation if organic material is present in the sample.

## DESCRIPTION OF SOIL TERMS

The following terminology was used to describe soils throughout this report and is generally adapted from ASTM 2487/2488 and ODOT Specifications for Geotechnical Explorations.

**Granular Soils** - The relative compactness of granular soils is described as:
ODOT A-1, A-2, A-3, A-4 (non-plastic) or USCS GW, GP, GM, GC, SW, SP, SM, SC, ML (non-plastic)

| Description | Blows per foot – SPT ($N_{60}$) | | |
|---|---|---|---|
| Very Loose | Below | | 5 |
| Loose | 5 | - | 10 |
| Medium Dense | 11 | - | 30 |
| Dense | 31 | - | 50 |
| Very Dense | Over | | 50 |

**Cohesive Soils** - The relative consistency of cohesive soils is described as:
ODOT A-4, A-5, A-6, A-7, A-8 or USCS ML, CL, OL, MH, CH, OH, PT

| Description | Unconfined Compression (tsf) | | |
|---|---|---|---|
| Very Soft | Less than | | 0.25 |
| Soft | 0.25 | - | 0.5 |
| Medium Stiff | 0.5 | - | 1.0 |
| Stiff | 1.0 | - | 2.0 |
| Very Stiff | 2.0 | - | 4.0 |
| Hard | Over | | 4.0 |

**Gradation** - The following size-related denominations are used to describe soils:

| Soil Fraction | | USCS Size | ODOT Size |
|---|---|---|---|
| Boulders | | Larger than 12” | Larger than 12” |
| Cobbles | | 12” to 3” | 12” to 3” |
| Gravel | coarse | 3” to ¾” | 3” to ¾“ |
| | fine | ¾” to 4.75 mm (¾” to #4 Sieve) | ¾” to 2.0 mm (¾” to #10 Sieve) |
| Sand | coarse | 4.75 mm to 2.0 mm (#4 to #10 Sieve) | 2.0 mm to 0.42 mm (#10 to #40 Sieve) |
| | medium | 2.0 mm to 0.42 mm (#10 to #40 Sieve) | - |
| | fine | 0.42 mm to 0.074 mm (#40 to #200 Sieve) | 0.42 mm to 0.074 mm (#40 to #200 Sieve) |
| Silt | | 0.074 mm to 0.005 mm (#200 to 0.005 mm) | 0.074 mm to 0.005 mm (#200 to 0.005 mm) |
| Clay | | Smaller than 0.005 mm | Smaller than 0.005 mm |

**Modifiers of Components** - Modifiers of components are as follows:

| Term | Range | | |
|---|---|---|---|
| Trace | 0% | - | 10% |
| Little | 10% | - | 20% |
| Some | 20% | - | 35% |
| And | 35% | - | 50% |

**Moisture Table** - The following moisture-related denominations are used to describe cohesive soils:

| Term | Range - USCS | Range - ODOT |
|---|---|---|
| Dry | 0% to 10% | Well below Plastic Limit |
| Damp | >2% below Plastic Limit | Below Plastic Limit |
| Moist | 2% below to 2% above Plastic Limit | Above PL to 3% below LL |
| Very Moist | >2% above Plastic Limit | |
| Wet | ≥ Liquid Limit | 3% below LL to above LL |

**Organic Content** – The following terms are used to describe organic soils:

| Term | Organic Content (%) |
|---|---|
| Slightly organic | 2-4 |
| Moderately organic | 4-10 |
| Highly organic | >10 |

**Bedrock** – The following terms are used to describe the relative strength of bedrock:

| Description | Field Parameter |
|---|---|
| Very Weak | Can be carved with knife and scratched by fingernail. Pieces 1 in. thick can be broken by finger pressure. |
| Weak | Can be grooved or gouged with knife readily. Small, thin pieces can be broken by finger pressure. |
| Slightly Strong | Can be grooved or gouged 0.05 in deep with knife. 1 in. size pieces from hard blows of geologist hammer. |
| Moderately Strong | Can be scratched with knife or pick. 1/4 in. size grooves or gouges from blows of geologist hammer. |
| Strong | Can be scratched with knife or pick with difficulty. Hard hammer blows to detach hand specimen. |
| Very Strong | Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to detach hand specimen. |
| Extremely Strong | Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to chip hand specimen. |

## DESCRIPTION OF ROCK TERMS

The following terminology was used to describe the rock throughout this report and is generally adapted from ASTM D5878 and the ODOT Specifications for Geotechnical Explorations.

**Weathering** – Describes the degree of weathering of the rock mass:

| Description | Field Parameter |
|---|---|
| Unweathered | No evidence of any chemical or mechanical alteration of the rock mass. Mineral crystals have a right appearance with no discoloration. Fractures show little or not staining on surfaces. |
| Slightly Weathered | Slight discoloration of the rock surface with minor alterations along discontinuities. Less than 10% of the rock volume presents alteration. |
| Moderately Weathered | Portions of the rock mass are discolored as evident by a dull appearance. Surfaces may have a pitted appearance with weathering "halos" evident. Isolated zones of varying rock strengths due to alteration may be present. 10 to 15% of the rock volume presents alterations. |
| Highly Weathered | Entire rock mass appears discolored and dull. Some pockets of slightly to moderately weathered rock may be present and some areas of severely weathered materials may be present. |
| Severely Weathered | Majority of the rock mass reduced to a soil-like state with relic rock structure discernable. Zones of more resistant rock may be present but the material can generally be molded and crumbled by hand pressures. |

**Strength of Bedrock** – The following terms are used to describe the relative strength of bedrock:

| Description | Field Parameter |
|---|---|
| Very Weak | Can be carved with knife and scratched by fingernail. Pieces 1 in. thick can be broken by finger pressure. |
| Weak | Can be grooved or gouged with knife readily. Small, thin pieces can be broken by finger pressure. |
| Slightly Strong | Can be grooved or gouged 0.05 in deep with knife. 1 in. size pieces from hard blows of geologist hammer. |
| Moderately Strong | Can be scratched with knife or pick. 1/4 in. size grooves or gouges from blows of geologist hammer. |
| Strong | Can be scratched with knife or pick with difficulty. Hard hammer blows to detach hand specimen. |
| Very Strong | Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to detach hand specimen. |
| Extremely Strong | Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to chip hand specimen. |

**Bedding Thickness** – Description of bedding thickness as the average perpendicular distances between bedding surfaces:

| Description | Thickness |
|---|---|
| Very Thick | Greater than 36 inches |
| Thick | 18 to 36 inches |
| Medium | 10 to 18 inches |
| Thin | 2 to 10 inches |
| Very Thin | 0.4 to 2 inches |
| Laminated | 0.1 to 0.4 inches |
| Thinly Laminated | Less than 0.1 inches |

**Fracturing** – Describes the degree and condition of fracturing (fault, joint, or shear):

**Degree of Fracturing**

| Description | Spacing |
|---|---|
| Unfractured | Greater than 10 feet |
| Intact | 3 to 10 feet |
| Slightly Fractured | 1 to 3 feet |
| Moderately Fractured | |

**Aperture Width**

| Description | Width |
|---|---|
| Open | Greater than 0.2 inches |
| Narrow | 0.05 to 0.2 inches |
| Tight | Less than 0.05 inches |

**Surface Roughness**

| Description | Criteria |
|---|---|
| Very Rough | Near vertical steps and ridges occur on surface |
| Slightly Rough | Asperities on the surfaces distinguishable |
| Slickensided | Surface has smooth, glassy finish, evidence of Striations |

**RQD** – Rock Quality Designation (calculation shown in report) and Rock Quality (ODOT, GB 3, January 13, 2006):

| RQD % | Rock Index Property Classification (based on RQD, not slake durability index) |
|---|---|
| 0 – 25% | Very Poor |
| 26 – 50% | Poor |
| 51 – 70% | Fair |
| 71 – 85% | Good |
| 86 – 100% | Very Good |

# APPENDIX IV

PROJECT BORING LOGS

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH | DRILL RIG: CME 55 (386345) | STATION / OFFSET: 1029+65.04 / 6.1' RT | **EXPLORATION ID B-001-0-19** | |
| TYPE: RETAINING WALL | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: BL RAMP D2 | | |
| PID: 98232 SFN: N/A | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/4/18 | ELEVATION: 803.4 (MSL) EOB: 38.7 ft. | | PAGE 1 OF 2 |
| START: 8/4/20 END: 8/4/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90 | LAT / LONG: 39.934994, -82.848710 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 803.4 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0' - ASPHALT (12.0") | 802.4 | | | | | | | | | | | | | | | | | | |
| 0.3' - AGGREGATE BASE (4.0") | 802.1 | | | | | | | | | | | | | | | | | | |
| **FILL**: STIFF TO VERY STIFF, BROWN, GRAY AND DARK BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 5 7 5 | 18 | 50 | SS-1 | 4.00 | - | - | - | - | - | - | - | - | 18 | A-6b (V) | - | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 7 3 4 | 11 | 44 | SS-2 | 2.00 | - | - | - | - | - | - | - | - | 24 | A-6b (V) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 6 4 5 | 14 | 58 | SS-3 | 2.75 | - | - | - | - | - | - | - | - | 20 | A-6b (V) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 4 4 6 | 15 | 69 | SS-4 | 3.00 | 7 | 16 | 14 | 30 | 33 | 37 | 19 | 18 | 18 | A-6b (9) | - | |
| | | 10 | | | | | | | | | | | | | | | | | |
| | | 11 | 5 6 7 | 20 | 92 | SS-5 | 3.50 | - | - | - | - | - | - | - | - | 15 | A-6b (V) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 4 8 10 | 27 | 33 | SS-6 | 3.50 | - | - | - | - | - | - | - | - | 13 | A-6b (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 10 9 10 | 29 | 67 | SS-7 | 3.00 | - | - | - | - | - | - | - | - | 20 | A-6b (V) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 12 15 14 | 44 | 61 | SS-8 | 3.00 | 1 | 6 | 14 | 38 | 41 | 38 | 19 | 19 | 17 | A-6b (12) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| -TRACE LIMESTONE FRAGMENTS IN SS-9 | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 9 15 24 | 59 | 33 | SS-9 | 3.25 | - | - | - | - | - | - | - | - | 14 | A-6b (V) | - | |
| | 780.4 | 23 | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, BROWN, GRAY AND DARK BROWN TO BLACK **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 24 | 10 11 13 | 36 | 44 | SS-10 | 3.00 | 2 | 11 | 16 | 37 | 34 | 29 | 16 | 13 | 7 | A-6a (8) | - | |
| -LIMESTONE FRAGMENTS IN SS-10 | | 25 | | | | | | | | | | | | | | | | | |
| | | 26 | | | | | | | | | | | | | | | | | |
| | | 27 | | | | | | | | | | | | | | | | | |
| | | 28 | | | | | | | | | | | | | | | | | |
| -SHALE FRAGMENTS IN SS-11 | | 29 | 8 13 10 | 35 | 44 | SS-11 | - | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |

| PID: 98232 | SFN: | PROJECT: FRA-070-22.85 | STATION / OFFSET: 102965.04, 6' RT. | START: 8/4/20 | END: 8/4/20 | PG 2 OF 2 | B-001-0-19 |
|---|---|---|---|---|---|---|---|

| MATERIAL DESCRIPTION AND NOTES | ELEV. 773.4 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VERY STIFF TO HARD, BROWN, GRAY AND DARK BROWN TO BLACK **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. *(continued)* | | ▽ 771.8 | | | | | | | | | | | | | | | | | |
| | 769.9 | TR | | | | | | | | | | | | | | | | | |
| **SHALE** : BLACK, HIGHLY WEATHERED. | | | 10<br>17<br>23 | 60 | 69 | SS-12 | - | - | - | - | - | - | - | - | - | 8 | Rock (V) | - | |
| | | W 767.4 | | | | | | | | | | | | | | | | | |
| | 764.6 | EOB | 60/3" | - | 100 | SS-13 | - | - | - | - | - | - | - | - | - | 13 | Rock (V) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 36.0' AND AT COMPLETION @ 31.6'; CAVE-IN DEPTH @ 34.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 50 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1058+54.55 / 143.9' RT | **EXPLORATION ID B-001-1-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. IR-270 | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 783.7 (MSL) EOB: 25.0 ft. | | PAGE 1 OF 1 |
| START: 9/24/20 END: 9/24/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.942745, -82.846180 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 783.7 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (4.5") | 783.2 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF TO HARD, BROWNISH GRAY **SANDY SILT**, SOME CLAY, SOME FINE GRAVEL, DAMP TO MOIST. | | 1 | 3 5 5 | 14 | 81 | SS-1B | 4.25 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 2 3 | 5 7 8 | 22 | 83 | SS-2 | 4.5+ | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| -COBBLE @ 5.0' | 778.2 | 4 5 | 4 5 11 | 23 | 75 | SS-3 | 3.50 | 25 | 13 | 13 | 28 | 21 | 23 | 15 | 8 | 11 | A-4a (3) | - | |
| MEDIUM DENSE TO DENSE, BROWNISH GRAY **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, MOIST. | | 6 7 | 19 17 18 | 50 | 0 | SS-4 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | 8 | 16 | - | 100 | 2S-4A | - | - | - | - | - | - | - | - | - | 7 | A-1-b (V) | - | |
| | 773.2 | 9 10 | 9 8 8 | 23 | 83 | SS-5 | - | 46 | 22 | 8 | 17 | 7 | NP | NP | NP | 12 | A-1-b (0) | - | |
| MEDIUM DENSE, BROWN **COARSE AND FINE SAND**, TRACE SILT, WET. | 770.7 | 11 12 | 11 7 10 | 24 | 78 | SS-6 | - | - | - | - | - | - | - | - | - | 15 | A-3a (V) | - | |
| | ▽ 770.7 | 13 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO DENSE, BROWN TO DARK GRAY **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, WET. | | 14 | 18 15 14 | 42 | 92 | SS-7 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | W 768.2 | 15 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 11 11 14 | 36 | 50 | SS-8 | - | - | - | - | - | - | - | - | - | 16 | A-1-b (V) | - | |
| -SHALE FRAGMENTS IN SS-9 | | 18 19 | 9 10 14 | 34 | 89 | SS-9 | - | 46 | 28 | 10 | 11 | 5 | NP | NP | NP | 12 | A-1-b (0) | - | |
| -HEAVING SAND @ 21.0' | | 20 21 22 | 6 8 13 | 30 | 81 | SS-10 | - | - | - | - | - | - | - | - | - | 15 | A-1-b (V) | - | |
| | | 23 24 | 11 14 14 | 40 | 89 | SS-11 | - | - | - | - | - | - | - | - | - | 12 | A-1-b (V) | - | |
| | 758.7 | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 13.1'; GROUNDWATER ENCOUNTERED INITIALLY @ 15.5' AND AT COMPLETION @ 13.0'; CAVE-IN DEPTH @ 15.6'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1056+67.13 / 173.2' RT | **EXPLORATION ID B-001-2-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. IR-270 | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 784.1 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/24/20 END: 9/24/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.942213, -82.846189 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 784.1 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (4.0") | 783.8 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF, MOTTLED GRAY AND BROWN **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, MOIST TO WET. | | 1 | 2 3 4 | 10 | 61 | SS-1B | 3.00 | - | - | - | - | - | - | - | - | 18 | A-4a (V) | - | |
| | | 2 3 | 3 3 3 | 9 | 58 | SS-2 | 2.50 | - | - | - | - | - | - | - | - | 25 | A-4a (V) | - | |
| | | 4 5 | 3 4 6 | 14 | 64 | SS-3 | 2.50 | 12 | 11 | 15 | 36 | 26 | 24 | 17 | 7 | 17 | A-4a (5) | - | |
| | 778.6 | | | | | | | | | | | | | | | | | | |
| LOOSE TO MEDIUM DENSE, GRAY **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, WET. | | 6 7 | 3 3 6 | 13 | 72 | SS-4 | - | - | - | - | - | - | - | - | - | 11 | A-3a (V) | - | |
| | | 8 9 | 3 1 4 | 7 | 0 | SS-5 | - | - | - | - | - | - | - | - | - | - | | - | |
| | 773.6 | 10 | 7 | - | 100 | 2S-5A | - | - | - | - | - | - | - | - | - | 22 | A-3a (V) | - | |
| MEDIUM DENSE TO VERY DENSE, BROWNISH GRAY TO GRAY **GRAVEL**, SOME FINE TO COARSE SAND, TRACE SILT, TRACE CLAY, MOIST TO WET. | | 11 12 | 11 9 14 | 33 | 72 | SS-6 | - | - | - | - | - | - | - | - | - | 12 | A-1-a (V) | - | |
| ▽ 770.1 | | 13 14 | 8 8 11 | 27 | 83 | SS-7 | - | - | - | - | - | - | - | - | - | 13 | A-1-a (V) | - | |
| W 767.6 | | 15 16 | 9 11 12 | 33 | 83 | SS-8 | - | 69 | 15 | 6 | 6 | 4 | NP | NP | NP | 19 | A-1-a (0) | - | |
| | | 17 18 19 | 14 12 24 | 52 | 56 | SS-9 | - | - | - | - | - | - | - | - | - | 19 | A-1-a (V) | - | |
| | | 20 21 | 22 15 17 | 46 | 0 | SS-10 | - | - | - | - | - | - | - | - | - | - | A-1-a (V) | - | |
| | | 22 | 20 | - | 100 | 2S-10A | - | - | - | - | - | - | - | - | - | 11 | A-1-a (V) | - | |
| | 759.1 | 23 24 | 15 13 16 | 42 | 78 | SS-11 | - | - | - | - | - | - | - | - | - | 11 | A-1-a (V) | - | |
| | | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 8.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 16.5' AND AT COMPLETION @ 14.0'; CAVE-IN DEPTH @ 12.4'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1054+69.76 / 176.3' RT | **EXPLORATION ID B-001-3-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. IR-270 | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 785.6 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/24/20 END: 9/24/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.941664, -82.846321 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 785.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 785.3 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| **FILL**: VERY STIFF TO HARD, BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 3 3 4 | 10 | 72 | SS-1B | 3.75 | - | - | - | - | - | - | - | - | 16 | A-4a (V) | - | |
| | | 2 | 4 6 9 | 22 | 67 | SS-2 | 4.5+ | - | - | - | - | - | - | - | - | 14 | A-4a (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 4 7 7 | 20 | 94 | SS-3 | 4.00 | 9 | 13 | 16 | 35 | 27 | 24 | 16 | 8 | 15 | A-4a (5) | - | |
| -COBBLE @ 5.5' | 780.1 | 5 | | | | | | | | | | | | | | | | | |
| **FILL**: VERY DENSE, BROWNISH GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST. | 777.6 | 6 | 6 12 24 | 52 | 89 | SS-4 | - | 46 | 14 | 11 | 19 | 10 | 24 | 16 | 8 | 8 | A-2-4 (0) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO VERY DENSE, BROWN TO GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST TO WET. | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 20 19 18 | 53 | 92 | SS-5 | - | - | - | - | - | - | - | - | - | 6 | A-2-4 (V) | - | |
| ▽ 774.1 | | 10 | | | | | | | | | | | | | | | | | |
| | | 11 | 26 21 20 | 59 | 53 | SS-6 | - | - | - | - | - | - | - | - | - | 6 | A-2-4 (V) | - | |
| W 772.6 | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 8 11 11 | 32 | 50 | SS-7 | - | - | - | - | - | - | - | - | - | 12 | A-2-4 (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 9 10 11 | 30 | 44 | SS-8 | - | - | - | - | - | - | - | - | - | 12 | A-2-4 (V) | - | |
| | 767.6 | 18 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, MOIST TO WET. | | 19 | 9 12 14 | 37 | 89 | SS-9 | - | 53 | 20 | 9 | 11 | 7 | NP | NP | NP | 11 | A-1-b (0) | - | |
| -SHALE FRAGMENTS IN SS-9 | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 11 10 9 | 27 | 69 | SS-10 | - | - | - | - | - | - | - | - | - | 13 | A-1-b (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | | 24 | 8 12 12 | 34 | 72 | SS-11 | - | - | - | - | - | - | - | - | - | 13 | A-1-b (V) | - | |
| | 760.6 | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 13.0' AND AT COMPLETION @ 11.5'; CAVE-IN DEPTH @ 14.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | |
|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1052+79.79 / 183.9' RT | **EXPLORATION ID B-001-4-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JP | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. IR-270 | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 786.6 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/23/20 END: 9/23/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.941136, -82.846455 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 786.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 786.1 | | | | | | | | | | | | | | | | | | |
| HARD, BROWNISH GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 1 3 5 | 11 | 44 | SS-1 | 4.25 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | - | |
| | | 2 | 5 9 11 | 29 | 67 | SS-2 | 4.50 | - | - | - | - | - | - | - | - | 15 | A-6a (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 6 8 9 | 24 | 100 | SS-3 | 4.5+ | 4 | 13 | 17 | 38 | 28 | 27 | 16 | 11 | 13 | A-6a (7) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 8 9 12 | 30 | 100 | SS-4 | 4.5+ | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |
| | 778.6 | 8 | | | | | | | | | | | | | | | | | |
| DENSE, GRAY **GRAVEL**, SOME FINE TO COARSE SAND, TRACE SILT, TRACE CLAY, MOIST. | | 9 | 13 13 15 | 40 | 0 | SS-5 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | 10 | 22 | - | 100 | 2S-5A | - | - | - | - | - | - | - | - | - | 6 | A-1-a (V) | - | |
| | | 11 | | | | | | | | | | | | | | | | | |
| | | 12 | 9 12 13 | 36 | 89 | SS-6 | - | - | - | - | - | - | - | - | - | 11 | A-1-a (V) | - | |
| | | W 774.1 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| -SHALE FRAGMENTS IN SS-7 | | 14 | 12 13 15 | 40 | 33 | SS-7 | - | - | - | - | - | - | - | - | - | 9 | A-1-a (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | 768.6 | 17 | 11 11 13 | 34 | 33 | SS-8 | - | 59 | 19 | 7 | 10 | 5 | NP | NP | NP | 9 | A-1-a (0) | - | |
| DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, MOIST. | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 9 12 14 | 37 | 44 | SS-9 | - | - | - | - | - | - | - | - | - | 12 | A-1-a (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 17 19 19 | 55 | 0 | SS-10 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | 23 | 18 | - | 100 | 2S-10A | - | - | - | - | - | - | - | - | - | 13 | A-1-b (V) | - | |
| | | 24 | | | | | | | | | | | | | | | | | |
| | 761.6 | EOB 25 | 46 20 21 | 59 | 44 | SS-11 | - | 32 | 31 | 14 | 16 | 7 | 22 | 16 | 6 | 13 | A-1-b (0) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 12.5' ; CAVE-IN DEPTH @ 14.1'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1050+92.36 / 178.8' RT | **EXPLORATION ID B-001-5-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. IR-270 | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 785.6 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/23/20 END: 9/24/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.940627, -82.846653 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 785.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 785.1 | | | | | | | | | | | | | | | | | | |
| **FILL**: VERY STIFF, MOTTLED BROWN AND GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | 784.1 | 1 | 2 3 6 | 13 | 78 | SS-1 | 4.00 | - | - | - | - | - | - | - | - | 25 | A-6b (V) | - | |
| | | 2 | 9 11 15 | 37 | 67 | SS-2 | 4.50 | 7 | 9 | 14 | 33 | 37 | 31 | 18 | 13 | 13 | A-6a (8) | - | |
| HARD, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 10 11 12 | 33 | 94 | SS-3 | 4.50 | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| | 780.1 | 5 | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, BROWN AND DARK BROWN **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP. | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 10 12 14 | 37 | 100 | SS-4 | 4.50 | 17 | 11 | 16 | 30 | 26 | 24 | 16 | 8 | 12 | A-4a (4) | - | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 10 9 19 | 40 | 33 | SS-5 | 4.00 | - | - | - | - | - | - | - | - | 14 | A-4a (V) | - | |
| | 775.1 | 10 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO VERY DENSE, GRAY **GRAVEL**, SOME FINE TO COARSE SAND, LITTLE SILT, TRACE CLAY, WET. | | 11 | | | | | | | | | | | | | | | | | |
| | | 12 | 8 11 16 | 39 | 56 | SS-6 | - | - | - | - | - | - | - | - | - | 11 | A-1-a (V) | - | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 8 10 34 | 63 | 61 | SS-7 | - | 57 | 23 | 6 | 11 | 3 | 23 | 18 | 5 | 13 | A-1-a (0) | - | |
| W 770.6 | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 10 11 13 | 34 | 72 | SS-8 | - | - | - | - | - | - | - | - | - | 10 | A-1-a (V) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 15 11 9 | 29 | 61 | SS-9 | - | - | - | - | - | - | - | - | - | 10 | A-1-a (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 10 21 14 | 50 | 67 | SS-10 | - | - | - | - | - | - | - | - | - | 13 | A-1-a (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| -SHALE FRAGMENTS IN SS-11 | | 24 | 15 16 16 | 46 | 72 | SS-11 | - | - | - | - | - | - | - | - | - | 10 | A-1-a (V) | - | |
| | 760.6 | EOB | 25 | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 12.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 15.0' ; CAVE-IN DEPTH @ 16.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1049+09.90 / 179.8' RT | **EXPLORATION ID B-001-6-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. IR-270 | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 785.2 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/23/20 END: 9/23/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.940133, -82.846846 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 785.2 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.4' - TOPSOIL (5.0") | 784.8 | | | | | | | | | | | | | | | | | | |
| **FILL**: VERY STIFF, BROWN TO GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 1 3 4 | 10 | 67 | SS-1 | 3.50 | - | - | - | - | - | - | - | - | 20 | A-6a (V) | - | |
| | | 2 | 3 3 5 | 11 | 78 | SS-2 | 2.50 | - | - | - | - | - | - | - | - | 16 | A-6a (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 3 4 4 | 11 | 89 | SS-3 | 2.50 | 10 | 12 | 16 | 37 | 25 | 28 | 17 | 11 | 20 | A-6a (6) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 7 9 13 | 32 | 0 | SS-4 | - | - | - | - | - | - | - | - | - | - | | - | |
| | 776.7 | 7 | 9 | - | 100 | 2S-4A | 3.50 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |
| VERY STIFF, DARK BROWN TO GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 4 7 9 | 23 | 78 | SS-5 | 3.50 | 18 | 14 | 18 | 30 | 20 | 23 | 15 | 8 | 12 | A-4a (3) | - | |
| | | 10 | | | | | | | | | | | | | | | | | |
| | | 11 | | | | | | | | | | | | | | | | | |
| | | 12 | 5 7 8 | 22 | 72 | SS-6 | 4.00 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | 772.2 | 13 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, WET. | | W 771.2 | | | | | | | | | | | | | | | | | |
| | | 14 | 9 9 11 | 29 | 61 | SS-7 | - | - | - | - | - | - | - | - | - | 12 | A-1-b (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 7 25 18 | 62 | 44 | SS-8 | - | 53 | 19 | 9 | 14 | 5 | 21 | 16 | 5 | 11 | A-1-b (0) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 12 32 19 | 73 | 56 | SS-9 | - | - | - | - | - | - | - | - | - | 14 | A-1-b (V) | - | |
| -SHALE FRAGMENTS PRESENT THROUGHOUT | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 10 12 14 | 37 | 67 | SS-10 | - | - | - | - | - | - | - | - | - | 12 | A-1-b (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | | 24 | 10 11 10 | 30 | 61 | SS-11 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | 760.2 | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 14.0' ; CAVE-IN DEPTH @ 14.1'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1046+78.42 / 176.9' RT | **EXPLORATION ID B-001-7-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. IR-270 | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 784.8 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/22/20 END: 9/22/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.939516, -82.847134 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 784.8 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 784.3 | | 1 2 3 | 7 | 83 | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF, BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | 783.3 | 1 | | | | SS-1B | 3.25 | - | - | - | - | - | - | - | - | 22 | A-6b (V) | - | |
| VERY STIFF TO HARD, BROWN TO GRAYISH BROWN **SANDY SILT**, SOME CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP. | | 2 | 4 6 8 | 20 | 94 | SS-2 | 4.00 | - | - | - | - | - | - | - | - | 15 | A-4a (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 6 6 7 | 19 | 78 | SS-3 | 4.25 | 7 | 9 | 16 | 40 | 28 | 28 | 18 | 10 | 14 | A-4a (7) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 3 5 7 | 17 | 100 | SS-4 | 3.75 | - | - | - | - | - | - | - | - | 14 | A-4a (V) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |
| | | 8 | 7 7 8 | 22 | 100 | SS-5 | 4.5+ | 11 | 12 | 16 | 39 | 22 | 23 | 15 | 8 | 11 | A-4a (5) | - | |
| -LIMESTONE FRAGMENTS IN SS-11 | | 9 | | | | | | | | | | | | | | | | | |
| | 771.8 | 10 | 22 17 9 | 37 | 83 | SS-6 | 4.5+ | - | - | - | - | - | - | - | - | - | A-4a (V) | - | |
| MEDIUM DENSE TO DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, WET. | | 11 | | | | | | | | | | | | | | | | | |
| W 771.3 | | 12 | 4 8 13 | 30 | 72 | SS-7 | - | - | - | - | - | - | - | - | - | 12 | A-1-b (V) | - | |
| ▽ 768.3 | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 10 9 9 | 26 | 58 | SS-8 | - | 49 | 27 | 9 | 12 | 3 | NP | NP | NP | 14 | A-1-b (0) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | 13 11 8 | 27 | 39 | SS-9 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | | 17 | | | | | | | | | | | | | | | | | |
| | | 18 | 14 10 12 | 32 | 0 | SS-10 | - | - | - | - | - | - | - | - | - | - | A-1-b (V) | - | |
| | 762.3 | 19 | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. | | 20 | 14 | - | 100 | 2S-10A | 3.00 | 16 | 13 | 16 | 37 | 18 | 22 | 15 | 7 | 12 | A-4a (4) | - | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 5 6 11 | 24 | 78 | SS-11 | 2.75 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | 759.8 | 23 | | | | | | | | | | | | | | | | | |
| EOB | | 24 | | | | | | | | | | | | | | | | | |
| | | 25 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 13.5' AND AT COMPLETION @ 16.5'; CAVE-IN DEPTH @ 12.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1045+05.59 / 196.2' RT | **EXPLORATION ID B-002-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. IR-270 | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 783.6 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/22/20 END: 9/22/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.939040, -82.847300 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 783.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (4.0") | 783.3 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| STIFF TO VERY STIFF, MOTTLED BROWN AND GRAY **CLAY**, SOME SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 1 | 2 2 2 | 6 | 97 | SS-1B | 2.00 | - | - | - | - | - | - | - | - | 25 | A-7-6 (V) | - | |
| | | 2 3 | 3 5 7 | 17 | 81 | SS-2 | 2.50 | - | - | - | - | - | - | - | - | 21 | A-7-6 (V) | - | |
| | | 4 5 | 0 1 3 | 6 | 61 | SS-3 | 1.75 | - | - | - | - | - | - | - | - | 22 | A-7-6 (V) | - | |
| | 778.1 | | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, BROWNISH GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP. | | 6 7 | 5 4 7 | 16 | 94 | SS-4 | 3.25 | 19 | 11 | 15 | 31 | 24 | 24 | 16 | 8 | 13 | A-4a (4) | - | |
| | | 8 9 10 | 8 9 13 | 32 | 78 | SS-5 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | 773.1 | | | | | | | | | | | | | | | | | | |
| STIFF, GRAYISH BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. | | 11 12 | 9 9 13 | 32 | 53 | SS-6 | 1.50 | 11 | 13 | 15 | 30 | 31 | 29 | 16 | 13 | 14 | A-6a (6) | - | |
| | 770.6 | | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO DENSE, GRAY **GRAVEL**, SOME FINE TO COARSE SAND, LITTLE SILT, TRACE CLAY, WET. | | ▽ 769.6 14 | 2 6 9 | 22 | 58 | SS-7 | - | - | - | - | - | - | - | - | - | 15 | A-1-a (V) | - | |
| | | W 768.1 15 16 17 | 10 9 7 | 23 | 67 | SS-8 | - | 55 | 23 | 9 | 11 | 2 | NP | NP | NP | 12 | A-1-a (0) | - | |
| | | 18 19 20 | 8 11 12 | 33 | 67 | SS-9 | - | - | - | - | - | - | - | - | - | 12 | A-1-a (V) | - | |
| | 763.1 | | | | | | | | | | | | | | | | | | |
| DENSE, GRAY **COARSE AND FINE SAND**, LITTLE FINE GRAVEL, TRACE SILT, TRACE CLAY, WET. | | 21 22 | 8 11 13 | 34 | 47 | SS-10 | - | - | - | - | - | - | - | - | - | 12 | A-3a (V) | - | |
| | | 23 24 | 9 12 14 | 37 | 78 | SS-11 | - | - | - | - | - | - | - | - | - | 11 | A-3a (V) | - | |
| | 758.6 | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 14.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 15.5' AND AT COMPLETION @ 14.0'; CAVE-IN DEPTH @ 10.7'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1043+08.19 / 121' RT | **EXPLORATION ID B-003-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: BL RAMP D2 | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 783.5 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/22/20 END: 9/22/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.938487, -82.847339 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 783.5 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.7' - TOPSOIL (8.0") | 782.8 | | 2 2 2 | 6 | 100 | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF, MOTTLED BROWN AND GRAY **CLAY**, SOME SILT, LITTLE COARSE TO FINE SAND, MOIST. | 782.0 | 1 | | | | SS-1B | 2.50 | - | - | - | - | - | - | - | - | 21 | A-7-6 (V) | - | |
| VERY STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, SOME CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP TO MOIST. | | 2 | 3 5 7 | 17 | 78 | SS-2 | 3.75 | - | - | - | - | - | - | - | - | 15 | A-4a (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 2 2 4 | 9 | 86 | SS-3 | 2.25 | 8 | 14 | 16 | 38 | 24 | 25 | 15 | 10 | 15 | A-4a (5) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 4 7 12 | 27 | 100 | SS-4 | 4.5+ | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | 773.0 | 9 | 5 7 7 | 20 | 97 | SS-5 | 4.25 | 13 | 13 | 16 | 38 | 20 | 22 | 15 | 7 | 11 | A-4a (5) | - | |
| | | 10 | | | | | | | | | | | | | | | | | |
| DENSE, GRAY **COARSE AND FINE SAND**, LITTLE FINE GRAVEL, TRACE SILT, MOIST. | | 11 | | | | | | | | | | | | | | | | | |
| W 772.0 | | 12 | 13 13 16 | 42 | 0 | SS-6 | - | - | - | - | - | - | - | - | - | - | A-3a (V) | - | |
| | 770.5 | 13 | 15 | - | 100 | 2S-6A | - | - | - | - | - | - | - | - | - | 10 | A-3a (V) | - | |
| MEDIUM DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, MOIST TO WET. | | 14 | 7 7 11 | 26 | 69 | SS-7 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | 20 33 28 | 88 | 64 | SS-8 | - | - | - | - | - | - | - | - | - | 9 | A-1-b (V) | - | |
| ▽ 765.5 | | 17 | | | | | | | | | | | | | | | | | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 10 15 17 | 46 | 56 | SS-9 | - | 56 | 19 | 9 | 11 | 5 | NP | NP | NP | 12 | A-1-b (0) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 12 13 11 | 34 | 56 | SS-10 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | 760.5 | 23 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, GRAY **COARSE AND FINE SAND**, LITTLE FINE GRAVEL, TRACE SILT, WET. | | 24 | 6 7 11 | 26 | 53 | SS-11 | - | - | - | - | - | - | - | - | - | 13 | A-3a (V) | - | |
| | 758.5 | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 11.5' AND AT COMPLETION @ 10.8'; CAVE-IN DEPTH @ 147'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1040+93.65 / 155.2' RT | **EXPLORATION ID B-004-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: BL RAMP D2 | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 784.1 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/22/20 END: 9/22/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.937918, -82.847451 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 784.1 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.4' - TOPSOIL (5.0") | 783.7 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF, MOTTLED BROWN AND GRAY **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. -TRACE ORGANICS IN SS-1B | | 1 | 2 4 5 | 13 | 75 | SS-1B | 3.75 | - | - | - | - | - | - | - | - | 22 | A-7-6 (V) | - | |
| | | 2 | 3 5 7 | 17 | 86 | SS-2 | 3.75 | 1 | 5 | 10 | 41 | 43 | 49 | 19 | 30 | 20 | A-7-6 (18) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 4 5 5 | 14 | 94 | SS-3 | 3.75 | - | - | - | - | - | - | - | - | 17 | A-7-6 (V) | - | |
| | 778.6 | 5 | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, DAMP. | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 7 9 13 | 32 | 100 | SS-4 | 4.25 | 18 | 12 | 16 | 34 | 20 | 22 | 16 | 6 | 12 | A-4a (4) | - | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 6 7 9 | 23 | 94 | SS-5 | 4.00 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | 773.6 | 10 | | | | | | | | | | | | | | | | | |
| DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST. | | 11 | | | | | | | | | | | | | | | | | |
| | 771.1 | | 6 11 12 | 33 | 69 | SS-6 | - | - | - | - | - | - | - | - | - | 10 | A-2-4 (V) | - | |
| MEDIUM DENSE, GRAY **COARSE AND FINE SAND**, LITTLE FINE GRAVEL, TRACE SILT, WET. -HEAVING SANDS @ 13.5' | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 5 7 10 | 24 | 67 | SS-7 | - | - | - | - | - | - | - | - | - | 13 | A-3a (V) | - | |
| | 768.6 | 15 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET. | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 6 8 9 | 24 | 75 | SS-8 | - | 56 | 25 | 6 | 7 | 6 | 20 | 18 | 2 | 11 | A-2-4 (V) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 9 9 6 | 22 | 58 | SS-9 | - | - | - | - | - | - | - | - | - | 13 | A-2-4 (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 4 7 10 | 24 | 53 | SS-10 | - | - | - | - | - | - | - | - | - | 11 | A-2-4 (V) | - | |
| | 761.1 | 23 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, GRAY **COARSE AND FINE SAND**, LITTLE FINE GRAVEL, TRACE SILT, WET. | | 24 | 7 7 9 | 23 | 50 | SS-11 | - | - | - | - | - | - | - | - | - | 18 | A-3a (V) | - | |
| | 759.1 | 25 | | | | | | | | | | | | | | | | | |
| | | EOB | | | | | | | | | | | | | | | | | |

▽ 771.1 (W 770.4)

NOTES: SEEPAGE @ 10.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 13.7' AND AT COMPLETION @ 13.0'; CAVE-IN DEPTH @ 12.4'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1030+58.50 / 278' RT | **EXPLORATION ID B-009-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: BL RAMP D2 | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 779.8 (MSL) EOB: 23.9 ft. | PAGE 1 OF 1 |
| START: 9/21/20 END: 9/21/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.935128, -82.847700 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 779.8 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 779.3 | | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, SOME COARSE TO FINE SAND, LITTLE TO SOME FINE GRAVEL, DAMP. | | 1 | 2 3 3 | 9 | 67 | SS-1 | 3.50 | - | - | - | - | - | - | - | - | 18 | A-4a (V) | - | |
| | | 2 | 4 5 7 | 17 | 94 | SS-2 | 4.50 | 11 | 14 | 17 | 36 | 22 | 25 | 17 | 8 | 14 | A-4a (5) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 3 6 11 | 24 | 89 | SS-3 | 4.00 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 10 13 17 | 43 | 100 | SS-4 | 4.50 | 21 | 11 | 15 | 35 | 18 | 22 | 15 | 7 | 9 | A-4a (4) | - | |
| | 771.8 | W 771.8 | | | | | | | | | | | | | | | | | |
| DENSE TO VERY DENSE, GRAY **GRAVEL**, LITTLE COARSE TO FINE SAND, LITTLE SILT, WET. -COBBLES @ 8.5' | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 20 16 15 | 45 | 78 | SS-5 | - | - | - | - | - | - | - | - | - | 9 | A-1-a (V) | - | |
| | | 10 | | | | | | | | | | | | | | | | | |
| | | 11 | 11 12 15 | 39 | 44 | SS-6 | - | - | - | - | - | - | - | - | - | 9 | A-1-a (V) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 9 12 13 | 36 | 56 | SS-7 | - | 64 | 19 | 6 | 7 | 4 | NP | NP | NP | 11 | A-1-a (0) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 11 17 35 | 75 | 89 | SS-8 | - | - | - | - | - | - | - | - | - | 11 | A-1-a (V) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 50 | - | 67 | SS-9 | - | - | - | - | - | - | - | - | - | 7 | A-1-a (V) | - | |
| | 758.8 | TR | | | | | | | | | | | | | | | | | |
| **SHALE** : BLACK, HIGHLY WEATHERED, VERY WEAK. | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | 50 | - | 67 | SS-10 | - | - | - | - | - | - | - | - | - | 7 | Rock (V) | - | |
| | | 22 | | | | | | | | | | | | | | | | | |
| | 755.9 | 23 EOB | 50 | - | 83 | SS-11 | - | - | - | - | - | - | - | - | - | 7 | Rock (V) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 8.0' AND AT COMPLETION @ 9.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH | DRILL RIG: CME 55 (386345) | STATION / OFFSET: 1538+53.29 / 93.1' LT | **EXPLORATION ID B-010-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL RAMP F | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/4/18 | ELEVATION: 778.8 (MSL) EOB: 24.3 ft. | PAGE 1 OF 1 |
| START: 7/17/20 END: 7/17/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90 | LAT / LONG: 39.934517, -82.847759 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 778.8 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 778.3 | | | | | | | | | | | | | | | | | | |
| HARD, DARK BROWN AND GRAY TO GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP. | | 1 | 7 9 11 | 30 | 94 | SS-1 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 9 9 13 | 33 | 78 | SS-2 | 4.5+ | 3 | 13 | 17 | 39 | 28 | 25 | 15 | 10 | 12 | A-4a (6) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 5 7 12 | 29 | 89 | SS-3 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | 770.8 | 7 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, MOIST TO WET. -COBBLES @ 9.0' | | 8 | | | | | | | | | | | | | | | | | |
| | 768.3 | 9 | 4 9 13 | 33 | 67 | SS-4 | - | - | - | - | - | - | - | - | - | 12 | A-2-4 (V) | - | |
| STIFF, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | | 10 | | | | | | | | | | | | | | | | | |
| W 767.8 | | 11 | 5 14 18 | 48 | 61 | SS-5 | 1.50 | - | - | - | - | - | - | - | - | 14 | A-4a (V) | - | |
| | 765.8 | 12 | | | | | | | | | | | | | | | | | |
| DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, MOIST TO WET. | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 14 21 20 | 62 | 89 | SS-6 | - | - | - | - | - | - | - | - | - | 13 | A-1-b (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 14 14 15 | 44 | 94 | SS-7 | - | - | - | - | - | - | - | - | - | 15 | A-1-b (V) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| -LIMESTONE AND SHALE FRAGMENTS PRESENT IN SS-8 | | 19 | 33 37 22 | 89 | 56 | SS-8 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | 757.8 | 20 | | | | | | | | | | | | | | | | | |
| **SHALE** : BLACK, HIGHLY WEATHERED. | | TR 21 | 11 50/5" | - | 100 | SS-9 | - | - | - | - | - | - | - | - | - | 10 | Rock (V) | - | |
| | | 22 | | | | | | | | | | | | | | | | | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | 754.5 | EOB 24 | 21 50/4" | - | 100 | SS-10 | - | - | - | - | - | - | - | - | - | 12 | Rock (V) | - | |

NOTES: SEEPAGE @ 9.0'; GROUNDWATER INTIALLY ENCOUNTERED @ 11.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH/KC | DRILL RIG: CME 55 (386345) | STATION / OFFSET: 1541+00.02 / 85.7' LT | **EXPLORATION ID B-011-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/4/18 | ELEVATION: 782.7 (MSL) EOB: 23.7 ft. | PAGE 1 OF 1 |
| START: 7/17/20 END: 7/17/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90 | LAT / LONG: 39.934344, -82.847004 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 782.7 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.7' - TOPSOIL (8.0") | 782.0 | | | | | | | | | | | | | | | | | | |
| HARD, BROWN AND GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | | 3 3 4 | 11 | 94 | SS-1 | 4.5+ | - | - | - | - | - | - | - | - | 21 | A-6b (V) | - | |
| | | | 5 7 8 | 23 | 56 | SS-2 | 4.5+ | - | - | - | - | - | - | - | - | 17 | A-6b (V) | - | |
| | | ▽ 775.7 | 7 7 9 | 24 | 83 | SS-3 | 4.5+ | 5 | 7 | 13 | 35 | 40 | 36 | 18 | 18 | 13 | A-6b (11) | - | |
| | 773.2 | | 6 9 18 | 41 | 83 | SS-4A | 4.5+ | - | - | - | - | - | - | - | - | - | A-6b (V) | - | |
| | | | | | | SS-4B | - | - | - | - | - | - | - | - | - | - | A-1-b (V) | - | |
| VERY DENSE, BROWN AND GRAY **GRAVEL WITH SAND**, TRACE SILT, DAMP. | | | 8 17 20 | 56 | 67 | SS-5 | - | - | - | - | - | - | - | - | - | 8 | A-1-b (V) | - | |
| | 769.7 | | 15 14 12 | 39 | 89 | SS-6 | - | - | - | - | - | - | - | - | - | 9 | A-2-4 (V) | - | |
| DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND AND SILT**, MOIST TO WET.<br>-COBBLES @ 13.0' | | W 767.2 | | | | | | | | | | | | | | | | | |
| -HEAVING SANDS @ 18.0' | | | 6 10 9 | 29 | 78 | SS-7 | - | - | - | - | - | - | - | - | - | 14 | A-2-4 (V) | - | |
| -COBBLES @ 18.0' | | | 10 13 20 | 50 | 89 | SS-8 | - | - | - | - | - | - | - | - | - | 14 | A-2-4 (V) | - | |
| | | | 18 29 38 | 101 | 56 | SS-9 | - | - | - | - | - | - | - | - | - | 13 | A-2-4 (V) | - | |
| | 759.7 | | | | | | | | | | | | | | | | | | |
| VERY DENSE, GRAY AND BROWN **COARSE AND FINE SAND**, TRACE SILT, WET. | 759.0 | EOB | 50/2" | - | 100 | SS-10 | - | - | - | - | - | - | - | - | - | 15 | A-3a (V) | - | |

NOTES: SEEPAGE @ 12.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 15.5' AND AT COMPLETION @ 7.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH/KC | DRILL RIG: CME 55 (386345) | STATION / OFFSET: 1542+64.08 / 8.1' LT | **EXPLORATION ID B-012-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/4/18 | ELEVATION: 784.8 (MSL) EOB: 10.0 ft. | | PAGE 1 OF 1 |
| START: 7/17/20 END: 7/17/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90 | LAT / LONG: 39.934074, -82.846464 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 784.8 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 784.3 | | | | | | | | | | | | | | | | | | |
| HARD, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP. | 782.8 | 1 | 3 9 3 | 18 | 67 | SS-1 | 4.50 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| VERY STIFF, BROWN, GRAY, AND ORANGE **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 4 4 5 | 14 | 83 | SS-2 | 3.25 | 1 | 9 | 12 | 39 | 39 | 39 | 18 | 21 | 18 | A-6b (12) | 280 | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 1 3 5 | 12 | 78 | SS-3 | 3.00 | - | - | - | - | - | - | - | - | 25 | A-6b (V) | - | |
| | 776.8 | 8 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, BROWN, ORANGE AND GRAY **SILTY SAND**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | 774.8 | 9 | 5 8 12 | 30 | 100 | SS-4 | - | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | EOB 10 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1543+13.33 / 33' LT | **EXPLORATION ID B-013-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 781.9 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/24/20 END: 9/24/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.934125, -82.846279 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 781.9 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (4.5") | 781.5 | | 4 | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| HARD, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. -TRACE ORGANICS IN SS-1B | 780.4 | 1 | 5 5 | 14 | 97 | SS-1B | 4.5+ | - | - | - | - | - | - | - | - | 15 | A-6b (V) | - | |
| VERY STIFF TO HARD, DARK BROWN TO DARK GRAY **CLAY**, "AND" SILT, TRACE COARSE TO FINE SAND, MOIST. -ROOT FIBERS IN SS-2 | | 2 3 | 5 7 8 | 22 | 56 | SS-2 | 4.00 | - | - | - | - | - | - | - | - | 23 | A-7-6 (V) | - | |
| | | 4 5 | 5 5 7 | 17 | 69 | SS-3 | 4.5+ | 0 | 2 | 4 | 44 | 50 | 52 | 20 | 32 | 20 | A-7-6 (18) | - | |
| | 776.4 | 6 7 | 10 12 15 | 39 | 89 | SS-4 | - | 54 | 12 | 12 | 16 | 6 | 24 | 18 | 6 | 6 | A-1-b (0) | - | |
| MEDIUM DENSE TO VERY DENSE, BROWN TO BROWNISH GRAY **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, MOIST TO WET. -GRANITE AND LIMESTONE FRAGMENTS IN SS-5 | | 8 9 10 | 11 16 15 | 45 | 78 | SS-5 | - | - | - | - | - | - | - | - | - | 8 | A-1-b (V) | - | |
| ▽ 769.9 | | 11 12 | 32 24 21 | 65 | 67 | SS-6 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| -COBBLES @ 13.0' W 767.9 | | 13 14 | 33 32 17 | 70 | 56 | SS-7 | - | - | - | - | - | - | - | - | - | 18 | A-1-b (V) | - | |
| -ROCK FRAGMENTS IN SS-8 | | 15 16 17 | 13 14 20 | 49 | 56 | SS-8 | - | - | - | - | - | - | - | - | - | 8 | A-1-b (V) | - | |
| | | 18 19 | 27 34 26 | 86 | 0 | SS-9 | - | 41 | 36 | 7 | 11 | 5 | NP | NP | NP | - | A-1-b (0) | - | |
| | | 20 | 24 | - | 83 | 2S-9A | - | - | - | - | - | - | - | - | - | 14 | A-1-b (V) | - | |
| -HEAVING SANDS @ 21.0' | | 21 22 | 12 12 9 | 30 | 67 | SS-10 | - | - | - | - | - | - | - | - | - | 9 | A-1-b (V) | - | |
| | 756.9 | EOB 23 24 25 | 17 23 35 | 83 | 61 | SS-11 | - | - | - | - | - | - | - | - | - | 10 | A-1-b (V) | - | |

NOTES: SEEPAGE @ 11.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 14.0' AND AT COMPLETION @ 12.0'; CAVE-IN DEPTH @ 16.4'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1544+79.26 / 30.1' LT | **EXPLORATION ID B-014-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 781.4 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/21/20 END: 9/21/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.934066, -82.845694 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 781.4 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6' - TOPSOIL (7.0") | 780.8 | | | | | | | | | | | | | | | | | | |
| **FILL**: STIFF, MOTTLED BROWN AND GRAY **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | 780.2 | | | | | | | | | | | | | | | | | | |
| STIFF TO VERY STIFF, MOTTLED BROWN AND GRAY **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | 775.9 | | 1<br>2<br>3 | 7 | 78 | SS-1 | 2.00 | - | - | - | - | - | - | - | - | 23 | A-7-6 (V) | - | |
| | | | 4<br>5<br>6 | 16 | 72 | SS-2 | 3.00 | 1 | 3 | 8 | 43 | 45 | 47 | 18 | 29 | 20 | A-7-6 (17) | - | |
| | | | 2<br>2<br>3 | 7 | 72 | SS-3 | 1.50 | - | - | - | - | - | - | - | - | 29 | A-7-6 (V) | - | |
| VERY STIFF, BROWN TO BROWNISH GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. | | | 4<br>6<br>9 | 22 | 89 | SS-4 | 3.50 | 15 | 15 | 18 | 34 | 18 | 22 | 16 | 6 | 13 | A-4a (3) | - | |
| -ROCK FRAGMENTS IN SS-4 | 770.9 | | 7<br>7<br>10 | 24 | 72 | SS-5 | 4.00 | - | - | - | - | - | - | - | - | - | A-4a (V) | - | |
| MEDIUM DENSE TO DENSE, GRAY TO BROWNISH GRAY **GRAVEL**, SOME FINE TO COARSE SAND, TRACE SILT, TRACE CLAY, WET. | | ▽ 769.4 | 9<br>16<br>17 | 47 | 100 | SS-6 | - | - | - | - | - | - | - | - | - | 6 | A-1-a (V) | - | |
| | | W 768.4 | 9<br>10<br>12 | 32 | 89 | SS-7 | - | - | - | - | - | - | - | - | - | 10 | A-1-a (V) | - | |
| | 760.9 | | 13<br>12<br>13 | 36 | 72 | SS-8 | - | 64 | 18 | 6 | 8 | 4 | NP | NP | NP | 11 | A-1-a (0) | - | |
| MEDIUM DENSE TO DENSE, GRAY **COARSE AND FINE SAND**, SOME FINE GRAVEL, LITTLE SILT, WET. | | | 23<br>18<br>12 | 43 | 39 | SS-9 | - | - | - | - | - | - | - | - | - | 13 | A-1-a (V) | - | |
| | | | 6<br>9<br>11 | 29 | 89 | SS-10 | - | - | - | - | - | - | - | - | - | 16 | A-3a (V) | - | |
| | 756.4 | EOB | 7<br>14<br>14 | 40 | 100 | SS-11 | - | - | - | - | - | - | - | - | - | 11 | A-3a (V) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 13.0' AND AT COMPLETION @ 12.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH/KC | DRILL RIG: CME 55 (386345) | STATION / OFFSET: 1546+70.77 / 3.4' RT | **EXPLORATION ID B-015-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/4/18 | ELEVATION: 788.3 (MSL) EOB: 10.0 ft. | PAGE 1 OF 1 |
| START: 7/17/20 END: 7/17/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90 | LAT / LONG: 39.933924, -82.845027 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 788.3 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (4.0") | 788.0 | | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, DARK BROWN AND DARK GRAY **GRAVEL WITH SAND AND SILT**, DAMP TO MOIST. | | | 2 5 6 | 17 | 67 | SS-1 | - | - | - | - | - | - | - | - | - | 7 | A-2-4 (V) | - | |
| | | ▽ 784.8 | 3 5 6 | 17 | 61 | SS-2 | - | - | - | - | - | - | - | - | - | 10 | A-2-4 (V) | 190 | |
| | 782.8 | | | | | | | | | | | | | | | | | | |
| MEDIUM STIFF TO HARD, GRAY TO BROWN AND GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | W 781.8 | 1 2 2 | 6 | 56 | SS-3 | 0.75 | 2 | 4 | 10 | 44 | 40 | 35 | 18 | 17 | 24 | A-6b (11) | - | |
| | | | 6 8 13 | 32 | 67 | SS-4 | 4.5+ | - | - | - | - | - | - | - | - | 22 | A-6b (V) | - | |
| | 778.3 | EOB | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 4.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 6.5' AND AT COMPLETION @ 3.5'; CAVE-IN DEPTH @ 4.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 750X (310218) | STATION / OFFSET: 1546+73.20 / 38.9' LT | **EXPLORATION ID** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | **B-016-0-19** | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/4/18 | ELEVATION: 782.1 (MSL) EOB: 25.0 ft. | PAGE | |
| START: 9/11/20 END: 9/11/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 79.5 | LAT / LONG: 39.934038, -82.845005 | 1 OF 1 | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 782.1 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 781.6 | | 1 | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF TO HARD, BROWNISH GRAY TO GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP TO MOIST. | | | 2 4 | 8 | 89 | SS-1B | 3.50 | - | - | - | - | - | - | - | - | 25 | A-4a (V) | - | |
| | | | 12 13 10 | 30 | 78 | SS-2 | 4.5+ | 9 | 16 | 13 | 36 | 26 | 26 | 17 | 9 | 14 | A-4a (5) | - | |
| | | | 3 5 6 | 15 | 83 | SS-3 | 4.5+ | - | - | - | - | - | - | - | - | 14 | A-4a (V) | - | |
| | | | 4 5 5 | 13 | 67 | SS-4 | 4.5+ | 27 | 21 | 10 | 30 | 12 | 23 | 16 | 7 | 12 | A-4a (1) | - | |
| | 774.1 | | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, MOIST. | | | 8 12 16 | 37 | 72 | SS-5 | - | - | - | - | - | - | - | - | - | 7 | A-1-b (V) | - | |
| | | W 771.1 | | | | | | | | | | | | | | | | | |
| | | | 6 8 10 | 24 | 61 | SS-6 | - | - | - | - | - | - | - | - | - | 9 | A-1-b (V) | - | |
| | 769.1 | ▽ 769.1 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, GRAY **COARSE AND FINE SAND**, WET. | | | 13 16 4 | 27 | 67 | SS-7 | - | - | - | - | - | - | - | - | - | 14 | A-3 (V) | - | |
| | 766.6 | | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET. | | | 3 20 8 | 37 | 78 | SS-8 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | | | 10 10 20 | 40 | 56 | SS-9 | - | - | - | - | - | - | - | - | - | 10 | A-1-b (V) | - | |
| | | | 4 8 10 | 24 | 72 | SS-10 | - | - | - | - | - | - | - | - | - | 13 | A-1-b (V) | - | |
| | 759.1 | | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, GRAY **COARSE AND FINE SAND**, WET. | | | 6 10 12 | 29 | 72 | SS-11 | - | - | - | - | - | - | - | - | - | 14 | A-3 (V) | - | |
| | 757.1 | EOB | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 11.0' AND AT COMPLETION @ 13.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 750X (310218) | STATION / OFFSET: 1548+68.43 / 39.5' LT | **EXPLORATION ID B-018-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/4/18 | ELEVATION: 784.6 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/1/20 END: 9/1/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 79.5 | LAT / LONG: 39.933997, -82.844313 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 784.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 784.1 | | 3 | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| HARD, BROWNISH GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. | 781.6 | 1 | 7 4 | 15 | 50 | SS-1B | 4.50 | - | - | - | - | - | - | - | - | 22 | A-6a (V) | - | |
| | | 2 | 5 | | | | | | | | | | | | | | | | |
| | | 3 | 6 10 | 21 | 78 | SS-2 | 4.00 | - | - | - | - | - | - | - | - | 24 | A-6a (V) | - | |
| HARD, BROWNISH GRAY TO DARK BROWNISH GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP. | | 4 | 14 13 13 | 34 | 67 | SS-3 | 4.50 | 26 | 15 | 11 | 33 | 15 | 25 | 20 | 5 | 12 | A-4a (3) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 4 | | | | | | | | | | | | | | | | |
| | | 7 | 6 8 | 19 | 83 | SS-4 | 4.50 | - | - | - | - | - | - | - | - | 14 | A-4a (V) | - | |
| | 775.6 | 8 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO VERY DENSE, DARK BROWN AND ORANGISH BROWN **GRAVEL WITH SAND**, TRACE SILT, VERY MOIST TO WET. | | 9 | 7 | | | SS-5A | 4.50 | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | | 10 | 21 16 | 49 | 78 | SS-5B | - | - | - | - | - | - | - | - | - | 8 | A-1-b (V) | - | |
| | | 11 | | | | | | | | | | | | | | | | | |
| ▽ 772.6 | | 12 | 13 20 21 | 54 | 78 | SS-6 | - | - | - | - | - | - | - | - | - | 5 | A-1-b (V) | - | |
| W 771.1 | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 8 | | | | | | | | | | | | | | | | |
| | | 15 | 12 10 | 29 | 33 | SS-7 | - | - | - | - | - | - | - | - | - | 9 | A-1-b (V) | - | |
| | 766.6 | 16 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, GRAY **COARSE AND FINE SAND**, WET. | | 17 | 5 7 10 | 23 | 61 | SS-8 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | 764.1 | 18 | | | | | | | | | | | | | | | | | |
| DENSE, GRAY AND DARK GRAY **GRAVEL WITH SAND**, TRACE SILT, WET. | | 19 | 7 11 11 | 29 | 50 | SS-9 | - | - | - | - | - | - | - | - | - | 14 | A-3 (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | 6 | | | | | | | | | | | | | | | | |
| | | 22 | 13 12 | 33 | 61 | SS-10 | - | - | - | - | - | - | - | - | - | 10 | A-1-b (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | | 24 | 14 | | | | | | | | | | | | | | | | |
| | 759.6 | 25 | 13 12 | 33 | 67 | SS-11 | - | - | - | - | - | - | - | - | - | 12 | A-1-b (V) | - | |
| | | EOB | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 13.5' AND AT COMPLETION @ 12.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH/KC | DRILL RIG: CME 55 (386345) | STATION / OFFSET: 1550+69.31 / 4.3' RT | **EXPLORATION ID B-019-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/4/18 | ELEVATION: 788.9 (MSL) EOB: 10.0 ft. | PAGE 1 OF 1 |
| START: 7/17/20 END: 7/17/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90 | LAT / LONG: 39.933838, -82.843610 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 788.9 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.2' - TOPSOIL (2.0") | 788.7 | | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, BROWN, DARK BROWN AND ORANGE **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 2 4 4 | 12 | 61 | SS-1 | 4.00 | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 4 5 4 | 14 | 89 | SS-2 | 3.25 | 1 | 3 | 9 | 51 | 36 | 33 | 19 | 14 | 21 | A-6a (10) | 220 | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 4 6 6 | 18 | 83 | SS-3 | 3.50 | - | - | - | - | - | - | - | - | 21 | A-6a (V) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 7 8 10 | 27 | 111 | SS-4 | 4.5+ | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |
| | 778.9 | EOB 10 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1550+64.97 / 44.3' LT | **EXPLORATION ID B-020-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 786.1 (MSL) EOB: 25.0 ft. | | PAGE 1 OF 1 |
| START: 9/21/20 END: 9/21/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.933972, -82.843613 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 786.1 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.7' - TOPSOIL (8.0") | 785.4 | | | | | | | | | | | | | | | | | | |
| HARD, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | 784.6 | | 3 7 6 | 19 | 67 | SS-1 | 4.50 | - | - | - | - | - | - | - | - | 15 | A-4a (V) | - | |
| VERY STIFF TO HARD, MOTTLED BROWN AND GRAY TO BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | | 7 6 10 | 23 | 78 | SS-2 | 4.50 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | - | |
| | | | 5 7 7 | 20 | 72 | SS-3 | 4.00 | 4 | 15 | 17 | 38 | 26 | 27 | 16 | 11 | 22 | A-6a (6) | - | |
| | | | 3 5 6 | 16 | 100 | SS-4 | 4.00 | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |
| | | | 7 7 12 | 27 | 94 | SS-5 | 3.50 | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |
| | 775.6 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, DARK GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP. | | | 5 7 9 | 23 | 0 | SS-6 | - | - | - | - | - | - | - | - | - | - | | - | |
| | 772.9 | | 15/5" | - | 120 | 2S-SS-6A | 3.00 | 11 | 13 | 16 | 35 | 25 | 23 | 15 | 8 | 11 | A-4a (5) | - | |
| MEDIUM DENSE TO DENSE, GRAY **GRAVEL**, SOME FINE TO COARSE SAND, LITTLE SILT, TRACE CLAY, MOIST TO WET. | | | 4 13 12 | 36 | 72 | SS-7 | - | - | - | - | - | - | - | - | - | 8 | A-1-a (V) | - | |
| -COBBLES @ 15.5' | | ▼ 770.1 769.8 | | | | | | | | | | | | | | | | | |
| | | | 12 7 8 | 22 | 44 | SS-8 | - | - | - | - | - | - | - | - | - | 11 | A-1-a (V) | - | |
| | | | 12 9 11 | 29 | 67 | SS-9 | - | 61 | 17 | 7 | 11 | 4 | NP | NP | NP | 14 | A-1-a (0) | - | |
| | | | 10 15 12 | 39 | 72 | SS-10 | - | - | - | - | - | - | - | - | - | 11 | A-1-a (V) | - | |
| | | | 12 9 10 | 27 | 72 | SS-11 | - | - | - | - | - | - | - | - | - | 11 | A-1-a (V) | - | |
| | 761.1 | EOB | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 16.0' AND AT COMPLETION @ 16.3'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (310218) | STATION / OFFSET: 1552+67.11 / 36.1' LT | **EXPLORATION ID B-021-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/4/18 | ELEVATION: 786.4 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/10/20 END: 9/10/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 79.5 | LAT / LONG: 39.933909, -82.842896 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 786.4 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.1' - TOPSOIL (1.0") | 786.3 | | | | | | | | | | | | | | | | | | |
| 0.7' - GRAVEL FILL (8.0") | 785.6 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN TO GRAY **SILTY CLAY**, COME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 1 2 3 4 5 6 7 8 9 10 | 8 7 6 | 17 | 94 | SS-1 | 3.75 | - | - | - | - | - | - | - | - | 17 | A-6b (V) | - | |
| | | | 4 5 7 | 16 | 100 | SS-2 | 4.00 | - | - | - | - | - | - | - | - | 17 | A-6b (V) | - | |
| | | | 7 8 10 | 24 | 92 | SS-3 | 4.00 | 1 | 8 | 18 | 35 | 38 | 35 | 16 | 19 | 16 | A-6b (11) | - | |
| | 778.4 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, MOIST. | | | 6 6 7 | 17 | 100 | SS-4 | 3.25 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | ▽ 775.4 | 4 4 5 | 12 | 89 | SS-5 | 2.75 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | | | 3 4 5 | 12 | 81 | SS-6 | 3.00 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | 768.4 | | 3 3 5 | 11 | 75 | SS-7 | 2.50 | - | - | - | - | - | - | - | - | 16 | A-4a (V) | - | |
| VERY SOFT TO SOFT, GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, MOIST. | | 19 20 21 | 1 2 2 | 5 | 92 | SS-8 | 0.50 | 12 | 14 | 18 | 35 | 21 | 21 | 14 | 7 | 14 | A-4a (4) | - | |
| | | 22 | 0 0 1 | 1 | 58 | SS-9 | 0.25 | - | - | - | - | - | - | - | - | 15 | A-4a (V) | - | |
| | 763.3 | W 763.4 23 | | | 0 | ST-10 | - | - | - | - | - | - | - | - | - | - | | - | |
| DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET. | | 24 | 8 12 14 | 34 | 42 | SS-11 | - | - | - | - | - | - | - | - | - | 10 | A-1-b (V) | - | |
| | 761.4 | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 23.0' AND AT COMPLETION @ 11.0'; CAVE-IN DEPTH @ 20.7'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / BH | DRILL RIG: MOBILE B53 (62440) | STATION / OFFSET: 1554+77.16 / 27.1' LT | **EXPLORATION ID B-022-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / TG | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/4/18 | ELEVATION: 785.6 (MSL) EOB: 25.0 ft. | | PAGE 1 OF 1 |
| START: 9/1/20 END: 9/1/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 80.7 | LAT / LONG: 39.933844, -82.842152 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 785.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 785.1 | | 1 | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF TO HARD, MOTTLED BROWN AND GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 1 | 3 5 | 11 | 100 | SS-1B | 4.00 | - | - | - | - | - | - | - | - | 19 | A-6a (V) | - | |
| | | 2 | 7 | | | | | | | | | | | | | | | | |
| | | 3 | 12 12 | 32 | 97 | SS-2 | 4.5+ | - | - | - | - | - | - | - | - | 21 | A-6a (V) | - | |
| | | 4 | 4 6 7 | 17 | 89 | SS-3 | 3.75 | 10 | 6 | 8 | 32 | 44 | 26 | 20 | 6 | 19 | A-6a (V) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 3 | | | | | | | | | | | | | | | | |
| | | 7 | 3 6 | 12 | 72 | SS-4 | 3.75 | - | - | - | - | - | - | - | - | 20 | A-6a (V) | - | |
| | 777.6 | 8 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO DENSE, BROWN, GRAY AND BLACK **GRAVEL WITH SAND AND SILT**, MOIST TO WET. | | 9 | 7 8 13 | 28 | 67 | SS-5 | - | - | - | - | - | - | - | - | - | 10 | A-2-4 (V) | - | |
| | | 10 | | | | | | | | | | | | | | | | | |
| | | 11 | 11 14 10 | 32 | 75 | SS-6 | - | - | - | - | - | - | - | - | - | 7 | A-2-4 (V) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 8 8 11 | 26 | 75 | SS-7 | - | - | - | - | - | - | - | - | - | 12 | A-2-4 (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 7 12 11 | 31 | 72 | SS-8 | - | - | - | - | - | - | - | - | - | 13 | A-2-4 (V) | - | |
| | ▽ 767.3 | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 8 12 14 | 35 | 64 | SS-9 | - | - | - | - | - | - | - | - | - | 12 | A-2-4 (V) | - | |
| | W 765.1 | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 9 12 16 | 38 | 78 | SS-10 | - | - | - | - | - | - | - | - | - | 11 | A-2-4 (V) | - | |
| | 762.6 | 23 | | | | | | | | | | | | | | | | | |
| DENSE, GRAY AND DARK GRAY **COARSE AND FINE SAND**, WET. | | 24 | 14 16 16 | 43 | 56 | SS-11 | - | - | - | - | - | - | - | - | - | 14 | A-3a (V) | - | |
| | 760.6 | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 16.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 20.5' AND AT COMPLETION @ 18.3'; CAVE-IN DEPTH @ 14.2'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH/KC | DRILL RIG: CME 55 (386345) | STATION / OFFSET: 1554+71.58 / 14.4' RT | **EXPLORATION ID B-023-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/4/18 | ELEVATION: 789.5 (MSL) EOB: 10.0 ft. | PAGE 1 OF 1 |
| START: 7/17/20 END: 7/17/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90 | LAT / LONG: 39.933731, -82.842182 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 789.5 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 789.0 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, DARK BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. | 786.5 | 1 | 2 4 4 | 12 | 50 | SS-1 | 4.00 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |
| VERY STIFF TO HARD, DARK BROWN AND GRAY TO BROWN AND ORANGE **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | 781.5 | 2 3 4 5 6 | 7 6 8 | 21 | 83 | SS-2 | 3.00 | 7 | 2 | 9 | 41 | 41 | 41 | 18 | 23 | 21 | A-7-6 (13) | 540 | |
| | | 7 | 5 7 11 | 27 | 100 | SS-3 | 4.25 | 3 | 3 | 8 | 36 | 50 | 50 | 22 | 28 | 22 | A-7-6 (17) | - | |
| VERY STIFF, BROWN AND ORANGE **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. | 779.5 | 8 9 | 7 7 7 | 21 | 100 | SS-4 | 4.00 | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |
| | | EOB 10 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / BH | DRILL RIG: MOBILE B53 (SN 386345) | STATION / OFFSET: 1556+50.80 / 24.6' LT | **EXPLORATION ID** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / TG | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | **B-024-0-19** | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 787.6 (MSL) EOB: 25.0 ft. | PAGE | |
| START: 9/1/20 END: 9/1/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 83.6 | LAT / LONG: 39.933810, -82.841536 | 1 OF 1 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 787.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.4' - TOPSOIL (5.0") | 787.2 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF TO HARD, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 1 | 2 5 5 | 14 | 89 | SS-1B | 4.5+ | - | - | - | - | - | - | - | - | 17 | A-6a (V) | - | |
| | | 2 3 | 3 5 | 11 | 81 | SS-2 | 4.25 | - | - | - | - | - | - | - | - | 19 | A-6a (V) | - | |
| | | 4 5 | 3 4 6 | 14 | 75 | SS-3 | 3.75 | 2 | 11 | 11 | 34 | 42 | 32 | 20 | 12 | 28 | A-6a (9) | - | |
| | 782.1 | 6 | | | | | | | | | | | | | | | | | |
| VERY LOOSE TO LOOSE, BROWN AND DARK BROWN **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST. | | 7 | 1 3 4 | 10 | 44 | SS-4 | - | - | - | - | - | - | - | - | - | 12 | A-2-6 (V) | - | |
| | | 8 9 | 2 2 2 | 6 | 67 | SS-5 | - | 55 | 20 | 4 | 15 | 6 | 32 | 19 | 13 | 13 | A-2-6 (0) | - | |
| | 777.1 | 10 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO DENSE, BROWN, DARK BROWN, AND BLACK **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST TO WET. | | 11 12 | 12 16 15 | 43 | 78 | SS-6 | - | - | - | - | - | - | - | - | - | 7 | A-2-4 (V) | - | |
| | | 13 14 | 14 14 10 | 33 | 78 | SS-7 | - | - | - | - | - | - | - | - | - | 8 | A-2-4 (V) | - | |
| ▽ 770.1 | | 15 16 | | | | | | | | | | | | | | | | | |
| W 769.6 | | 17 | 19 14 12 | 36 | 56 | SS-8 | - | - | - | - | - | - | - | - | - | 9 | A-2-4 (V) | - | |
| | | 18 19 | 7 16 14 | 42 | 86 | SS-9 | - | - | - | - | - | - | - | - | - | 13 | A-2-4 (V) | - | |
| | | 20 21 | 9 10 13 | 32 | 47 | SS-10 | - | - | - | - | - | - | - | - | - | 15 | A-2-4 (V) | - | |
| | 764.6 | 22 23 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, GRAY **COARSE AND FINE SAND**, TRACE SILT, WET. | | 24 | 7 9 12 | 29 | 83 | SS-11 | - | - | - | - | - | - | - | - | - | 11 | A-3a (V) | - | |
| | 762.6 | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 16.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 18.0' AND AT COMPLETION @ 17.5'; CAVE-IN DEPTH @ 16.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / BH | DRILL RIG: MOBILE B53 (SN 386345) | STATION / OFFSET: 1558+24.12 / 13.7' LT | **EXPLORATION ID B-025-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / TG | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 789.1 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/1/20 END: 9/1/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 83.6 | LAT / LONG: 39.933760, -82.840921 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 789.1 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6' - TOPSOIL (7.0") | 788.5 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF TO HARD, MOTTLED BROWN AND GRAY **SILT AND CLAY**, LITTLE TO SOME COARSE TO FINE SAND, TRACE TO LITTLE FINE GRAVEL, DAMP TO MOIST. | | 1 | 2 3 4 | 10 | 94 | SS-1B | 3.00 | - | - | - | - | - | - | - | - | 19 | A-6a (V) | - | |
| | | 2 3 | 5 6 10 | 22 | 89 | SS-2 | 4.5+ | 1 | 5 | 7 | 52 | 35 | 32 | 20 | 12 | 18 | A-6a (9) | - | |
| | | 4 5 | 6 9 10 | 26 | 72 | SS-3 | 4.5+ | - | - | - | - | - | - | - | - | 23 | A-6a (V) | - | |
| | | 6 7 | 8 9 10 | 26 | 100 | SS-4 | 4.5+ | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |
| | | 8 9 | 5 6 6 | 17 | 92 | SS-5 | 3.50 | 18 | 19 | 12 | 32 | 19 | 29 | 17 | 12 | 14 | A-6a (4) | - | |
| | 778.6 | 10 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO DENSE, BROWN, BLACK, AND GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST TO WET. | | 11 | 5 6 10 | 22 | 69 | SS-6 | - | - | - | - | - | - | - | - | - | 11 | A-2-4 (V) | - | |
| | | 12 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 5 9 10 | 26 | 78 | SS-7 | - | - | - | - | - | - | - | - | - | 10 | A-2-4 (V) | - | |
| | | 15 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 18 16 19 | 49 | 78 | SS-8 | - | - | - | - | - | - | - | - | - | 10 | A-2-4 (V) | - | |
| | | ▽ 771.1 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 7 8 6 | 20 | 72 | SS-9 | - | - | - | - | - | - | - | - | - | 13 | A-2-4 (V) | - | |
| | 768.6 | 20 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, GRAY **COARSE AND FINE SAND**, TRACE SILT, WET. | | 21 22 | 6 9 11 | 28 | 64 | SS-10 | - | - | - | - | - | - | - | - | - | 19 | A-3a (V) | - | |
| | | 23 24 | 9 11 10 | 29 | 69 | SS-11 | - | - | - | - | - | - | - | - | - | 11 | A-3a (V) | - | |
| | 764.1 | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 17.1'; GROUNDWATER ENCOUNTERED INITIALLY @ 18.0' AND AT COMPLETION @ 18.0'; CAVE-IN DEPTH @ 17.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / BH | DRILL RIG: MOBILE B53 (SN 386345) | STATION / OFFSET: 1558+78.12 / 9' RT | **EXPLORATION ID B-026-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / TG | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 786.6 (MSL) EOB: 10.0 ft. | | PAGE 1 OF 1 |
| START: 9/1/20 END: 9/1/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 83.6 | LAT / LONG: 39.933691, -82.840732 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 786.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.7' - TOPSOIL (8.0") | 785.9 | | 2 3 4 | 10 | 100 | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF, BROWN AND GRAY TO BROWN **SILT AND CLAY**, SOME FINE GRAVEL, LITTLE COARSE TO FINE SAND, DAMP TO MOIST. | | 1 | | | | SS-1B | 3.25 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | <100 | |
| | | 2 | 3 4 5 | 13 | 56 | SS-2 | 3.50 | 21 | 10 | 10 | 29 | 30 | 30 | 17 | 13 | 18 | A-6a (6) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 5 7 9 | 22 | 94 | SS-3 | 3.75 | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | 779.7 | 6 | 3 3 3 | 8 | 78 | SS-4A | 2.50 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | - | |
| LOOSE, BROWN **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST TO WET. | | 7 | | | | SS-4B | - | 41 | 28 | 6 | 19 | 6 | 30 | 18 | 12 | 13 | A-2-6 (0) | - | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 1 2 3 | 7 | 42 | SS-5 | - | - | - | - | - | - | - | - | - | 23 | A-2-6 (V) | - | |
| | 776.6 | EOB 10 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 7.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH/KC | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1562+92.13 / 47.9' RT | **EXPLORATION ID B-028-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 792.3 (MSL) EOB: 10.0 ft. | PAGE 1 OF 1 |
| START: 7/17/20 END: 7/17/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.933535, -82.839265 | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 792.3 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 791.8 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, DARK BROWN AND BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | 789.3 | 1 | 5 5 6 | 15 | 61 | SS-1 | 4.00 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | - | |
| VERY STIFF, BROWN, GRAY, AND ORANGE **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, VERY STIFF TO AHRD | 786.8 | 2<br>3<br>4<br>5 | 6 7 11 | 25 | 111 | SS-2 | 4.00 | 12 | 14 | 20 | 31 | 23 | 24 | 15 | 9 | 10 | A-4a (4) | 1000 | |
| VERY STIFF TO HARD, BROWN AND GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | 782.3 | 6<br>7<br>8 | 5 8 7 | 21 | 89 | SS-3 | 3.25 | - | - | - | - | - | - | - | - | 19 | A-6a (V) | - | |
| | EOB | 9<br>10 | 4 8 9 | 24 | 94 | SS-4 | 4.5+ | - | - | - | - | - | - | - | - | 19 | A-6a (V) | - | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1566+37.27 / 10.7' LT | **EXPLORATION ID B-029-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 790.6 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 7/20/20 END: 7/20/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.933633, -82.838025 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 790.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 790.1 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | A-4a (V) | - | |
| VERY STIFF TO HARD, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 4 4 4 | 11 | 56 | SS-1B | 3.00 | - | - | - | - | - | - | - | - | 15 | A-4a (V) | - | |
| | | 2 | 4 6 6 | 17 | 72 | SS-2 | 3.00 | - | - | - | - | - | - | - | - | 14 | A-4a (V) | - | |
| -TRACE ROOT FIBERS PRESENT THROUGHOUT | | 3 4 5 | 6 7 9 | 23 | 28 | SS-3 | 4.5+ | - | - | - | - | - | - | - | - | 17 | A-4a (V) | - | |
| | 785.1 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN AND ORANGE **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. -TRACE ROOT FIBERS IN SS-4 | 782.6 | 6 7 | 2 2 5 | 10 | 56 | SS-4 | 4.00 | - | - | - | - | - | - | - | - | 15 | A-6a (V) | - | |
| STIFF TO HARD, BROWN AND ORANGE AND DARK GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST. -COBBLES PRESENT @ 8.0' | | 8 9 10 | 3 5 5 | 14 | 83 | SS-5 | 1.50 | - | - | - | - | - | - | - | - | 17 | A-4a (V) | - | |
| | | 11 12 13 | 3 5 9 | 20 | 39 | SS-6 | 4.25 | - | - | - | - | - | - | - | - | 14 | A-4a (V) | - | |
| W 775.6 | | 14 15 | 4 5 6 | 16 | 56 | SS-7 | 3.00 | 16 | 10 | 16 | 32 | 26 | 24 | 14 | 10 | 11 | A-4a (5) | - | |
| | 775.1 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. | | 16 17 18 | 3 4 5 | 13 | 61 | SS-8 | 3.00 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |
| | 770.1 | 19 20 | 3 3 4 | 10 | 100 | SS-9 | 4.00 | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| VERY STIFF TO HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | | 21 22 23 | 3 5 5 | 14 | 94 | SS-10 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | 765.6 | EOB 24 25 | 3 5 7 | 17 | 39 | SS-11 | 3.00 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 15.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH/KC | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1566+72.54 / 19.5' RT | **EXPLORATION ID B-030-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 790.3 (MSL) EOB: 10.0 ft. | PAGE 1 OF 1 |
| START: 7/17/20 END: 7/17/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.933544, -82.837907 | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 790.3 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5'- TOPSOIL (6.0") | 789.8 | | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, DARK BROWN TO BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO DRY. | | 1 | 1 3 3 | 8 | 50 | SS-1 | 3.00 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 8 9 13 | 31 | 100 | SS-2 | 4.25 | 4 | 10 | 15 | 35 | 36 | 33 | 18 | 15 | 14 | A-6a (9) | 330 | |
| | 784.8 | 5 | | | | | | | | | | | | | | | | | |
| STIFF, BROWN AND REDDISH BROWN **SILTY CLAY**, SOME FINE TO COARSE SAND, LITTLE FINE GRAVEL, MOIST. | | 6 | 3 4 4 | 11 | 72 | SS-3 | 1.25 | 18 | 20 | 11 | 26 | 25 | 39 | 18 | 21 | 19 | A-6b (7) | - | |
| | 782.3 | 7 | | | | | | | | | | | | | | | | | |
| MEDIUM STIFF, BROWN, DARK BROWN AND RED **SANDY SILT**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 8 | | | | | | | | | | | | | | | | | |
| | 780.3 | 9 | 4 6 7 | 18 | 83 | SS-4 | 0.75 | - | - | - | - | - | - | - | - | 15 | A-4a (V) | - | |
| | | EOB 10 | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 9.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1568+42.52 / 14' LT | **EXPLORATION ID B-031-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 793.9 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 7/20/20 END: 7/20/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.933602, -82.837294 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 793.9 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FILL**: VERY STIFF TO HARD, BROWN AND DARK BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 3 6 8 | 20 | 78 | SS-1 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 8 10 12 | 32 | 83 | SS-2 | 4.5+ | - | - | - | - | - | - | - | - | 15 | A-4a (V) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| -COBBLES PRESENT @ 6.0' | | 6 | 7 9 5 | 20 | 67 | SS-3 | 2.50 | - | - | - | - | - | - | - | - | 18 | A-4a (V) | - | |
| | 785.4 | 7 | | | | | | | | | | | | | | | | | |
| STIFF, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | | 8 | | | | | | | | | | | | | | | | | |
| | 783.4 | 9 | 3 4 4 | 11 | 94 | SS-4 | 1.50 | - | - | - | - | - | - | - | - | 19 | A-4a (V) | - | |
| MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET. | | 10 | | | | | | | | | | | | | | | | | |
| | | 11 | 2 6 4 | 14 | 50 | SS-5 | - | - | - | - | - | - | - | - | - | 24 | A-2-4 (V) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 3 4 5 | 13 | 0 | SS-6 | - | - | - | - | - | - | - | - | - | - | | - | |
| | 778.9 | 15 | 7 | - | 100 | 2S-6A | 4.5+ | 8 | 12 | 16 | 35 | 29 | 25 | 15 | 10 | 13 | A-4a (6) | - | |
| VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP TO MOIST. | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 3 4 5 | 13 | 0 | SS-7 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | 18 | 5 | - | 100 | 2S-7A | 4.5+ | - | - | - | - | - | - | - | - | 14 | A-4a (V) | - | |
| | | 19 | 2 3 5 | 11 | 83 | SS-8 | 3.50 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| W 772.9 | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 5 7 8 | 22 | 67 | SS-9 | 4.50 | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | | 24 | 4 4 8 | 17 | 72 | SS-10 | 4.25 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | 768.9 | 25 | | | | | | | | | | | | | | | | | |
| EOB | | | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 21.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

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|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1570+25.94 / 11.8' LT | **EXPLORATION ID B-032-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 795.1 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 7/20/20 END: 7/20/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.933559, -82.836642 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 795.1 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FILL**: VERY STIFF TO HARD, BROWN AND DARK BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP TO MOIST. | | | 4 5 6 | 16 | 61 | SS-1 | 4.5+ | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | | 6 5 5 | 14 | 44 | SS-2 | 4.5+ | - | - | - | - | - | - | - | - | 16 | A-4a (V) | - | |
| | | | 8 7 7 | 20 | 44 | SS-3 | 4.5+ | - | - | - | - | - | - | - | - | 9 | A-4a (V) | - | |
| | 784.6 | | 8 8 7 | 22 | 67 | SS-4 | 2.50 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| DENSE, GRAY **GRAVEL WITH SAND AND SILT**, WET. | 782.1 | | 2 10 14 | 34 | 67 | SS-5 | - | - | - | - | - | - | - | - | - | 12 | A-2-4 (V) | - | |
| HARD, GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, MOIST. | 779.6 | W 781.6 | 5 9 15 | 34 | 72 | SS-6 | 4.5+ | 13 | 16 | 16 | 31 | 24 | 24 | 15 | 9 | 12 | A-4a (4) | - | |
| VERY DENSE, GRAY **GRAVEL WITH SAND, SILT, AND CLAY**, WET. | 777.1 | | 16 29 30 | 85 | 78 | SS-7 | - | - | - | - | - | - | - | - | - | 12 | A-2-6 (V) | - | |
| STIFF TO HARD, GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST. | | | 16 17 24 | 59 | 83 | SS-8 | 4.5+ | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | | | 18 20 28 | 69 | 94 | SS-9 | 1.75 | - | - | - | - | - | - | - | - | 7 | A-4a (V) | - | |
| | 770.1 | EOB | 22 28 18 | 66 | 100 | SS-10 | 2.00 | - | - | - | - | - | - | - | - | 8 | A-4a (V) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 13.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LB BENTONITE CHIPS AND SOIL CUTTINGS. .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH/KC | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1570+70.55 / 17.7' RT | **EXPLORATION ID B-033-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 794.9 (MSL) EOB: 10.0 ft. | PAGE 1 OF 1 |
| START: 7/16/20 END: 7/16/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.933470, -82.836491 | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 794.9 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.7' - TOPSOIL (8.0") | 794.2 | | | | | | | | | | | | | | | | | | |
| **FILL**: VERY STIFF, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. | | 1 2 3 4 5 | 1 2 5 | 10 | 67 | SS-1 | 3.50 | 2 | 4 | 9 | 52 | 33 | 35 | 22 | 13 | 16 | A-6a (9) | 140 | |
| | 789.4 | | 10 7 8 | 21 | 89 | SS-2 | 3.50 | - | - | - | - | - | - | - | - | 16 | A-6a (V) | - | |
| **FILL**: MEDIUM DENSE, BROWN AND GRAY **SANDY SILT**, TRACE CLAY, TRACE FINE GRAVEL, DAMP. | 786.9 | 6 7 8 | 13 10 9 | 27 | 100 | SS-3 | - | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| VERY STIFF, BROWN AND GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, MOIST. | 784.9 | EOB 9 10 | 7 6 9 | 21 | 100 | SS-4 | 2.50 | 15 | 9 | 22 | 39 | 15 | 20 | 16 | 4 | 17 | A-4a (4) | - | |

NOTES: SEEPAGE @ 9.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1572+15.89 / 8' LT | **EXPLORATION ID B-034-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 793.0 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 7/21/20 END: 7/21/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.933511, -82.835968 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 793.0 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0" - TOPSOIL (12.0") | 792.0 | | 2 4 4 | 11 | 61 | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| **FILL**: VERY STIFF, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | | | | | | SS-1B | 3.50 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | 789.5 | | 5 8 9 | 24 | 83 | SS-2 | 4.00 | - | - | - | - | - | - | - | - | 14 | A-4a (V) | - | |
| DENSE, BROWN AND TAN **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST. | 787.5 | | 12 14 12 | 37 | 83 | SS-3 | - | - | - | - | - | - | - | - | - | 9 | A-2-6 (V) | - | |
| DENSE, BROWN AND GRAY **GRAVEL WITH SAND**, TRACE SILT, MOIST. | 785.0 | | 11 11 12 | 33 | 100 | SS-4 | - | - | - | - | - | - | - | - | - | 7 | A-1-b (V) | - | |
| MEDIUM DENSE, DARK BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET. | 782.5 | | 9 12 9 | 30 | 83 | SS-5 | - | - | - | - | - | - | - | - | - | 10 | A-2-4 (V) | - | |
| VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, MOIST. | | W 782.0 | 23 11 15 | 37 | 67 | SS-6 | 3.00 | - | - | - | - | - | - | - | - | 15 | A-4a (V) | - | |
| | | | 3 3 4 | 10 | 72 | SS-7 | 4.25 | 17 | 13 | 15 | 33 | 22 | 22 | 13 | 9 | 12 | A-4a (4) | - | |
| -COBBLES @ 18.0' | | | 5 5 12 | 24 | 50 | SS-8 | 3.50 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | | | 10 6 6 | 17 | 56 | SS-9 | 3.75 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | | | 6 8 10 | 26 | 78 | SS-10 | 4.50 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | 768.0 | EOB | 6 10 12 | 32 | 106 | SS-11 | 4.50 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 11.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

00-2021 RII STAND ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 12/27/22 10:31 - U:\GI8\PROJECTS\2017\W-17-140.GPJ

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1574+26.89 / 11.7' LT | **EXPLORATION ID B-036-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 791.6 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 7/21/20 END: 7/21/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.933480, -82.835216 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 791.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FILL**: VERY STIFF TO HARD, BROWN, ORANGE, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST. | | 1 | 4 5 7 | 17 | 61 | SS-1 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| -ORGANICS TO 5.0' | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 5 6 12 | 26 | 83 | SS-2 | 3.50 | - | - | - | - | - | - | - | - | 16 | A-4a (V) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | | | | | | | | | | | | | | | | | |
| -SHALE FRAGMENTS IN SS-3 | | 7 | 4 6 10 | 23 | 100 | SS-3 | 3.50 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 18 7 8 | 22 | 100 | SS-4 | 2.50 | 15 | 12 | 20 | 33 | 20 | 23 | 15 | 8 | 12 | A-4a (4) | - | |
| | 780.6 | 10 | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, DARK GRAY TO GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. | | 11 | 30 9 8 | 24 | 67 | SS-5 | 4.00 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 5 6 5 | 16 | 67 | SS-6 | 4.00 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 17 18 5 | 33 | 50 | SS-7 | - | - | - | - | - | - | - | - | - | 9 | A-4a (V) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 2 4 5 | 13 | 89 | SS-8 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 5 8 12 | 29 | 100 | SS-9 | 3.00 | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | | 24 | 8 10 10 | 29 | 100 | SS-10 | 2.50 | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | 766.6 | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH/KC | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1574+74.71 / 11.4' RT | **EXPLORATION ID B-037-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 790.7 (MSL) EOB: 10.0 ft. | | PAGE 1 OF 1 |
| START: 7/16/20 END: 7/16/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.933407, -82.835052 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 790.7 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.7' - TOPSOIL (8.0") | 790.0 | | | | | | | | | | | | | | | | | | |
| **FILL**: VERY STIFF TO HARD, BROWN, DARK BROWN, TAN AND DARK GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, DAMP TO MOIST. | | 1 | 2 2 4 | 8 | 50 | SS-1 | 4.25 | - | - | - | - | - | - | - | - | 19 | A-6a (V) | - | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 9 5 4 | 13 | 50 | SS-2 | - | 19 | 12 | 15 | 29 | 25 | 28 | 16 | 12 | 13 | A-6a (5) | 300 | |
| | 785.2 | 5 | | | | | | | | | | | | | | | | | |
| HARD, DARK GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, DAMP. | | 6 | 5 5 6 | 15 | 94 | SS-3 | 4.25 | - | - | - | - | - | - | - | - | 15 | A-6a (V) | - | |
| | 782.7 | 7 | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP. | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 4 4 8 | 17 | 100 | SS-4 | 4.00 | 17 | 9 | 16 | 36 | 22 | 22 | 14 | 8 | 11 | A-4a (5) | - | |
| | 780.7 EOB | 10 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1576+31.24 / 7.1' LT | **EXPLORATION ID B-038-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 788.1 (MSL) EOB: 25.0 ft. | | PAGE 1 OF 1 |
| START: 7/21/20 END: 7/21/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.933426, -82.834491 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 788.1 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FILL**: STIFF TO HARD, BROWN AND GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | | 1 | 6 5 3 | 11 | 72 | SS-1 | 4.5+ | - | - | - | - | - | - | - | - | 18 | A-4a (V) | - | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 4 2 1 | 4 | 78 | SS-2 | 2.00 | - | - | - | - | - | - | - | - | 22 | A-4a (V) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 4 2 4 | 9 | 89 | SS-3 | 1.75 | - | - | - | - | - | - | - | - | 15 | A-4a (V) | - | |
| | 779.6 | 7 | | | | | | | | | | | | | | | | | |
| HARD, GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, SOME FINE GRAVEL, DAMP. | | 8 | 9 7 8 | 22 | 56 | SS-4 | 4.5+ | 24 | 11 | 14 | 31 | 20 | 25 | 14 | 11 | 9 | A-6a (4) | - | |
| | | 9 | | | | | | | | | | | | | | | | | |
| | | 10 | 6 8 8 | 23 | 0 | SS-5 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | 11 | 9 | - | 100 | 2S-5A | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | 6 6 8 | 20 | 0 | SS-6 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | 14 | 9 | - | 100 | 2S-6A | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | 5 6 9 | 22 | 78 | SS-7 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |
| | | 17 | | | | | | | | | | | | | | | | | |
| | | 18 | 5 7 10 | 24 | 100 | SS-8 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |
| | | 19 | | | | | | | | | | | | | | | | | |
| | | 20 | 5 9 11 | 29 | 94 | SS-9 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 8 12 14 | 37 | 100 | SS-10 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |
| | 763.1 | 23 | | | | | | | | | | | | | | | | | |
| | EOB | 24 | | | | | | | | | | | | | | | | | |
| | | 25 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1578+33.48 / 22.6' LT | **EXPLORATION ID B-039-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 788.6 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 8/31/20 END: 8/31/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.933438, -82.833771 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 788.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.7' - ASPHALT (8.0") | 787.9 | | | | | | | | | | | | | | | | | | |
| 0.8' - AGGREGATE BASE (10.0") | 787.1 | | | | | | | | | | | | | | | | | | |
| STIFF TO VERY STIFF, GRAY, DARK BROWN AND DARK GRAY **CLAY**, "AND" SILT, LITTLE FINE GRAVEL, TRACE COARSE AND FINE SAND, MOIST. | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | 3 5 5 | 14 | 89 | SS-1 | 3.00 | - | - | - | - | - | - | - | - | 20 | A-7-6 (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 3 3 4 | 10 | 50 | SS-2 | 3.50 | 19 | 3 | 3 | 36 | 39 | 51 | 29 | 22 | 32 | A-7-6 (15) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 3 4 3 | 10 | 53 | SS-3 | 2.00 | - | - | - | - | - | - | - | - | 28 | A-7-6 (V) | - | |
| | 780.6 | 7 | | | | | | | | | | | | | | | | | |
| HARD, GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP TO MOIST. | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 3 8 9 | 24 | 61 | SS-4 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 10 | | | | | | | | | | | | | | | | | |
| | | 11 | 2 6 8 | 20 | 72 | SS-5 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | 6 8 10 | 25 | 42 | SS-6 | 4.5+ | 25 | 15 | 11 | 31 | 18 | 23 | 15 | 8 | 10 | A-4a (3) | - | |
| | | 14 | | | | | | | | | | | | | | | | | |
| | | 15 | 6 9 10 | 27 | 89 | SS-7 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 5 8 10 | 25 | 72 | SS-8 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 4 8 10 | 25 | 89 | SS-9 | 4.5+ | - | - | - | - | - | - | - | - | 9 | A-4a (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | 15 19 15 | 48 | 83 | SS-10 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | 763.6 | 22 | | | | | | | | | | | | | | | | | |
| EOB | | 23 | | | | | | | | | | | | | | | | | |
| | | 24 | | | | | | | | | | | | | | | | | |
| | | 25 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 22.4'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 1578+85.24 / 32.8' RT | **EXPLORATION ID B-040-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / KS | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 788.6 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 9/10/20 END: 9/10/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.933285, -82.833587 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 788.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 788.3 | | 1 2 4 | 9 | 67 | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| STIFF TO VERY STIFF, DARK BROWNISH GRAY **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE TO LITTLE FINE GRAVEL, DAMP. | | | | | | SS-1B | 2.00 | 18 | 16 | 10 | 35 | 21 | 40 | 21 | 19 | 16 | A-6b (8) | - | |
| | 785.4 | | 4 5 6 | 16 | 89 | SS-2 | 3.75 | 8 | 11 | 10 | 45 | 26 | 38 | 20 | 18 | 19 | A-6b (10) | - | |
| STIFF TO VERY STIFF, DARK BROWNISH GRAY **SILT**, SOME COARSE TO FINE SAND, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. -COBBLES @ 5.0' | | | 3 4 4 | 11 | 94 | SS-3 | 3.25 | - | - | - | - | - | - | - | - | 21 | A-4b (V) | - | |
| | 780.6 | | 1 2 2 | 6 | 44 | SS-4 | 1.50 | 6 | 8 | 14 | 53 | 19 | 27 | 18 | 9 | 21 | A-4b (7) | - | |
| DENSE, BROWN **GRAVEL WITH SAND**, TRACE SILT, WET. -COBBLES @ 9.5' | 778.1 | W 779.6 | 4 9 14 | 33 | 53 | SS-5 | - | - | - | - | - | - | - | - | - | 15 | A-1-b (V) | - | |
| HARD, GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | | 9 10 12 | 32 | 89 | SS-6 | 4.5+ | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |
| | | ▽ 775.6 | 8 9 11 | 29 | 94 | SS-7 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| | | | 15 16 18 | 49 | 0 | SS-8 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | | 19 | - | 67 | 2S-8A | 4.5+ | 7 | 12 | 16 | 35 | 30 | 25 | 14 | 11 | 17 | A-6a (6) | - | |
| | | | 8 12 13 | 36 | 92 | SS-9 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |
| | | | 11 16 20 | 52 | 81 | SS-10 | 4.5+ | - | - | - | - | - | - | - | - | 9 | A-6a (V) | - | |
| | 763.6 | EOB | 9 12 15 | 39 | 89 | SS-11 | 4.25 | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 9.0' AND AT COMPLETION @ 13.0'; CAVE-IN DEPTH @ 16.4'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: MOBILE B53 (SN 386345) | STATION / OFFSET: 1579+46.71 / 51.3' LT | **EXPLORATION ID B-040-1-21** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 788.7 (MSL) EOB: 20.0 ft. | | PAGE 1 OF 1 |
| START: 11/22/21 END: 11/12/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 83.6 | LAT / LONG: 39.933520, -82.833376 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 788.7 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - ASPHALT (6.0") | 788.2 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, DARK BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | 785.7 | | 1 2 4 | 8 | 42 | SS-1 | 2.50 | - | - | - | - | - | - | - | - | 21 | A-6a (V) | - | |
| STIFF, MOTTLED BROWN AND GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. | 783.2 | | 6 3 3 | 8 | 39 | SS-2 | 1.75 | 16 | 4 | 9 | 44 | 27 | 37 | 18 | 19 | 25 | A-6b (11) | - | |
| MEDIUM DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, TRACE FINE GRAVEL, MOIST. | 778.2 | ▽ 782.1 | 5 5 7 | 17 | 50 | SS-3 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | | W 780.0 | 5 5 7 | 17 | 39 | SS-4 | - | 45 | 24 | 11 | 14 | 6 | 22 | 16 | 6 | 11 | A-1-b (0) | - | |
| VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP TO MOIST. | 768.7 | | 6 8 9 | 24 | 0 | SS-5 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | | 8 | - | 100 | 2S-5A | 3.50 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | | 11 14 18 | 45 | 92 | SS-6 | 4.00 | 21 | 18 | 15 | 29 | 17 | 22 | 13 | 9 | 8 | A-4a (2) | - | |
| | | | 11 13 13 | 36 | 100 | SS-7 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | | EOB | 9 10 14 | 33 | 86 | SS-8 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 8.7' AND AT COMPLETION @ 6.6'; CAVE-IN DEPTH @ 7.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 2580+72.37 / 19.9' LT | **EXPLORATION ID B-041-0-19** | |
| TYPE: RETAINING WALL | SAMPLING FIRM / LOGGER: RII / TG | HAMMER: AUTOMATIC | ALIGNMENT: BL RAMP M | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 789.5 (MSL) EOB: 30.0 ft. | | PAGE 1 OF 1 |
| START: 9/10/20 END: 9/10/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.933271, -82.833009 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 789.5 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 789.2 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWNISH GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 1 | 2 3 4 | 10 | 56 | SS-1 | 2.50 | - | - | - | - | - | - | - | - | 19 | A-6a (V) | - | |
| | | 2 | 4 6 6 | 17 | 58 | SS-2 | 2.25 | - | - | - | - | - | - | - | - | 25 | A-6a (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 2 4 5 | 13 | 33 | SS-3A | 2.50 | - | - | - | - | - | - | - | - | 27 | A-6a (V) | - | |
| | | | | | | SS-3B | 2.25 | - | - | - | - | - | - | - | - | 26 | A-6a (V) | - | |
| | 784.0 | 5 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, BROWN TO DARK GRAY **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, MOIST. | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 4 6 8 | 20 | 58 | SS-4 | - | - | - | - | - | - | - | - | - | 17 | A-2-4 (V) | - | |
| | 779.0 | 8 | | | | | | | | | | | | | | | | | |
| HARD, GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. | | 9 | 4 4 6 | 14 | 47 | SS-5 | - | 36 | 14 | 19 | 12 | 19 | 19 | 17 | 2 | 15 | A-2-4 (0) | - | |
| | 776.5 | 10 | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | | 11 | 4 5 9 | 20 | 67 | SS-6 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| ▽ 775.8 | | 12 | | | | | | | | | | | | | | | | | |
| W 774.5 | | 13 | | | | | | | | | | | | | | | | | |
| | 774.0 | 14 | 3 4 4 | 11 | 67 | SS-7 | 3.75 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| HARD, GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 4 5 8 | 19 | 81 | SS-8 | 4.25 | 12 | 14 | 19 | 22 | 33 | 28 | 16 | 12 | 15 | A-6a (5) | - | |
| | 771.5 | 18 | | | | | | | | | | | | | | | | | |
| HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | | 19 | 5 9 10 | 27 | 83 | SS-9 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | 769.0 | 20 | | | | | | | | | | | | | | | | | |
| DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, VERY MOIST. | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 9 12 20 | 46 | 61 | SS-10 | 2.75 | - | - | - | - | - | - | - | - | 11 | A-2-4 (V) | - | |
| | 766.5 | 23 | | | | | | | | | | | | | | | | | |
| HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | | 24 | 10 11 12 | 33 | 89 | SS-11 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | | 25 | | | | | | | | | | | | | | | | | |
| | | 26 | | | | | | | | | | | | | | | | | |
| | | 27 | | | | | | | | | | | | | | | | | |
| | | 28 | | | | | | | | | | | | | | | | | |
| | 759.5 | 29 | 7 11 14 | 36 | 42 | SS-12 | 4.5+ | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | EOB | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 7.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 15.0' AND AT COMPLETION @ 13.7'; CAVE-IN DEPTH @ 16.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: MOBILE B53 (SN 386345) | STATION / OFFSET: 1580+86.04 / 15.2' LT | **EXPLORATION ID B-042-0-19** |
| TYPE: CULVERT | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 790.0 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 8/31/20 END: 8/31/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 83.6 | LAT / LONG: 39.933442, -82.832876 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 790.0 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 789.5 | | | | | | | | | | | | | | | | | | |
| HARD, DARK BROWN AND BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP. | 786.7 | | 2 5 5 | 14 | 78 | SS-1 | 4.5+ | - | - | - | - | - | - | - | - | - | A-4a (V) | - | |
| | | | 7 8 10 | 25 | 72 | SS-2 | 4.5+ | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| LOOSE TO MEDIUM DENSE, BROWN, TAN, AND GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET. | | | 7 6 7 | 18 | 78 | SS-3 | - | - | - | - | - | - | - | - | - | 8 | A-1-b (V) | - | |
| | | W 784.4 | | | | | | | | | | | | | | | | | |
| | 782.0 | | 4 3 4 | 10 | 61 | SS-4 | - | 43 | 46 | 4 | 6 | 1 | NP | NP | NP | 17 | A-1-b (0) | - | |
| STIFF, GRAY **SILT**, LITTLE CLAY, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, WET. | 780.8 | | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET. -COBBLES ENCOUNTERED @ 10.0' & 12.0' | | | 4 5 5 | 14 | 75 | SS-5A | - | - | - | - | - | - | - | - | - | 25 | A-4b (V) | - | |
| | | | | | | SS-5B | - | - | - | - | - | - | - | - | - | 10 | A-1-b (V) | - | |
| | | | 6 12 17 | 40 | 72 | SS-6 | - | - | - | - | - | - | - | - | - | 7 | A-1-b (V) | - | |
| | 774.5 | | 23 6 6 | 17 | 36 | SS-7 | - | - | - | - | - | - | - | - | - | 13 | A-1-b (V) | - | |
| VERY STIFF, GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, MOIST. -WATER ADDED TO BOREHOLE @ 18.0' | | | 2 2 3 | 7 | 36 | SS-8 | 3.00 | 22 | 20 | 11 | 30 | 17 | 23 | 15 | 8 | 13 | A-4a (2) | - | |
| | | | 5 5 6 | 15 | 19 | SS-9 | 2.50 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | | | 5 | - | 0 | 2S-9A | - | - | - | - | - | - | - | - | - | - | | - | |
| | | | 3 5 7 | 17 | 72 | SS-10 | 3.00 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | 765.0 | EOB | 3 6 9 | 21 | 58 | SS-11 | 3.00 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 5.6' AND NOT DETERMINED AT COMPLETION DUE TO THE USE OF WASH WATER; CAVE-IN DEPTH @ 15.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LARRY | DRILL RIG: CME 55 TRUCK | STATION / OFFSET: 2+73.11 / 49.4' LT | **EXPLORATION ID B-048-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: DHDC / GANESH | HAMMER: CME AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.25" HSA | CALIBRATION DATE: 5/7/13 | ELEVATION: 787.0 (MSL) EOB: 6.0 ft. | | PAGE 1 OF 1 |
| START: 9/16/20 END: 9/16/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 89 | LAT / LONG: 39.925040, -82.831246 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 787.0 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TOPSOIL** (4") | 786.7 | | | | | | | | | | | | | | | | | | |
| FILL: MEDIUM DENSE, BROWN AND GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, DAMP | 785.5 | 1 | 3 5 4 | 13 | 44 | SS-1 | - | - | - | - | - | - | - | - | - | 7 | A-2-4 (V) | - | |
| VERY STIFF, DARK BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP | | 2 | 3 4 5 | 13 | 56 | SS-2 | 2.50 | 2 | 3 | 9 | 50 | 36 | 37 | 24 | 13 | 22 | A-6a (9) | <100 | |
| | 782.5 | 3 | 4 2 4 | 9 | 58 | SS-3 | 1.50 | - | - | - | - | - | - | - | - | 26 | A-6a (V) | - | |
| STIFF, BROWN, **SILTY CLAY**, TRACE TO LITTLE SAND, MOIST | 781.0 | 4 | 5 3 6 | 13 | 75 | SS-4 | 1.50 | - | - | - | - | - | - | - | - | 23 | A-6b (V) | - | |
| ---TRACE SHALE FRAGMENTS--- | | EOB 5 6 | | | | | | | | | | | | | | | | | |

NOTES: BORING WAS MOVED 4.0 FEET WEST AND 12.0 FEET NORTH OF THE STAKED LOCATION

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LARRY | DRILL RIG: CME 55 TRUCK | STATION / OFFSET: 4+08.57 / 24.5' RT | **EXPLORATION ID B-049-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: DHDC / GANESH | HAMMER: CME AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.25" HSA | CALIBRATION DATE: 5/7/13 | ELEVATION: 784.6 (MSL) EOB: 7.5 ft. | | PAGE 1 OF 1 |
| START: 9/10/20 END: 9/10/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 89 | LAT / LONG: 39.925456, -82.831126 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 784.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ASPHALT** (12") & **GRANULAR BASE** (6") | 783.1 | 1 | | | | | | | | | | | | | | | | | |
| FILL: VERY STIFF, MOTTLED BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, TRACE TO LITTLE GRAVEL, DAMP<br>---CONTAINS ROCK FRAGMENTS---<br>@ 6.0'-7.5'; SAMPLE IS MOIST | | 2<br>3<br>4<br>5<br>6 | 5<br>8<br>11<br>8<br>9<br>10<br>8<br>6<br>7 | 28<br>28<br>19 | 89<br>64<br>89 | SS-1<br>SS-2<br>SS-3 | 4.00<br>3.00<br>4.00 | 8<br>12<br>- | 13<br>12<br>- | 17<br>16<br>- | 32<br>30<br>- | 30<br>30<br>- | 33<br>32<br>- | 19<br>18<br>- | 14<br>14<br>- | 11<br>13<br>12 | A-6a (7)<br>A-6a (7)<br>A-6a (V) | -<br>220<br>- | |
| | 777.1 | EOB 7 | 8<br>6<br>6 | 18 | 58 | SS-4 | 2.00 | - | - | - | - | - | - | - | - | 29 | A-6a (V) | - | |

NOTES: BORING WAS RELOCATED TO AN OFFSET LOCATION ABOUT 3.0 FEET NORTH AND 16.0 FEET WEST DUE TO UTILITIES

ABANDONMENT METHODS, MATERIALS, QUANTITIES: USED ASPHALT PATCH; BACKFILLED WITH AUGER CUTTINGS

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LARRY | DRILL RIG: CME 55 TRUCK | STATION / OFFSET: 5+98.04 / 59.4' LT | **EXPLORATION ID B-050-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: DHDC / GANESH | HAMMER: CME AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.25" HSA | CALIBRATION DATE: 5/7/13 | ELEVATION: 785.0 (MSL) EOB: 6.0 ft. | PAGE 1 OF 1 |
| START: 9/14/20 END: 9/14/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 89 | LAT / LONG: 39.925938, -82.831531 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 785.0 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TOPSOIL** (4") | 784.7 | | | | | | | | | | | | | | | | | | |
| FILL: STIFF, DARK BROWN AND BROWN, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, DAMP | 783.5 | 1 | 2 3 5 | 12 | 39 | SS-1 | 3.50 | 10 | 17 | 12 | 35 | 26 | 38 | 18 | 20 | 17 | A-6b (9) | - | |
| ---ROCK FRAGMENTS IN SAMPLE--- | | 2 | 3 2 2 | 6 | 61 | SS-2 | 1.00 | 18 | 36 | 9 | 16 | 21 | 36 | 22 | 14 | 17 | A-6a (1) | <100 | |
| FILL: MEDIUM STIFF TO STIFF, DARK BROWN AND BROWN, **SILT AND CLAY**, AND SAND, LITTLE GRAVEL, DAMP | 780.5 | 3 | 3 3 3 | 9 | 64 | SS-3 | 4.00 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | - | |
| ---SHALE FRAGMENTS IN SAMPLE #3--- | 779.0 | 4 5 | 5 6 9 | 22 | 81 | SS-4 | 3.00 | - | - | - | - | - | - | - | - | 29 | A-6b (V) | - | |
| VERY STIFF, BLACK, **SILTY CLAY**, TRACE SAND, MOIST | | EOB 6 | | | | | | | | | | | | | | | | | |
| ---LIGHT ORGANIC ODOR--- | | | | | | | | | | | | | | | | | | | |

NOTES: BORING WAS RELOCATED TO AN OFFSET LOCATION 11.0 FEET NORTH AND 6.0 FEET WEST DUE TO UTILITIES

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 8+12.26 / 58.3' RT | **EXPLORATION ID B-051-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 783.5 (MSL) EOB: 6.0 ft. | | PAGE 1 OF 1 |
| START: 9/9/20 END: 9/9/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.926532, -82.831130 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 783.5 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (4.0") | 783.2 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF TO HARD, BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 2 3 4 | 10 | 92 | SS-1B | 4.25 | 1 | 5 | 11 | 40 | 43 | 38 | 19 | 19 | 19 | A-6b (12) | 240 | |
| | | 2 | 3 2 3 | 7 | 67 | SS-2 | 4.25 | 1 | 4 | 11 | 44 | 40 | 39 | 18 | 21 | 18 | A-6b (12) | - | |
| | | 3 | 3 3 4 | 10 | 94 | SS-3 | 4.00 | - | - | - | - | - | - | - | - | 16 | A-6b (V) | - | |
| | 777.5 | 4 5 6 EOB | 4 5 5 | 14 | 100 | SS-4 | 3.50 | - | - | - | - | - | - | - | - | 14 | A-6b (V) | - | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LARRY | DRILL RIG: CME 55 TRUCK | STATION / OFFSET: 9+84.75 / 37.5' LT | **EXPLORATION ID B-053-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: DHDC / GANESH | HAMMER: CME AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.25" HSA | CALIBRATION DATE: 5/7/13 | ELEVATION: 786.4 (MSL) EOB: 7.5 ft. | | PAGE 1 OF 1 |
| START: 9/16/20 END: 9/16/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 89 | LAT / LONG: 39.927020, -82.831428 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 786.4 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ASPHALT** (8") & **GRANULAR BASE** (4") | 785.4 | | | | | | | | | | | | | | | | | | |
| FILL: VERY STIFF, DARK BROWN, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, DAMP | | 1 | 9 5 6 | 16 | 78 | SS-1 | 4.00 | 13 | 12 | 13 | 28 | 34 | 34 | 18 | 16 | 13 | A-6b (8) | - | |
| ---ORGANIC STAINING IN SAMPLE--- | 783.4 | 2 | | | | | | | | | | | | | | | | | |
| FILL: STIFF, BROWN AND GRAY, **CLAY**, SOME SAND, SOME SILT, LITTLE GRAVEL, DAMP | | 3 | 2 2 3 | 7 | 44 | SS-2 | 1.50 | 11 | 10 | 12 | 29 | 38 | 42 | 24 | 18 | 22 | A-7-6 (10) | <100 | |
| | 780.4 | 4 | 3 3 5 | 12 | 67 | SS-3 | 1.50 | - | - | - | - | - | - | - | - | 22 | A-7-6 (V) | - | |
| FILL: STIFF, BROWN TO DARK BROWN, **SILT AND CLAY**, LITTLE SAND, LITTLE GRAVEL, MOIST | 778.9 | 5 | | | | | | | | | | | | | | | | | |
| ---ROCK FRAGMENTS IN SAMPLE--- | EOB | 6 | 3 5 5 | 15 | 33 | SS-4 | 1.50 | - | - | - | - | - | - | - | - | 23 | A-6a (V) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |

NOTES: BORING WAS RELOCATED TO AN OFFSET LOCATION ABOUT 16.0 FEET EAST OF THE STAKED LOCATION

ABANDONMENT METHODS, MATERIALS, QUANTITIES: USED ASPHALT PATCH; BACKFILLED WITH AUGER CUTTINGS

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 12+26.90 / 53.7' RT | **EXPLORATION ID B-054-0-19** |
| TYPE: CULVERT | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 784.9 (MSL) EOB: 40.0 ft. | PAGE 1 OF 2 |
| START: 9/8/20 END: 9/8/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.927665, -82.831041 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 784.9 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.4' - TOPSOIL (5.0") | 784.5 | 1 | 3 4 5 | 13 | 39 | SS-1 | 2.00 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |
| STIFF TO VERY STIFF, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 2 | 5 7 7 | 20 | 33 | SS-2 | 2.50 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 10 7 6 | 18 | 36 | SS-3 | 2.75 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 4 3 3 | 8 | 44 | SS-4 | 2.00 | - | - | - | - | - | - | - | - | 22 | A-6a (V) | - | |
| | 776.9 | 8 | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE TO LITTLE FINE GRAVEL, DAMP TO MOIST. | | 9 | 3 6 8 | 20 | 53 | SS-5 | 2.00 | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| | | 10 | | | | | | | | | | | | | | | | | |
| | | 11 | | | | | | | | | | | | | | | | | |
| | | 12 | 10 9 12 | 29 | 56 | SS-6 | 4.00 | 13 | 7 | 12 | 35 | 33 | 26 | 14 | 12 | 11 | A-6a (7) | - | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 6 6 10 | 22 | 75 | SS-7 | 4.25 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 5 7 11 | 25 | 69 | SS-8 | 4.25 | 4 | 7 | 17 | 41 | 31 | 25 | 14 | 11 | 12 | A-6a (8) | - | |
| | 766.4 | 18 | | | | | | | | | | | | | | | | | |
| HARD, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. | | 19 | 5 8 10 | 25 | 83 | SS-9 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 6 9 10 | 27 | 89 | SS-10 | 4.5+ | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | | 24 | 12 13 15 | 39 | 100 | SS-11 | 4.5+ | - | - | - | - | - | - | - | - | 8 | A-4a (V) | - | |
| | | 25 | | | | | | | | | | | | | | | | | |
| | | 26 | | | | | | | | | | | | | | | | | |
| | | 27 | | | | | | | | | | | | | | | | | |
| | | 28 | | | | | | | | | | | | | | | | | |
| | | 29 | 9 11 17 | 39 | 89 | SS-12 | 4.5+ | - | - | - | - | - | - | - | - | 9 | A-4a (V) | - | |

| PID: 98232 | SFN: | PROJECT: FRA-070-22.85 | STATION / OFFSET: 1226.9, 54' RT. | START: 9/8/20 | END: 9/8/20 | PG 2 OF 2 | B-054-0-19 |
|---|---|---|---|---|---|---|---|

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HARD, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. *(continued)* | 754.9 | 31 | | | | | | | | | | | | | | | | | |
| | | 32 | | | | | | | | | | | | | | | | | |
| | | 33 | | | | | | | | | | | | | | | | | |
| | | 34 | 12 18 18 | 51 | 36 | SS-13 | 4.25 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 35 | | | | | | | | | | | | | | | | | |
| | | 36 | | | | | | | | | | | | | | | | | |
| | | 37 | | | | | | | | | | | | | | | | | |
| | | 38 | | | | | | | | | | | | | | | | | |
| | | 39 | 13 14 23 | 52 | 100 | SS-14 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | 744.9 | EOB 40 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 28.6'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LARRY | DRILL RIG: CME 55 TRUCK | STATION / OFFSET: 12+35.00 / 225' RT | **EXPLORATION ID B-055-0-19** | |
| TYPE: CULVERT | SAMPLING FIRM / LOGGER: DHDC / GANESH | HAMMER: CME AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.25" HSA | CALIBRATION DATE: 5/7/13 | ELEVATION: 788.9 (MSL) EOB: 40.0 ft. | | PAGE 1 OF 2 |
| START: 9/22/20 END: 9/22/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 89 | LAT / LONG: 39.927654, -82.830430 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 788.9 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ASPHALT** (6") | 788.4 | | | | | | | | | | | | | | | | | | |
| **CONCRETE** (12") | 787.4 | | | | | | | | | | | | | | | | | | |
| FILL: VERY STIFF, MOTTLED BROWN AND GRAY, **SILTY CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, DAMP | 785.9 | 1 | 2 3 6 | 13 | 50 | SS-1 | 3.00 | - | - | - | - | - | - | - | - | 19 | A-6b (V) | - | |
| ---TRACE SHALE FRAGMENTS--- | | 2 | | | | | | | | | | | | | | | | | |
| FILL: STIFF TO VERY STIFF, MOTTLED BROWN AND GRAY WITH OCCASIONAL BLUISH GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP TO MOIST | | 3 | 5 3 5 | 12 | 42 | SS-2 | 2.50 | - | - | - | - | - | - | - | - | 20 | A-6a (V) | - | |
| ---LITTLE ROCK FRAGMENTS IN SAMPLE--- | | 4 | | | | | | | | | | | | | | | | | |
| | | 5 | 3 5 7 | 18 | 36 | SS-3 | 1.50 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | - | |
| | | 6 | | | | | | | | | | | | | | | | | |
| | 778.9 | 7 | 7 3 5 | 12 | 78 | SS-4 | 1.50 | 10 | 10 | 15 | 32 | 33 | 33 | 18 | 15 | 24 | A-6a (8) | - | |
| FILL: VERY STIFF, BROWN WITH TRACE GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP | | 8 | | | | | | | | | | | | | | | | | |
| ---ROCK FRAGMENTS IN SAMPLE--- | 775.9 | 9 | 5 7 9 | 24 | 100 | SS-5 | 4.00 | 8 | 11 | 14 | 34 | 33 | 34 | 19 | 15 | 13 | A-6a (8) | - | |
| POSSIBLE FILL: VERY STIFF, BROWN WITH LITTLE GRAY TO LIGHT GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP | | 10 | | | | | | | | | | | | | | | | | |
| ---ROCK FRAGMENTS IN SAMPLE--- | 773.4 | 11 | 6 7 9 | 24 | 78 | SS-6 | 4.00 | 14 | 12 | 16 | 28 | 30 | 34 | 19 | 15 | 11 | A-6a (7) | - | |
| VERY STIFF, GRAY, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, DAMP | | 12 | | | | | | | | | | | | | | | | | |
| ---OCCASIONAL COARSE GRAVEL AND/OR COBBLE--- | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 4 5 8 | 19 | 83 | SS-7 | 4.00 | 15 | 11 | 15 | 29 | 30 | 35 | 18 | 17 | 11 | A-6b (8) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | | | | | | | | | | | | | | | | | |
| | | 18 | 6 7 13 | 30 | 47 | SS-8 | 4.00 | - | - | - | - | - | - | - | - | 11 | A-6b (V) | - | |
| | | 19 | | | | | | | | | | | | | | | | | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | 6 10 14 | 36 | 89 | SS-9 | 4.00 | - | - | - | - | - | - | - | - | 10 | A-6b (V) | - | |
| | | 22 | | | | | | | | | | | | | | | | | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | | 24 | 11 12 15 | 40 | 89 | SS-10 | 4.00 | - | - | - | - | - | - | - | - | 10 | A-6b (V) | - | |
| | | 25 | | | | | | | | | | | | | | | | | |
| | | 26 | | | | | | | | | | | | | | | | | |
| | | 27 | | | | | | | | | | | | | | | | | |
| | | 28 | | | | | | | | | | | | | | | | | |
| | | 29 | 11 11 16 | 40 | 78 | SS-11 | 4.00 | - | - | - | - | - | - | - | - | 10 | A-6b (V) | - | |

| PID: 98232 | SFN: | PROJECT: FRA-070-22.85 | STATION / OFFSET: 1235, 225' RT. | START: 9/22/20 | END: 9/22/20 | PG 2 OF 2 | B-055-0-19 |
|---|---|---|---|---|---|---|---|

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VERY STIFF, GRAY, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, DAMP<br><br>---OCCASIONAL COARSE GRAVEL AND/OR COBBLE--- *(continued)* | 758.9 | 31<br>32<br>33<br>34<br>35 | 7<br>10<br>18 | 42 | 89 | SS-12 | 4.00 | - | - | - | - | - | - | - | - | 11 | A-6b (V) | - | |
| | 751.9 | 36<br>37<br>38 | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY, **SILT** AND **CLAY**, LITTLE SAND, LITTLE GRAVEL, MOIST<br><br>---SURFACE OF THE SAMPLE IS WET, POSSIBLE PRESENCE OF SATURATED SAND/GRAVEL SEAM OR LAYERS--- | 748.9 | 39<br>EOB 40 | 8<br>13<br>18 | 46 | 100 | SS-13 | 4.00 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: USED ASPHALT PATCH; BACKFILLED WITH AUGER CUTTINGS

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 15+95.82 / 44.6' RT | **EXPLORATION ID B-057-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 788.1 (MSL) EOB: 6.0 ft. | | PAGE 1 OF 1 |
| START: 9/9/20 END: 9/9/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.928677, -82.830980 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 788.1 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (4.0") | 787.8 | | | | | | | | | | | | | | | | | | |
| HARD, BROWN **SILT AND CLAY**, SOME FINE TO COARSE SAND, TRACE TO LITTLE FINE GRAVEL, DAMP TO MOIST. | | 1 | 2 3 9 | 17 | 72 | SS-1 | 4.25 | 19 | 13 | 11 | 33 | 24 | 31 | 17 | 14 | 16 | A-6a (6) | <100 | |
| | | 2 | 9 6 4 | 14 | 33 | SS-2 | 4.5+ | 10 | 14 | 13 | 36 | 27 | 31 | 17 | 14 | 16 | A-6a (7) | - | |
| | | 3 | 4 5 9 | 20 | 78 | SS-3 | 4.25 | - | - | - | - | - | - | - | - | 23 | A-6a (V) | - | |
| | | 4 | 10 7 13 | 28 | 75 | SS-4 | 4.25 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |
| | 782.1 | EOB 6 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

# WILDCAT DYNAMIC CONE LOG



Resource International, Inc.
6350 Presidential Gateway
Columbus, Ohio 43231

PROJECT NUMBER: W-17-140
DATE STARTED: 11-18-2021
DATE COMPLETED: 11-18-2021

HOLE #: D-058-1-21
CREW: J.K., M.J.
PROJECT: FRA-70-24.26 Far East Freeway
ADDRESS: Brice Rd & I-70
LOCATION: Columbus, Ohio

SURFACE ELEVATION: 789
WATER ON COMPLETION: 0
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

| DEPTH | BLOWS PER 10 cm | RESISTANCE Kg/cm² | GRAPH OF CONE RESISTANCE 0 50 100 150 | N' | TESTED CONSISTENCY NON-COHESIVE | COHESIVE |
|---|---|---|---|---|---|---|
| - | 2 | 8.9 | •• | 2 | VERY LOOSE | SOFT |
| - | 2 | 8.9 | •• | 2 | VERY LOOSE | SOFT |
| - 1 ft | 5 | 22.2 | •••••• | 6 | LOOSE | MEDIUM STIFF |
| - | 4 | 17.8 | ••••• | 5 | LOOSE | MEDIUM STIFF |
| - | 7 | 31.1 | ••••••••• | 8 | LOOSE | MEDIUM STIFF |
| - 2 ft | 7 | 31.1 | ••••••••• | 8 | LOOSE | MEDIUM STIFF |
| - | 7 | 31.1 | ••••••••• | 8 | LOOSE | MEDIUM STIFF |
| - | 5 | 22.2 | •••••• | 6 | LOOSE | MEDIUM STIFF |
| - 3 ft | 5 | 22.2 | •••••• | 6 | LOOSE | MEDIUM STIFF |
| - 1 m | 5 | 22.2 | •••••• | 6 | LOOSE | MEDIUM STIFF |
| - | 4 | 15.4 | •••• | 4 | VERY LOOSE | SOFT |
| - 4 ft | 3 | 11.6 | ••• | 3 | VERY LOOSE | SOFT |
| - | 11 | 42.5 | •••••••••••• | 12 | MEDIUM DENSE | STIFF |
| - | 14 | 54.0 | •••••••••••••• | 15 | MEDIUM DENSE | STIFF |
| - 5 ft | 34 | 131.2 | •••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 24 | 92.6 | ••••••••••••••••••••••••• | 25+ | MEDIUM DENSE | VERY STIFF |
| - | 22 | 84.9 | ••••••••••••••••••••••• | 24 | MEDIUM DENSE | VERY STIFF |
| - 6 ft | 18 | 69.5 | •••••••••••••••••• | 19 | MEDIUM DENSE | VERY STIFF |
| - | 17 | 65.6 | ••••••••••••••••• | 18 | MEDIUM DENSE | VERY STIFF |
| - 2 m | 30 | 115.8 | •••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - 7 ft | 41 | 140.2 | •••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 46 | 157.3 | •••••••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 49 | 167.6 | •••••••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - 8 ft | 40 | 136.8 | •••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 45 | 153.9 | •••••••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 47 | 160.7 | •••••••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - 9 ft | 46 | 157.3 | •••••••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 42 | 143.6 | •••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 45 | 153.9 | •••••••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - 3 m 10 ft | 50 | 171.0 | •••••••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | | | | | | |
| - | | | | | | |
| - | | | | | | |
| - 11 ft | | | | | | |
| - | | | | | | |
| - | | | | | | |
| - 12 ft | | | | | | |
| - | | | | | | |
| - | | | | | | |
| - 4 m 13 ft | | | | | | |

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: MOBILE B53 (SN 386345) | STATION / OFFSET: 20+32.03 / 119.3' RT | **EXPLORATION ID B-058-2-21** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 792.3 (MSL) EOB: 10.0 ft. | | PAGE 1 OF 1 |
| START: 11/22/21 END: 11/22/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 83.6 | LAT / LONG: 39.929857, -82.830603 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 792.3 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6' - TOPSOIL (7.0") | 791.7 | | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, DARK BROWN TO MOTTLED BROWN AND GRAY **SILT AND CLAY**, SOME TO "AND" COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 2 2 5 | 10 | 53 | SS-1 | 4.00 | 5 | 12 | 17 | 40 | 26 | 29 | 16 | 13 | 16 | A-6a (7) | - | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 10 10 10 | 28 | 89 | SS-2 | 4.5+ | 2 | 14 | 22 | 34 | 28 | 30 | 17 | 13 | 12 | A-6a (7) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 7 4 5 | 13 | 86 | SS-3 | 4.5+ | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |
| | 784.3 | 7 | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE, BROWNISH GRAY **COARSE AND FINE SAND**, LITTLE FINE GRAVEL, LITTLE SILT, TRACE CLAY, WET. | | 8 | | | | | | | | | | | | | | | | | |
| | 782.3 | 9 | 3 6 6 | 17 | 47 | SS-4 | - | - | - | - | - | - | - | - | - | 19 | A-3a (V) | - | |
| | | EOB 10 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 8.5' AND AT COMPLETION @ 8.2'; CAVE-IN DEPTH @ 8.2'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG | DRILL RIG: MOBILE B53 (SN 386345) | STATION / OFFSET: 23+15.22 / 146.3' RT | **EXPLORATION ID B-059-1-21** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 790.9 (MSL) EOB: 15.0 ft. | | PAGE 1 OF 1 |
| START: 11/22/21 END: 11/22/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 83.6 | LAT / LONG: 39.930627, -82.830434 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 790.9 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5' - TOPSOIL (6.0") | 790.4 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, DAMP. | 787.9 | 1 | 3 3 4 | 10 | 50 | SS-1 | 3.00 | 20 | 6 | 8 | 42 | 24 | 34 | 22 | 12 | 21 | A-6a (7) | - | |
| VERY STIFF, MOTTLED BROWN AND GRAY **CLAY**, SOME SILT, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. | 785.4 | 4 | 3 4 4 | 11 | 83 | SS-2 | 2.25 | 12 | 3 | 15 | 35 | 35 | 44 | 15 | 29 | 26 | A-7-6 (15) | - | |
| MEDIUM DENSE, BROWNISH GRAY TO GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST TO WET. -COBBLES @ 7.0' | 784.1 W 782.9 | 7 | 6 12 9 | 29 | 53 | SS-3 | - | - | - | - | - | - | - | - | - | 11 | A-2-4 (V) | - | |
| | | 9 | 6 7 10 | 24 | 56 | SS-4 | - | - | - | - | - | - | - | - | - | 13 | A-2-4 (V) | - | |
| | | 12 | 6 8 10 | 25 | 44 | SS-5 | - | - | - | - | - | - | - | - | - | 11 | A-2-4 (V) | - | |
| | 775.9 EOB | 15 | 9 8 9 | 24 | 69 | SS-6 | - | - | - | - | - | - | - | - | - | 10 | A-2-4 (V) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 8.0' AND AT COMPLETION @ 6.8'; CAVE-IN DEPTH @ 7.2'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

# WILDCAT DYNAMIC CONE LOG



Resource International, Inc.
6350 Presidential Gateway
Columbus, Ohio 43231

PROJECT NUMBER: W-17-140
DATE STARTED: 11-18-2021
DATE COMPLETED: 11-18-2021

HOLE #: D-059-2-21
CREW: J.K., M.J.
PROJECT: FRA-70-24.26 Far East Freeway
ADDRESS: Brice Rd & I-70
LOCATION: Columbus, Ohio

SURFACE ELEVATION: 803
WATER ON COMPLETION: 1.4
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

| DEPTH | BLOWS PER 10 cm | RESISTANCE Kg/cm² | GRAPH OF CONE RESISTANCE 0 50 100 150 | N' | TESTED CONSISTENCY NON-COHESIVE | COHESIVE |
|---|---|---|---|---|---|---|
| - | 2 | 8.9 | •• | 2 | VERY LOOSE | SOFT |
| - | 3 | 13.3 | ••• | 3 | VERY LOOSE | SOFT |
| - 1 ft | 4 | 17.8 | ••••• | 5 | LOOSE | MEDIUM STIFF |
| - | 4 | 17.8 | ••••• | 5 | LOOSE | MEDIUM STIFF |
| - | 4 | 17.8 | ••••• | 5 | LOOSE | MEDIUM STIFF |
| - 2 ft | 4 | 17.8 | ••••• | 5 | LOOSE | MEDIUM STIFF |
| - | 4 | 17.8 | ••••• | 5 | LOOSE | MEDIUM STIFF |
| - | 7 | 31.1 | ••••••••• | 8 | LOOSE | MEDIUM STIFF |
| - 3 ft | 5 | 22.2 | •••••• | 6 | LOOSE | MEDIUM STIFF |
| - 1 m | 5 | 22.2 | •••••• | 6 | LOOSE | MEDIUM STIFF |
| - | 3 | 11.6 | ••• | 3 | VERY LOOSE | SOFT |
| - 4 ft | 5 | 19.3 | ••••• | 5 | LOOSE | MEDIUM STIFF |
| - | 9 | 34.7 | ••••••••• | 9 | LOOSE | STIFF |
| - | 14 | 54.0 | •••••••••••••• | 15 | MEDIUM DENSE | STIFF |
| - 5 ft | 41 | 158.3 | •••••••••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 20 | 77.2 | •••••••••••••••••••• | 22 | MEDIUM DENSE | VERY STIFF |
| - | 26 | 100.4 | •••••••••••••••••••••••••• | 25+ | MEDIUM DENSE | VERY STIFF |
| - 6 ft | 37 | 142.8 | •••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 42 | 162.1 | •••••••••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - 2 m | 12 | 46.3 | •••••••••••••• | 13 | MEDIUM DENSE | STIFF |
| - 7 ft | 8 | 27.4 | ••••••• | 7 | LOOSE | MEDIUM STIFF |
| - | 11 | 37.6 | ••••••••• | 10 | LOOSE | STIFF |
| - | 20 | 68.4 | •••••••••••••••••• | 19 | MEDIUM DENSE | VERY STIFF |
| - 8 ft | 19 | 65.0 | ••••••••••••••••• | 18 | MEDIUM DENSE | VERY STIFF |
| - | 29 | 99.2 | •••••••••••••••••••••••••• | 25+ | MEDIUM DENSE | VERY STIFF |
| - | 28 | 95.8 | •••••••••••••••••••••••••• | 25+ | MEDIUM DENSE | VERY STIFF |
| - 9 ft | 33 | 112.9 | •••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 29 | 99.2 | •••••••••••••••••••••••••• | 25+ | MEDIUM DENSE | VERY STIFF |
| - | 25 | 85.5 | •••••••••••••••••••••• | 24 | MEDIUM DENSE | VERY STIFF |
| - 3 m 10 ft | 34 | 116.3 | •••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 27 | 82.6 | •••••••••••••••••••••• | 23 | MEDIUM DENSE | VERY STIFF |
| - | 29 | 88.7 | •••••••••••••••••••••••• | 25 | MEDIUM DENSE | VERY STIFF |
| - | 37 | 113.2 | •••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - 11 ft | 31 | 94.9 | •••••••••••••••••••••••••• | 25+ | MEDIUM DENSE | VERY STIFF |
| - | 30 | 91.8 | •••••••••••••••••••••••••• | 25+ | MEDIUM DENSE | VERY STIFF |
| - | 38 | 116.3 | •••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - 12 ft | 37 | 113.2 | •••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 40 | 122.4 | •••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - | 48 | 146.9 | •••••••••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |
| - 4 m 13 ft | 42 | 128.5 | •••••••••••••••••••••••••••••••••••• | 25+ | DENSE | HARD |

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 23+85.70 / 43.2' RT | **EXPLORATION ID B-060-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 810.8 (MSL) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 9/9/20 END: 9/9/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.930840, -82.830783 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 810.8 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.9' - ASPHALT (11.0") | 809.9 | | | | | | | | | | | | | | | | | | |
| 2.1' - AGGREGATE BASE (25.25") | 807.8 | 1 | | | | | | | | | | | | | | | | | |
| **FILL**: MEDIUM DENSE, GRAY TO BROWN **GRAVEL WITH SAND**, TRACE SILT, MOIST. -BRICK FRAGMENTS PRESENT IN SS-2 | 806.3 | 2 | 15 7 7 | 20 | 53 | SS-1 | - | - | - | - | - | - | - | - | - | 5 | A-1-b (V) | 840 | |
| | | 3 | 5 7 4 | 15 | 44 | SS-2 | - | - | - | - | - | - | - | - | - | 6 | A-1-b (V) | - | |
| | | 4 W | | | | | | | | | | | | | | | | | |
| HARD, BROWNISH GRAY TO BROWN **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. | | 5 | 3 8 9 | 24 | 50 | SS-3 | 4.25 | 16 | 17 | 17 | 33 | 17 | 25 | 15 | 10 | 10 | A-4a (3) | - | |
| | | 6 | 7 12 14 | 36 | 100 | SS-4 | 4.5+ | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | 803.3 | 7 EOB | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 4.4'; GROUNDWATER NOT ENCOUNTERED INITIALLY OR AFTER DRILLING COMPLETION; CAVE-IN DEPTH @ 6.2'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LARRY | DRILL RIG: CME 55 TRUCK | STATION / OFFSET: 6077+03.62 / 27.1' LT | **EXPLORATION ID B-061-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: DHDC / GANESH | HAMMER: CME AUTOMATIC | ALIGNMENT: BL RAMP C1 | |
| PID: 98232 SFN: | DRILLING METHOD: 4.25" HSA | CALIBRATION DATE: 5/7/13 | ELEVATION: 809.4 (MSL) EOB: 6.5 ft. | PAGE 1 OF 1 |
| START: 9/14/20 END: 9/14/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 89 | LAT / LONG: 39.931239, -82.831196 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 809.4 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FILL: MEDIUM DENSE, BROWN AND GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND, SILT AND CLAY**, MOIST | | 1 | 2 11 7 | 27 | 33 | SS-1 | - | - | - | - | - | - | - | - | - | 7 | A-2-6 (V) | <100 | |
| | | 2 | 11 8 10 | 27 | 0 | SS-2A | - | - | - | - | - | - | - | - | - | - | A-2-6 (V) | - | |
| | 805.9 | 3 | 16 | - | 100 | SS-2B | - | - | - | - | - | - | - | - | - | 16 | A-2-6 (V) | - | |
| FILL: VERY STIFF, BLUISH BROWN AND GRAY TO LIGHT ORANGISH BROWN, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, DAMP<br><br>---LIGHT ORGANIC ODOR AND TRACE ORGANICS IN SAMPLE--- | | 4 | 8 7 7 | 21 | 78 | SS-3 | 4.00 | 10 | 10 | 12 | 30 | 38 | 39 | 23 | 16 | 14 | A-6b (9) | - | |
| | 802.9 | 5 | 8 6 8 | 21 | 39 | SS-4 | 4.00 | - | - | - | - | - | - | - | - | 13 | A-6b (V) | - | |
| | | 6 EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 25+77.68 / 51.9' RT | **EXPLORATION ID B-062-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 814.5 (MSL) EOB: 6.0 ft. | | PAGE 1 OF 1 |
| START: 9/9/20 END: 9/9/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.931364, -82.830703 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 814.5 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (4.0") | 814.2 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN **SILT AND CLAY**, SOME FINE TO COARSE SAND, TRACE TO LITTLE FINE GRAVEL, MOIST. | 811.5 | 1<br>2<br>3 | 5<br>4<br>4 | 11 | 72 | SS-1 | 4.00 | 6 | 15 | 14 | 37 | 28 | 31 | 16 | 15 | 16 | A-6a (8) | 990 | |
| | | | 9<br>5<br>6 | 15 | 39 | SS-2 | 3.50 | 14 | 15 | 14 | 32 | 25 | 31 | 16 | 15 | 16 | A-6a (6) | - | |
| VERY STIFF TO HARD, GRAY TO BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP. | | | 9<br>9<br>9 | 25 | 100 | SS-3 | 4.00 | - | - | - | - | - | - | - | - | 9 | A-4a (V) | - | |
| | 808.5 | EOB 4<br>5<br>6 | 14<br>17<br>16 | 46 | 36 | SS-4 | 4.25 | - | - | - | - | - | - | - | - | 9 | A-4a (V) | - | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH/KC | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 26+73.91 / 96.5' LT | **EXPLORATION ID B-062-1-21** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 795.0 (MSL) EOB: 15.0 ft. | PAGE 1 OF 1 |
| START: 11/30/21 END: 11/30/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.931657, -82.831206 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 795.0 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6' - TOPSOIL (7.0") | 794.4 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, DARK BROWN TO DARK GRAY **SILTY CLAY**, SOME COARSE TO FINE SAND, SOME FINE GRAVEL, MOIST. | | 1 | 3 3 4 | 10 | 47 | SS-1 | 2.50 | 24 | 10 | 12 | 29 | 25 | 33 | 17 | 16 | 17 | A-6b (6) | - | |
| -TRACE ORGANICS IN SS-1 AND SS-2 | 789.5 | 2 3 4 | 4 3 5 | 11 | 61 | SS-2 | 2.25 | - | - | - | - | - | - | - | - | 21 | A-6b (V) | - | |
| STIFF TO VERY STIFF, BROWNISH GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, MOIST. | | 5 6 | 3 4 6 | 14 | 89 | SS-3 | 1.50 | 17 | 10 | 13 | 40 | 20 | 26 | 17 | 9 | 18 | A-4a (5) | - | |
| -TRACE ORGANICS IN SS-3 | | W 787.5 7 8 | | | | | | | | | | | | | | | | | |
| | 784.5 | 9 | 6 5 8 | 19 | 100 | SS-4 | 3.00 | - | - | - | - | - | - | - | - | 20 | A-4a (V) | - | |
| VERY STIFF, BROWNISH GRAY TO MOTTLED BROWN AND GRAY **SILT AND CLAY** | | 10 11 12 | 6 5 7 | 17 | 81 | SS-5 | 2.50 | 22 | 13 | 15 | 29 | 21 | 27 | 15 | 12 | 15 | A-6a (4) | - | |
| | 780.0 | EOB 13 14 15 | 6 7 10 | 24 | 100 | SS-6 | 3.50 | - | - | - | - | - | - | - | - | 22 | A-6a (V) | - | |

NOTES: SEEPAGE @ 7.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LARRY | DRILL RIG: CME 55 TRUCK | STATION / OFFSET: 6073+38.78 / 14.7' LT | **EXPLORATION ID B-063-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: DHDC / GANESH | HAMMER: CME AUTOMATIC | ALIGNMENT: BL RAMP C1 | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.25" HSA | CALIBRATION DATE: 5/7/13 | ELEVATION: 798.3 (MSL) EOB: 6.0 ft. | | PAGE 1 OF 1 |
| START: 9/14/20 END: 9/14/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 89 | LAT / LONG: 39.932055, -82.831992 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 798.3 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FILL: VERY STIFF, DARK BROWN TO BROWN WITH SPOTTY BLACK, **SANDY SILT**, LITTLE CLAY, SOME GRAVEL, DAMP | 796.8 | 1 | 2 8 12 | 30 | 61 | SS-1 | 3.00 | 21 | 19 | 17 | - 43 - | | 28 | 18 | 10 | 15 | A-4a (2) | 280 | |
| ---TRACE ORGANICS IN SAMPLE--- | 795.3 | 2 | 9 11 18 | 43 | 44 | SS-2 | - | 39 | 22 | 13 | - 26 - | | NP | NP | NP | 8 | A-2-4 (0) | - | |
| FILL: DENSE, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, MOIST | | 3 | 4 5 8 | 19 | 89 | SS-3 | 3.00 | - | - | - | - | - | - | - | - | 16 | A-6b (V) | - | |
| FILL: VERY STIFF, DARK BROWN TO MOTTLED BROWN AND GRAY, **SILTY CLAY**, LITTLE SAND, LITTLE GRAVEL, MOIST | 792.3 | 4 | 10 12 12 | 36 | 100 | SS-4 | 4.00 | - | - | - | - | - | - | - | - | 20 | A-6b (V) | - | |
| ---ROCK FRAGMENTS IN SAMPLE--- ---LIGHT ORGANIC ODOR--- | | EOB 5 6 | | | | | | | | | | | | | | | | | |

NOTES: BORING WAS RELOCATED 20.0 FEET WEST OF THE STAKED LOCATION

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / CC/KS | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 34+52.69 / 70.4' LT | **EXPLORATION ID B-079-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / LH | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 818.6 (MSL) EOB: 10.0 ft. | PAGE 1 OF 1 |
| START: 7/7/20 END: 7/7/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.933784, -82.830914 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 818.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 818.3 | | 3 6 8 | 20 | 86 | SS-1A | - | - | - | - | - | - | - | - | - | 7 | | - | |
| HARD, BROWN **SANDY SILT**, SOME CLAY, SOME FINE GRAVEL, DAMP. | 817.1 | 1 | | | | SS-1B | 4.5+ | 25 | 13 | 13 | 23 | 26 | 25 | 18 | 7 | 6 | A-4a (3) | - | |
| VERY STIFF TO HARD, BROWN TO GRAY **SILT AND CLAY**, SOME FINE TO COARSE SAND, SOME FINE GRAVEL, DAMP TO MOIST. | | 2 | 13 15 12 | 38 | 75 | SS-2 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 8 10 12 | 31 | 100 | SS-3 | 4.5+ | 30 | 20 | 7 | 25 | 18 | 31 | 18 | 13 | 13 | A-6a (2) | 270 | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 1 1 2 | 4 | 44 | SS-4 | 2.50 | - | - | - | - | - | - | - | - | 25 | A-6a (V) | - | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | | W 9 | | | | | | | | | | | | | | | | | |
| | 808.6 | EOB 10 | 4 3 3 | 8 | 78 | SS-5 | 2.00 | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |

NOTES: SEEPAGE @ 9.0'; GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG/KC | DRILL RIG: MOBILE B53 (SN 386345) | STATION / OFFSET: 35+39.42 / 117.7' RT | **EXPLORATION ID B-080-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / LH | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 816.0 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 7/10/20 END: 7/10/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 83.6 | LAT / LONG: 39.933984, -82.830223 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 816.0 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.8' - TOPSOIL (9.0") | 815.2 | | | | | | | | | | | | | | | | | | |
| **FILL**: DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, DAMP. | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | 25 27 27 | 75 | 67 | SS-1 | - | - | - | - | - | - | - | - | - | 3 | A-1-b (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 12 11 2 | 18 | 33 | SS-2 | - | - | - | - | - | - | - | - | - | 6 | A-1-b (V) | - | |
| | 810.5 | 5 | | | | | | | | | | | | | | | | | |
| **FILL**: VERY STIFF TO HARD, BROWN TO GRAYISH BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, DAMP TO MOIST. | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 4 5 8 | 18 | 75 | SS-3 | 3.00 | 15 | 17 | 19 | 23 | 26 | 28 | 16 | 12 | 12 | A-6a (3) | - | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 8 6 7 | 18 | 83 | SS-4 | 4.25 | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |
| | | 10 | | | | | | | | | | | | | | | | | |
| | | 11 | | | | | | | | | | | | | | | | | |
| | | 12 | 9 14 15 | 40 | 92 | SS-5 | 4.50 | - | - | - | - | - | - | - | - | 9 | A-6a (V) | - | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 9 8 8 | 22 | 100 | SS-6 | 4.50 | 17 | 14 | 16 | 28 | 25 | 25 | 14 | 11 | 10 | A-6a (4) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 10 14 18 | 45 | 100 | SS-7 | 4.50 | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 9 9 11 | 28 | 86 | SS-8 | 4.50 | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 9 11 21 | 45 | 100 | SS-9 | 4.50 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | | 24 | 9 9 10 | 26 | 86 | SS-10 | 4.50 | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| | 791.0 | EOB 25 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 37+05.20 / 80.1' RT | **EXPLORATION ID B-081-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 798.9 (MSL) EOB: 25.0 ft. | | PAGE 1 OF 1 |
| START: 10/28/20 END: 10/28/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.934446, -82.830314 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 798.9 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.8'-TOPSOIL (10.0") | 798.1 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWNISH GRAY **SILT AND CLAY**, LITTLE TO SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | 793.4 | | 5 10 12 | 32 | 56 | SS-1 | 3.00 | - | - | - | - | - | - | - | - | 22 | A-6a (V) | - | |
| | | | 7 11 18 | 42 | 61 | SS-2 | 3.75 | - | - | - | - | - | - | - | - | 15 | A-6a (V) | - | |
| MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, SOME CLAY, DAMP. | 788.4 | | 4 6 11 | 24 | 69 | SS-3 | - | 33 | 23 | 9 | 13 | 22 | 28 | 18 | 10 | 11 | A-2-4 (0) | - | |
| | | | 9 8 9 | 24 | 78 | SS-4 | - | - | - | - | - | - | - | - | - | 10 | A-2-4 (V) | - | |
| MEDIUM DENSE TO DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, WET. | | W 787.9 | 12 11 12 | 33 | 89 | SS-5 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| -SHALE FRAGMENTS IN SS-5 | | | 6 8 13 | 30 | 78 | SS-6 | - | - | - | - | - | - | - | - | - | 10 | A-1-b (V) | - | |
| | | | 14 15 16 | 45 | 56 | SS-7 | - | - | - | - | - | - | - | - | - | 15 | A-1-b (V) | - | |
| | | | 9 13 10 | 33 | 83 | SS-8 | - | 35 | 42 | 10 | 13 | - | NP | NP | NP | 12 | A-1-b (0) | - | |
| | | | 12 13 13 | 37 | 78 | SS-9 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | 773.9 | EOB | 11 15 17 | 46 | 92 | SS-10 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 11.0' AND AT COMPLETION @ 9.8'; CAVE-IN DEPTH @ 14.3'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 37+51.17 / 65.9' LT | **EXPLORATION ID B-083-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 811.7 (MSL) EOB: 6.0 ft. | PAGE 1 OF 1 |
| START: 9/9/20 END: 9/9/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.934600, -82.830822 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 811.7 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 811.4 | | | | | | | | | | | | | | | | | | |
| HARD, DARK BROWNISH GRAY TO BROWN **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP. | 810.2 | 1 | 4 5 3 | 11 | 64 | SS-1 | 4.25 | 35 | 17 | 12 | 22 | 14 | 25 | 15 | 10 | 9 | A-4a (0) | 180 | |
| | | 2 | 3 3 5 | 11 | 72 | SS-2 | 4.25 | 6 | 13 | 15 | 39 | 27 | 27 | 16 | 11 | 15 | A-6a (7) | - | |
| STIFF TO HARD, BROWNISH GRAY TO BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 3 | 2 4 5 | 13 | 50 | SS-3 | 1.75 | - | - | - | - | - | - | - | - | 21 | A-6a (V) | - | |
| | | 4 | | | | | | | | | | | | | | | | | |
| | | 5 | 4 3 7 | 14 | 47 | SS-4 | 4.25 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | - | |
| | 805.7 | EOB 6 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 38+84.34 / 116.9' LT | **EXPLORATION ID B-083-1-19** | |
| TYPE: CULVERT | SAMPLING FIRM / LOGGER: RII / J.K. | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 797.5 (MSL) EOB: 40.0 ft. | | PAGE 1 OF 2 |
| START: 10/30/20 END: 10/30/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.934975, -82.830969 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 797.5 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5'- TOPSOIL (6.0") | 797.0 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | | 1 | 3 4 4 | 11 | 61 | SS-1 | 3.50 | - | - | - | - | - | - | - | - | 15 | A-4a (V) | - | |
| -LIMESTONE AND SHALE FRAGMENTS IN SS-1 | 794.5 | 2 | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN TO BROWNISH GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 2 4 6 | 14 | 69 | SS-2 | 3.50 | - | - | - | - | - | - | - | - | 23 | A-6a (V) | - | |
| -WOOD FIBERS IN SS-3A | 790.5 | 5 | | | | | | | | | | | | | | | | | |
| MEDIUM STIFF TO VERY STIFF, GRAY **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE TO SOME FINE GRAVEL, DAMP. | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 3 4 3 | 10 | 58 | SS-3A | 2.50 | 18 | 12 | 13 | 32 | 25 | - | - | - | 14 | A-6a (V) | - | |
| | | | | | | SS-3B | 1.00 | - | - | - | - | - | - | - | - | 18 | A-4a (V) | - | |
| | | 8 | | | 83 | ST-4 | 3.50 | - | - | - | - | - | - | - | - | - | A-4a (V) | - | |
| W 788.1 | | 9 | | | | | | | | | | | | | | | | | |
| | | 10 | 3 3 7 | 14 | 58 | SS-5 | 3.00 | 15 | 11 | 14 | 36 | 24 | - | - | - | 13 | A-4a (V) | - | |
| | | 11 | 7 8 10 | 26 | 67 | SS-6 | 3.50 | 21 | 14 | 14 | 31 | 20 | 24 | 14 | 10 | 11 | A-4a (3) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | 7 6 8 | 20 | 61 | SS-7 | 3.50 | 24 | 13 | 14 | 29 | 20 | - | - | - | 11 | A-4a (V) | - | |
| | | 14 | | | | | | | | | | | | | | | | | |
| | | 15 | 8 9 13 | 32 | 75 | SS-8 | 2.50 | 33 | 12 | 12 | 30 | 13 | - | - | - | 11 | A-4a (V) | - | |
| ▽ 780.7 | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 30 5 13 | 26 | 44 | SS-9 | 2.50 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | 779.5 | 18 | | | | | | | | | | | | | | | | | |
| DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST. | | 19 | | | | | | | | | | | | | | | | | |
| | | 20 | 13 15 14 | 42 | 78 | SS-10 | - | - | - | - | - | - | - | - | - | 9 | A-2-4 (V) | - | |
| -SHALE FRAGMENTS IN SS-10 | 777.0 | 21 | | | | | | | | | | | | | | | | | |
| DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, WET. | | 22 | 10 13 14 | 39 | 75 | SS-11 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| -LIMESTONE FRAGMENTS IN SS-12 | | 24 | 7 17 18 | 50 | 81 | SS-12 | - | - | - | - | - | - | - | - | - | 9 | A-1-b (V) | - | |
| | 770.5 | 25 | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY **SANDY SILT**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 26 | | | | | | | | | | | | | | | | | |
| | | 27 | | | | | | | | | | | | | | | | | |
| | | 28 | | | | | | | | | | | | | | | | | |
| | | 29 | 6 9 9 | 26 | 83 | SS-13 | 3.50 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |

| PID: 98232 | SFN: | PROJECT: FRA-070-22.85 | STATION / OFFSET: 3884.34, 117' LT. | START: 10/30/20 | END: 10/30/20 | PG 2 OF 2 | B-083-1-19 |
|---|---|---|---|---|---|---|---|

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VERY STIFF, GRAY **SANDY SILT**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. *(continued)* | 767.5 | 31 | | | | | | | | | | | | | | | | | |
| | | 32 | | | | | | | | | | | | | | | | | |
| | | 33 | | | | | | | | | | | | | | | | | |
| -WOOD FRAGMENTS IN SS-14 | | 34 | 6 6 10 | 23 | 92 | SS-14 | 3.00 | - | - | - | - | - | - | - | - | 16 | A-4a (V) | - | |
| | | 35 | | | | | | | | | | | | | | | | | |
| | | 36 | | | | | | | | | | | | | | | | | |
| | | 37 | | | | | | | | | | | | | | | | | |
| | | 38 | | | | | | | | | | | | | | | | | |
| | | 39 | 10 8 8 | 23 | 83 | SS-15 | 2.50 | - | - | - | - | - | - | - | - | 17 | A-4a (V) | - | |
| | 757.5 | EOB 40 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 9.4' AND AT COMPLETION @ 16.8'; CAVE-IN DEPTH @ 29.8'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / SB | DRILL RIG: CME 750X (SN 310218) | STATION / OFFSET: 38+36.40 / 85.1' RT | **EXPLORATION ID B-083-2-19** | |
| TYPE: CULVERT | SAMPLING FIRM / LOGGER: RII / T.G. | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 793.9 (MSL) EOB: 40.0 ft. | | PAGE 1 OF 2 |
| START: 10/28/20 END: 10/28/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 86.2 | LAT / LONG: 39.934804, -82.830263 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 793.9 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3'-TOPSOIL (3.0") | 793.6 | | | | | | | | | | | | | | | | | | |
| HARD, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP. | | 1 | 5 11 13 | 34 | 81 | SS-1 | 4.5+ | - | - | - | - | - | - | - | - | 7 | A-4a (V) | - | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | 11 21 23 | 63 | 83 | SS-2 | 4.5+ | - | - | - | - | - | - | - | - | 7 | A-4a (V) | - | |
| | 789.9 | 4 | | | | | | | | | | | | | | | | | |
| HARD, DARK BROWN **SILT AND CLAY**, LITTLE FINE GRAVEL, LITTLE COARSE TO FINE SAND, DAMP. | 788.4 | 5 | 22 18 23 | 59 | 78 | SS-3 | 4.5+ | 17 | 9 | 7 | 21 | 46 | 34 | 19 | 15 | 13 | A-6a (8) | - | |
| HARD, BROWNISH GRAY **SANDY SILT**, "AND" GRAVEL, SOME CLAY, DAMP. | 786.9 | 6 | 8 9 11 | 29 | 81 | SS-4 | 4.5+ | 42 | 6 | 6 | 26 | 20 | - | - | - | 11 | A-4a (V) | - | |
| DENSE, BROWN **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST. | 785.4 | 7 | | | | | | | | | | | | | | | | | |
| | | 8 | 8 9 15 | 34 | 61 | SS-5 | - | 53 | 10 | 5 | 19 | 13 | 31 | 19 | 12 | 10 | A-2-6 (0) | - | |
| MEDIUM DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, MOIST TO WET. | | W 784.4 9 | 9 9 11 | 29 | 75 | SS-6 | - | 67 | 11 | 6 | 11 | 5 | NP | NP | NP | 11 | A-1-b (0) | - | |
| | | ▽ 783.9 10 | | | | | | | | | | | | | | | | | |
| | | 11 | | | | | | | | | | | | | | | | | |
| | | 12 | 12 12 13 | 36 | 0 | SS-7 | - | - | - | - | - | - | - | - | - | - | A-1-b (V) | - | |
| | | 13 | 11 | - | 100 | 2S-SS-7A | - | - | - | - | - | - | - | - | - | 12 | A-1-b (V) | - | |
| | | 14 | 8 9 11 | 29 | 83 | SS-8 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 8 12 14 | 37 | 50 | SS-9 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 8 11 12 | 33 | 81 | SS-10 | - | - | - | - | - | - | - | - | - | 10 | A-1-b (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 7 12 17 | 42 | 69 | SS-11 | - | - | - | - | - | - | - | - | - | 9 | A-1-b (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | | 24 | 8 15 31 | 66 | 92 | SS-12 | - | - | - | - | - | - | - | - | - | 11 | A-1-b (V) | - | |
| | | 25 | | | | | | | | | | | | | | | | | |
| | | 26 | | | | | | | | | | | | | | | | | |
| | 766.9 | 27 | | | | | | | | | | | | | | | | | |
| DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET. | | 28 | | | | | | | | | | | | | | | | | |
| | | 29 | 5 10 14 | 34 | 53 | SS-13 | - | - | - | - | - | - | - | - | - | 15 | A-2-4 (V) | - | |

| PID: 98232 | SFN: | PROJECT: FRA-070-22.85 | STATION / OFFSET: 3836.4, 85' RT. | START: 10/28/20 | END: 10/28/20 | PG 2 OF 2 | B-083-2-19 |
|---|---|---|---|---|---|---|---|

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET. *(continued)* | 763.9 | | | | | | | | | | | | | | | | | | |
| | 761.9 | 31 | | | | | | | | | | | | | | | | | |
| HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | | 32 | | | | | | | | | | | | | | | | | |
| | | 33 | | | | | | | | | | | | | | | | | |
| -LIMESTONE FRAGMENTS IN SS-14 | | 34 | 6 17 21 | 55 | 56 | SS-14 | 4.25 | - | - | - | - | - | - | - | - | 18 | A-4a (V) | - | |
| | | 35 | | | | | | | | | | | | | | | | | |
| | | 36 | | | | | | | | | | | | | | | | | |
| | | 37 | | | | | | | | | | | | | | | | | |
| | | 38 | | | | | | | | | | | | | | | | | |
| | | 39 | 6 9 41 | 72 | 81 | SS-15 | 4.5+ | - | - | - | - | - | - | - | - | 15 | A-4a (V) | - | |
| | 753.9 | EOB 40 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 9.5' AND AT COMPLETION @ 10.0'; CAVE-IN DEPTH @ 26.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 40+06.15 / 52.4' RT | **EXPLORATION ID B-084-0-19** |
| TYPE: RETAINING WALL | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 805.3 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 8/31/20 END: 8/31/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.935275, -82.830336 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 805.3 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0' - ASPHALT (12.0") | 804.3 | | | | | | | | | | | | | | | | | | |
| 0.5' - AGGREGATE BASE (6.0") | 803.8 | | | | | | | | | | | | | | | | | | |
| **FILL**: MEDIUM DENSE TO DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, DAMP. | | | 20 16 12 | 39 | 83 | SS-1 | - | - | - | - | - | - | - | - | - | 4 | A-1-b (V) | - | |
| | 800.8 | | 3 4 6 | 14 | 0 | SS-2 | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF, DARK BROWN TO MODDLED REDDISH BROWN AND GRAY **CLAY**, SOME SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | | 7 | - | 75 | 2S-2A | 3.50 | - | - | - | - | - | - | - | - | 18 | A-7-6 (V) | - | |
| | | | 6 8 8 | 22 | 0 | SS-3 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | | 10 | - | 250 | 2S-3A | 4.00 | - | - | - | - | - | - | - | - | 13 | A-7-6 (V) | - | |
| | 794.8 | | 4 5 8 | 18 | 67 | SS-4 | 4.00 | 4 | 6 | 13 | 28 | 49 | 42 | 21 | 21 | 21 | A-7-6 (13) | - | |
| VERY STIFF TO HARD, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | | 5 8 10 | 25 | 67 | SS-5 | 4.00 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | - | |
| | | | 6 8 10 | 25 | 11 | SS-6 | 4.25 | - | - | - | - | - | - | - | - | - | A-6a (V) | - | |
| | 789.3 | | 10 | - | 67 | 2S-6A | 3.00 | - | - | - | - | - | - | - | - | 15 | A-6a (V) | - | |
| DENSE TO VERY DENSE, DARK BROWN , BROWN, ORANGISH BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, DAMP TO MOIST. -COBBELS @ 17.0' | | ▽ 788.8 | 12 16 19 | 49 | 56 | SS-7 | - | - | - | - | - | - | - | - | - | 7 | A-2-4 (V) | - | |
| | | | 14 15 15 | 42 | 64 | SS-8 | - | - | - | - | - | - | - | - | - | 9 | A-2-4 (V) | - | |
| | | | 16 18 19 | 52 | 72 | SS-9 | - | - | - | - | - | - | - | - | - | 12 | A-2-4 (V) | - | |
| | 780.3 | W 780.8 EOB | 9 12 14 | 36 | 100 | SS-10 | - | - | - | - | - | - | - | - | - | 9 | A-2-4 (V) | - | |

NOTES: SEEPAGE @ 19.7'; GROUNDWATER ENCOUNTERED INITIALLY @ 24.5' AND AT COMPLETION @ 16.5'; CAVE-IN DEPTH @ 18.9'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | | |
|---|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / BH | DRILL RIG: MOBILE B53 (SN 386345) | STATION / OFFSET: 41+45.27 / 54.1' RT | **EXPLORATION ID B-085-0-19** |
| TYPE: RETAINING WALL | SAMPLING FIRM / LOGGER: RII / TG | HAMMER: AUTOMATIC | ALIGNMENT: CL CONST. BRICE RD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 802.4 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 8/31/20 END: 8/31/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 83.6 | LAT / LONG: 39.935656, -82.830294 | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 802.4 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.7' - ASPHALT (8.0") | 801.7 | | | | | | | | | | | | | | | | | | |
| 0.3' - AGGREGATE BASE (4.0") | 801.4 | | | | | | | | | | | | | | | | | | |
| DENSE, BROWN **GRAVEL WITH SAND**, TRACE SILT, DAMP. | 799.4 | 1 | 18 14 12 | 36 | 58 | SS-1 | - | - | - | - | - | - | - | - | - | 6 | A-1-b (V) | - | |
| STIFF TO VERY STIFF, BROWN **SILT AND CLAY**, SOME FINE TO COARSE SAND, SOME FINE GRAVEL, DAMP. | | 4 | 2 3 5 | 11 | 89 | SS-2 | 2.00 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | - | |
| | | 7 | 4 3 5 | 11 | 0 | SS-3 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | 8 | 6 | - | 100 | 2S-3A | 3.00 | - | - | - | - | - | - | - | - | 19 | A-6a (V) | - | |
| | | 9 | 1 2 3 | 7 | 67 | SS-4 | 1.75 | 31 | 15 | 9 | 20 | 25 | 33 | 20 | 13 | 18 | A-6a (3) | - | |
| | 791.9 | | | | | | | | | | | | | | | | | | |
| MEDIUM DENSE TO DENSE, GRAY **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, MOIST. | | 11 | 2 10 7 | 24 | 44 | SS-5 | - | - | - | - | - | - | - | - | - | 13 | A-2-4 (V) | - | |
| | | 14 | 4 6 13 | 26 | 94 | SS-6 | - | 45 | 18 | 8 | 15 | 14 | 26 | 18 | 8 | 12 | A-2-4 (0) | - | |
| | | 17 | 9 7 8 | 21 | 56 | SS-7 | - | - | - | - | - | - | - | - | - | 11 | A-2-4 (V) | - | |
| W 783.4 | | 19 | 10 12 13 | 35 | 0 | SS-8 | - | - | - | - | - | - | - | - | - | - | | - | |
| ▽ 782.4 | | 20 | 6 | - | 100 | 2S-8A | - | - | - | - | - | - | - | - | - | 12 | A-2-4 (V) | - | |
| | 781.4 | | | | | | | | | | | | | | | | | | |
| VERY DENSE, GRAY **GRAVEL**, TRACE COARSE TO FINE SAND, WET. | 779.4 | 22 | 13 17 25 | 59 | 83 | SS-9 | - | - | - | - | - | - | - | - | - | 13 | A-1-a (V) | - | |
| MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST. | 777.4 | 24 | 9 12 12 | 33 | 81 | SS-10 | - | - | - | - | - | - | - | - | - | 13 | A-2-4 (V) | - | |
| EOB | | 25 | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 16.2'; GROUNDWATER ENCOUNTERED INITIALLY @ 19.0' AND AT COMPLETION @ 20.0'; CAVE-IN DEPTH @ 17.3'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG/KC | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1594+39.02 / 22.4' RT | **EXPLORATION ID B-090-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / LH | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 800.5 (MSL) EOB: 10.0 ft. | | PAGE 1 OF 1 |
| START: 7/7/20 END: 7/7/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.933022, -82.828113 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 800.5 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 800.2 | | | | | | | | | | | | | | | | | | |
| **FILL**: DENSE, BLACK **ASPHALT FRAGMENTS**, DAMP. | 799.0 | | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, BROWN AND GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 9 22 10 | 45 | 78 | SS-1 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | 2 3 | 5 6 9 | 21 | 81 | SS-2 | 4.5+ | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |
| | | 4 5 | 2 3 6 | 13 | 78 | SS-3 | 3.00 | 2 | 3 | 9 | 40 | 46 | 31 | 20 | 11 | 19 | A-6a (8) | <100 | |
| | | W 6 7 | 1 6 8 | 20 | 83 | SS-4 | 3.50 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | - | |
| | 790.5 | EOB 9 10 | 6 6 7 | 18 | 94 | SS-5 | 2.75 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |

NOTES: SEEPAGE @ 6.5'; CAVE-IN DEPTH @ 8.3'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG/KC | DRILL RIG: MOBILE B53 (SN 386345) | STATION / OFFSET: 1597+94.42 / 6.8' RT | **EXPLORATION ID B-094-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / LH | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 803.3 (MSL) EOB: 10.0 ft. | | PAGE 1 OF 1 |
| START: 7/7/20 END: 7/7/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 83.6 | LAT / LONG: 39.932898, -82.826851 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 803.3 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 803.0 | | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, "AND" FINE GRAVEL, LITTLE CLAY, DRY TO MOIST. | | 1 | 9 17 18 | 49 | 81 | SS-1 | 4.5+ | - | - | - | - | - | - | - | - | 5 | A-4a (V) | - | |
| | | 2 | 1 9 10 | 26 | 44 | SS-2 | 4.5+ | 36 | 15 | 10 | 26 | 13 | 26 | 18 | 8 | 7 | A-4a (1) | >8000 | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | W 4 | 2 3 2 | 7 | 72 | SS-3 | 2.50 | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | 797.8 | 5 | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAYISH BROWN WITH ORANGE **CLAY**, "AND" SILT, TRACE COARSE TO FINE SAND, MOIST. | | 6 | 4 4 4 | 11 | 100 | SS-4 | 3.00 | 0 | 2 | 5 | 41 | 52 | 61 | 20 | 41 | 24 | A-7-6 (20) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | 793.3 | 9 | 6 6 7 | 18 | 100 | SS-5 | 2.50 | - | - | - | - | - | - | - | - | 22 | A-7-6 (V) | - | |
| | | EOB 10 | | | | | | | | | | | | | | | | | |

NOTES: SEEPAGE @ 4.0'; GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG/KC | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1598+91.46 / 28.2' LT | **EXPLORATION ID B-095-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / LH | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 799.6 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 7/7/20 END: 7/7/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.932960, -82.826493 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 799.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 799.3 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| HARD, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 1 | 3 5 6 | 15 | 56 | SS-1B | 4.25 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |
| | 796.4 | 2 | 6 7 7 | 20 | 72 | SS-2 | 4.50 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | - | |
| STIFF TO VERY STIFF, MOTTLED BROWN AND GRAY **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 3 4 5 | 5 5 6 | 15 | 72 | SS-3 | 3.00 | 1 | 3 | 8 | 39 | 49 | 53 | 19 | 34 | 20 | A-7-6 (19) | - | |
| | | 6 7 8 | 4 3 5 | 11 | 94 | SS-4 | 3.00 | - | - | - | - | - | - | - | - | 22 | A-7-6 (V) | - | |
| | 789.1 | 9 10 | 4 5 6 | 15 | 94 | SS-5 | 2.00 | - | - | - | - | - | - | - | - | 21 | A-7-6 (V) | - | |
| VERY STIFF, GRAYISH BROWN **SILT**, LITTLE CLAY, LITTLE COARSE TO FINE SAND, MOIST. | 786.6 | 11 12 13 | 3 5 4 | 13 | 72 | SS-6 | 3.50 | - | - | - | - | - | - | - | - | 14 | A-4b (V) | - | |
| VERY STIFF, GRAYISH BROWN TO GRAY **SANDY SILT**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. | | 14 15 16 | 3 4 6 | 14 | 44 | SS-7 | - | - | - | - | - | - | - | - | - | - | A-4a (V) | - | |
| | | 17 18 19 | 3 4 5 | 13 | 100 | SS-8 | 3.75 | 13 | 10 | 13 | 38 | 26 | 24 | 14 | 10 | 12 | A-4a (6) | - | |
| | | 20 21 22 | 4 5 8 | 18 | 94 | SS-9 | 3.25 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 23 24 | 5 6 7 | 18 | 61 | SS-10 | 2.75 | - | - | - | - | - | - | - | - | - | A-4a (V) | - | |
| | 774.6 | EOB 25 | 5 7 7 | 20 | 83 | SS-11 | 2.75 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG/KC | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1600+98.34 / 33.1' LT | **EXPLORATION ID B-096-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / LH | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 800.9 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 7/7/20 END: 7/7/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.932922, -82.825762 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 800.9 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 800.6 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF TO HARD, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | 797.7 | 1 | 4 4 5 | 13 | 22 | SS-1B | - | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |
| | | 2 | 5 4 5 | 13 | 72 | SS-2 | 4.00 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| STIFF TO VERY STIFF, DARK BROWN, BROWN, AND GRAY **CLAY**, "AND" SILT, TRACE COARSE TO FINE SAND, MOIST. | | 4 | 3 3 3 | 8 | 56 | SS-3 | 2.75 | 0 | 3 | 9 | 43 | 45 | 48 | 18 | 30 | 23 | A-7-6 (18) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 3 3 3 | 8 | 72 | SS-4 | 2.25 | - | - | - | - | - | - | - | - | 23 | A-7-6 (V) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | 790.4 | 9 | 3 4 3 | 10 | 100 | SS-5 | 1.50 | - | - | - | - | - | - | - | - | 22 | A-7-6 (V) | - | |
| VERY STIFF, GRAYISH BROWN TO GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST. | | 10 | | | | | | | | | | | | | | | | | |
| | | 11 | 3 3 4 | 10 | 44 | SS-6 | 1.50 | 13 | 12 | 14 | 39 | 22 | 22 | 15 | 7 | 13 | A-4a (5) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 3 4 6 | 14 | 78 | SS-7 | 4.00 | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | | 15 | | | | | | | | | | | | | | | | | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 5 5 5 | 14 | 72 | SS-8 | 3.00 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 3 4 5 | 13 | 100 | SS-9 | 3.00 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 3 6 6 | 17 | 100 | SS-10 | 4.00 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | 775.9 | 24 | 4 6 7 | 18 | 100 | SS-11 | 3.75 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | EOB | 25 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 2.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / CC/KS | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1601+86.50 / 0.3' LT | **EXPLORATION ID B-097-0-19** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 806.1 (MSL) EOB: 10.0 ft. | | PAGE 1 OF 1 |
| START: 7/7/20 END: 7/7/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.932815, -82.825457 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 806.1 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (4.0") | 805.8 | | 6 7 5 | 17 | 89 | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| HARD, BROWN **SILT AND CLAY**, SOME FINE TO COARSE SAND, SOME FINE GRAVEL, DAMP. | | 1 | | | | SS-1B | 4.5+ | - | - | - | - | - | - | - | - | - | A-6a (V) | - | |
| | | 2 | 5 6 7 | 18 | 72 | SS-2 | 4.5+ | 31 | 13 | 8 | 29 | 19 | 31 | 18 | 13 | 11 | A-6a (4) | <100 | |
| | 802.8 | 3 | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAYISH BROWN **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. | | 4 | 6 4 7 | 15 | 78 | SS-3 | 3.50 | 20 | 13 | 14 | 34 | 19 | 27 | 18 | 9 | 14 | A-4a (4) | - | |
| | 800.6 | 5 | | | | | | | | | | | | | | | | | |
| VERY STIFF, MOTTLED BROWN AND GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 11 5 5 | 14 | 75 | SS-4 | 3.50 | - | - | - | - | - | - | - | - | 21 | A-6b (V) | - | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 3 3 6 | 13 | 83 | SS-5 | 3.00 | - | - | - | - | - | - | - | - | 23 | A-6b (V) | - | |
| | 796.1 | EOB 10 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG/KC | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1602+96.41 / 31.8' LT | **EXPLORATION ID B-098-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / LH | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 802.6 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 7/7/20 END: 7/7/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.932879, -82.825058 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 802.6 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 802.3 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| VERY STIFF TO HARD, BROWN AND GRAY **CLAY**, SOME SILT, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 2 4 6 | 14 | 61 | SS-1B | 4.00 | - | - | - | - | - | - | - | - | 10 | A-7-6 (V) | - | |
| | | 2 3 | 8 6 7 | 18 | 72 | SS-2 | 4.50 | 2 | 8 | 15 | 30 | 45 | 50 | 20 | 30 | 17 | A-7-6 (18) | - | |
| | | 4 5 | 7 3 5 | 11 | 0 | SS-3 | - | - | - | - | - | - | - | - | - | - | | - | |
| | 796.6 | | 6 | - | 50 | 2S-3A | 3.75 | - | - | - | - | - | - | - | - | 19 | A-7-6 (V) | - | |
| VERY STIFF TO HARD, MOTTLED BROWN AND GRAY TO GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. | | 6 7 | 3 4 3 | 10 | 100 | SS-4 | 3.00 | 16 | 23 | 20 | 25 | 16 | 22 | 16 | 6 | 13 | A-4a (1) | - | |
| | | 8 9 10 | 7 8 15 | 32 | 94 | SS-5 | 4.50 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 11 12 13 | 4 6 7 | 18 | 100 | SS-6 | 4.50 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 14 15 | 3 4 6 | 14 | 67 | SS-7 | 3.00 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 16 17 18 | 7 7 10 | 24 | 83 | SS-8 | 3.75 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 19 20 | 4 5 7 | 17 | 100 | SS-9 | 3.00 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 21 22 23 | 4 4 5 | 13 | 72 | SS-10 | 3.00 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | 777.6 | EOB 24 25 | 5 5 7 | 17 | 100 | SS-11 | 3.00 | - | - | - | - | - | - | - | - | - | A-4a (V) | - | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG/KC | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1605+03.48 / 32' LT | **EXPLORATION ID B-099-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / LH | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 805.4 (MSL) EOB: 25.0 ft. | PAGE 1 OF 1 |
| START: 7/7/20 END: 7/7/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.932839, -82.824321 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 805.4 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (4.0") | 805.1 | | 3 4 6 | 14 | 50 | SS-SS-1B 1A | - 3.50 | - - | - | - | - | - | - | - | - | 11 - | - A-7-6 (V) | - - | |
| VERY STIFF, BROWN TO MOTTLED BROWN AND GRAY **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, DAMP TO MOIST. | | 1 2 3 | 7 6 6 | 17 | 61 | SS-2 | 4.00 | 0 | 4 | 11 | 38 | 47 | 45 | 20 | 25 | 18 | A-7-6 (15) | - | |
| | | 4 5 | 4 4 4 | 11 | 83 | SS-3 | 2.75 | - | - | - | - | - | - | - | - | 21 | A-7-6 (V) | - | |
| | 799.9 | 6 | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, DAMP. | | 7 8 | 4 7 11 | 25 | 72 | SS-4 | 3.75 | 11 | 11 | 15 | 35 | 28 | 27 | 16 | 11 | 13 | A-6a (6) | - | |
| | | 9 10 | 5 7 13 | 28 | 83 | SS-5 | 3.75 | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| | 794.9 | 11 | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, MOIST. | | 12 13 | 5 8 11 | 27 | 100 | SS-6 | 4.50 | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | | 14 15 | 8 11 18 | 41 | 94 | SS-7 | 4.50 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 16 17 | 5 7 11 | 25 | 100 | SS-8 | 4.50 | 14 | 9 | 13 | 37 | 27 | 24 | 14 | 10 | 11 | A-4a (6) | - | |
| | | 18 19 | 6 8 11 | 27 | 78 | SS-9 | 3.75 | - | - | - | - | - | - | - | - | 10 | A-4a (V) | - | |
| | | 20 21 | 7 11 14 | 35 | 100 | SS-10 | 4.50 | - | - | - | - | - | - | - | - | 9 | A-4a (V) | - | |
| | 780.4 | 22 EOB 23 | | | | | | | | | | | | | | | | | |
| | | 24 25 | 9 10 14 | 34 | 100 | SS-11 | 4.50 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / TG/KC | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1605+88.28 / 19.8' RT | **EXPLORATION ID B-100-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / LH | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 809.1 (MSL) EOB: 10.0 ft. | PAGE 1 OF 1 |
| START: 7/7/20 END: 7/7/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.932679, -82.824034 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 809.1 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 808.8 | | | | | | | | | | | | | | | | | | |
| HARD, BROWN **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP TO MOIST. | | 1 | 8 18 18 | 51 | 92 | SS-1 | 4.5+ | - | - | - | - | - | - | - | - | 7 | A-4a (V) | - | |
| | 805.8 | 2 | 8 6 8 | 20 | 97 | SS-2 | 4.00 | 29 | 22 | 9 | 28 | 12 | 26 | 19 | 7 | 19 | A-4a (1) | 1800 | |
| VERY STIFF, BROWN AND GRAY **CLAY**, "AND" SILT, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 4 4 7 | 15 | 92 | SS-3 | 3.00 | 2 | 3 | 9 | 40 | 46 | 58 | 19 | 39 | 24 | A-7-6 (20) | - | |
| | 801.1 | 5 | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN AND GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. | | 6 | 2 2 3 | 7 | 64 | SS-4 | 3.00 | - | - | - | - | - | - | - | - | 18 | A-7-6 (V) | - | |
| | 799.1 | 7 | | | | | | | | | | | | | | | | | |
| EOB | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 5 8 11 | 27 | 89 | SS-5 | 4.00 | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| | | 10 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / LH | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1605+90.01 / 13.3' RT | **EXPLORATION ID B-100-1-19** | |
| TYPE: CULVERT | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | | |
| PID: 98232 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 9/14/20 | ELEVATION: 808.5 (MSL) EOB: 40.0 ft. | | PAGE 1 OF 2 |
| START: 10/22/20 END: 10/22/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.932697, -82.824026 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 808.5 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5'- TOPSOIL (6.0") | 808.0 | | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, DARK BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | 4 5 6 | 15 | 86 | SS-1 | 4.25 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 5 4 4 | 11 | 56 | SS-2 | 2.50 | - | - | - | - | - | - | - | - | 17 | A-4a (V) | - | |
| | 803.0 | 5 | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN TO BROWNISH GRAY **CLAY**, "AND" SILT, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 6 | | | | | | | | | | | | | | | | | |
| | 800.5 | 7 | 5 4 3 | 10 | 64 | SS-3 | 2.75 | 2 | 3 | 9 | 40 | 46 | 48 | 21 | 27 | 23 | A-7-6 (16) | - | |
| VERY STIFF, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 8 | | | | | | | | | | | | | | | | | |
| | 798.0 | 9 | 4 4 6 | 14 | 78 | SS-4 | 2.50 | - | - | - | - | - | - | - | - | 21 | A-6a (V) | - | |
| STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP TO MOIST. | | 10 | | | | | | | | | | | | | | | | | |
| | | 11 | 4 6 10 | 22 | 72 | SS-5 | 4.25 | 9 | 11 | 26 | 23 | 31 | 21 | 15 | 6 | 16 | A-4a (4) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 8 12 12 | 34 | 11 | SS-6 | - | - | - | - | - | - | - | - | - | - | | - | |
| | | 15 | 12 | - | 100 | 2S-SS-6A | 4.25 | - | - | - | - | - | - | - | - | 11 | A-4a (V) | - | |
| | | 16 | | | | | | | | | | | | | | | | | |
| | | 17 | 6 8 8 | 22 | 44 | SS-7 | 2.50 | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 18 | | | | | | | | | | | | | | | | | |
| | | 19 | 3 4 7 | 15 | 61 | SS-8 | 1.75 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | | 20 | | | | | | | | | | | | | | | | | |
| | | 21 | | | | | | | | | | | | | | | | | |
| | | 22 | 6 8 12 | 28 | 42 | SS-9 | 1.75 | - | - | - | - | - | - | - | - | 14 | A-4a (V) | - | |
| | | 23 | | | | | | | | | | | | | | | | | |
| | | 24 | 5 10 13 | 32 | 100 | SS-10 | 4.5+ | - | - | - | - | - | - | - | - | 9 | A-4a (V) | - | |
| | | 25 | | | | | | | | | | | | | | | | | |
| | | 26 | | | | | | | | | | | | | | | | | |
| | | 27 | 7 15 18 | 46 | 44 | SS-11 | 4.5+ | - | - | - | - | - | - | - | - | 8 | A-4a (V) | - | |
| | | 28 | | | | | | | | | | | | | | | | | |
| | | 29 | 8 17 30 | 66 | 78 | SS-12 | 4.5+ | - | - | - | - | - | - | - | - | 9 | A-4a (V) | - | |

| PID: 98232 | SFN: | PROJECT: FRA-070-22.85 | STATION / OFFSET: 160590.01, 13' RT. | START: 10/22/20 | END: 10/22/20 | PG 2 OF 2 | B-100-1-19 |
|---|---|---|---|---|---|---|---|

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP TO MOIST. *(continued)* | 778.5 | 31 | | | | | | | | | | | | | | | | | |
| | 776.5 | 32 | | | | | | | | | | | | | | | | | |
| DENSE, DARK GRAY **GRAVEL WITH SAND AND SILT**, WET. | | 33 | | | | | | | | | | | | | | | | | |
| | | 34 | 3 12 19 | 44 | 50 | SS-13 | - | - | - | - | - | - | - | - | - | 11 | A-2-4 (V) | - | |
| | 771.5 | 35 | | | | | | | | | | | | | | | | | |
| DENSE, DARK GRAY **GRAVEL WITH SAND**, TRACE SILT, WET. -SHALE FRAGMENTS IN SS-14 | | 36 | | | | | | | | | | | | | | | | | |
| | | 37 | | | | | | | | | | | | | | | | | |
| | | 38 | | | | | | | | | | | | | | | | | |
| | | 39 | 10 13 20 | 46 | 72 | SS-14 | - | - | - | - | - | - | - | - | - | 9 | A-1-b (V) | - | |
| | 768.5 EOB | 40 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @34.5'; CAVE-IN DEPTH @ 28.4'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: FRA-070-22.85 | DRILLING FIRM / OPERATOR: RII / CC | DRILL RIG: CME 55 (SN 386345) | STATION / OFFSET: 1609+35.23 / 14.2' RT | **EXPLORATION ID B-101-0-19** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / JK | HAMMER: AUTOMATIC | ALIGNMENT: BL IR 70 WB-CD | |
| PID: 98232 SFN: | DRILLING METHOD: 4.5" CFA | CALIBRATION DATE: 9/14/20 | ELEVATION: 811.2 (MSL) EOB: 10.0 ft. | PAGE 1 OF 1 |
| START: 7/7/20 END: 7/7/20 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 84.2 | LAT / LONG: 39.932604, -82.822802 | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 811.2 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.3' - TOPSOIL (3.0") | 810.9 | | | | | SS-1A | - | - | - | - | - | - | - | - | - | - | | - | |
| HARD, BROWN **SILT AND CLAY**, SOME FINE TO COARSE SAND, LITTLE FINE GRAVEL, DAMP. | | 1 | 5 9 10 | 27 | 75 | SS-1B | 4.5+ | - | - | - | - | - | - | - | - | - | A-6a (V) | - | |
| | 808.0 | 2 3 | 3 6 7 | 18 | 47 | SS-2 | 4.5+ | 20 | 14 | 9 | 32 | 25 | 31 | 18 | 13 | 11 | A-6a (6) | <100 | |
| VERY STIFF, BROWN AND GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. | 805.7 | 4 5 | 7 7 8 | 21 | 78 | SS-3 | 4.00 | - | - | - | - | - | - | - | - | 18 | A-6b (V) | - | |
| VERY STIFF, BROWN AND GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST. | 803.2 | 6 7 8 | 5 5 11 | 22 | 72 | SS-4 | 4.00 | 10 | 12 | 19 | 33 | 26 | 25 | 15 | 10 | 13 | A-4a (5) | - | |
| SOFT, BROWNISH GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. | 801.2 | W 9 EOB 10 | 3 4 7 | 15 | 44 | SS-5 | 0.50 | - | - | - | - | - | - | - | - | 17 | A-4a (V) | - | |

NOTES: SEEPAGE @ 9.3'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

# APPENDIX V

PAVEMENT CORE DATASHEETS

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

# Pavement Core Data Summary

| | |
|---|---|
| PROJECT | FRA-70-22.85 |
| LOCATION | I-70 Sta. 548+64, 30.3 LT |
| JOB No. | W-17-140 |
| BORING/CORE No. | X-017-0-19 |
| DATE CORE OBTAINED | 9/23/2020 |
| CORE OBTAINED BY | SB / TG / JP |

## Core Composition

| Core Number | Lift Thickness (in.) | Asphalt | | | Concrete | Aggregate/Granular Base | Other | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 404 | 402 | 301 | | | | | | |
| X-017-0-19 | 1.50 | ✓ | | | | | | | | |
| | 1.50 | ✓ | | | | | | | | |
| | 2.00 | ✓ | | | | | | | | |
| | 2.00 | | ✓ | | | | | | | |
| | 6.00 | | ✓ | | | | | | | |
| | 5.00 | | ✓ | | | | | | | |
| | 6.50 | | | | | ✓ | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

## Comments/Remarks

- Core is broken at 3.0", 7.0", and 13.0".
- Rounded aggregate and small voids throughout.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 18.00 | in. | Total Asphalt Thickness = | 18.00 | in. | Total Concrete Thickness = | 0.00 | in. | Total Base Thickness = | 6.50 | in. |

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

# Pavement Core Data Summary

| | |
|---|---|
| PROJECT | FRA-70-22.85 |
| LOCATION | I-70 Sta. 562+00, 17.4 LT |
| JOB No. | W-17-140 |
| BORING/CORE No. | X-027-0-19 |
| DATE CORE OBTAINED | 9/23/2020 |
| CORE OBTAINED BY | SB / TG / JP |

## Core Composition

| Core Number | Lift Thickness (in.) | Asphalt | | | Concrete | Aggregate/Granular Base | Other | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 404 | 402 | 301 | | | | | | |
| X-027-0-19 | 2.50 | ✓ | | | | | | | | |
| | 4.00 | | ✓ | | | | | | | |
| | 7.00 | | ✓ | | | | | | | |
| | 5.75 | | ✓ | | | | | | | |
| | 7.00 | | | | | ✓ | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

## Comments/Remarks

- Core is broken at 13.5".
- Rounded aggregate and small voids throughout.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 19.25 | in. | Total Asphalt Thickness = | 19.25 | in. | Total Concrete Thickness = | 0.00 | in. | Total Base Thickness = | 7.00 | in. |

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

# Pavement Core Data Summary

| | |
|---|---|
| PROJECT | FRA-70-22.85 |
| LOCATION | I-70 Sta. 573+02, 35.1 LT |
| JOB No. | W-17-140 |
| BORING/CORE No. | X-035-0-19 |
| DATE CORE OBTAINED | 9/23/2020 |
| CORE OBTAINED BY | SB / TG / JP |

## Core Composition

| Core Number | Lift Thickness (in.) | Asphalt: 404 | Asphalt: 402 | Asphalt: 301 | Concrete | Aggregate/Granular Base | Other | Other | Other | Other |
|---|---|---|---|---|---|---|---|---|---|---|
| X-035-0-19 | 3.50 | ✓ | | | | | | | | |
| | 2.75 | | ✓ | | | | | | | |
| | 6.00 | | | ✓ | | | | | | |
| | 5.25 | | ✓ | | | | | | | |
| | 7.00 | | | | | ✓ | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

## Comments/Remarks

- Core is broken at 3.5", 6.25", and 12.25".
- Rounded aggregate and small voids throughout.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 17.50 | in. | Total Asphalt Thickness = | 17.50 | in. | Total Concrete Thickness = | 0.00 in. | Total Base Thickness = | 7.00 in. |

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

# Pavement Core Data Summary

| | |
|---|---|
| PROJECT | FRA-70-22.85 |
| LOCATION | Brice Road Sta. 8+08, 35.2 LT |
| JOB No. | W-17-140 |
| BORING/CORE No. | X-052-0-19 |
| DATE CORE OBTAINED | 9/23/2020 |
| CORE OBTAINED BY | SB / TG / JP |

## Core Composition

| Core Number | Lift Thickness (in.) | Asphalt | | | Concrete | Aggregate/Granular Base | Other | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 404 | 402 | 301 | | | | | | |
| X-052-0-19 | 1.00 | ✓ | | | | | | | | |
| | 2.00 | ✓ | | | | | | | | |
| | 4.75 | ✓ | | | | | | | | |
| | 3.00 | | ✓ | | | | | | | |
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## Comments/Remarks

- Core is broken at 7.75".
- Rounded aggregate and small voids througout.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 10.75 | in. | Total Asphalt Thickness = | 10.75 | in. | Total Concrete Thickness = | 0.00 in. | Total Base Thickness = | 0.00 in. |

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

# Pavement Core Data Summary

| | |
|---|---|
| PROJECT | FRA-70-22.85 |
| LOCATION | Brice Road Sta. 14+27, 14.0 RT |
| JOB No. | W-17-140 |
| BORING/CORE No. | X-056-0-19 |
| DATE CORE OBTAINED | 10/28/2021 |
| CORE OBTAINED BY | SB / TG / JP |

## Core Composition

| Core Number | Lift Thickness (in.) | Asphalt | | | Concrete | Aggregate/Granular Base | Other | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 404 | 402 | 301 | | | | | | |
| X-056-0-19 | 1.25 | ✓ | | | | | | | | |
| | 1.75 | ✓ | | | | | | | | |
| | 9.75 | | ✓ | | | | | | | |
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## Comments/Remarks

- Core is intact.
- Rounded aggregate and a few small voids throughout.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 12.75 | in. | Total Asphalt Thickness = | 12.75 | in. | Total Concrete Thickness = | 0.00 | in. | Total Base Thickness = | 0.00 | in. |

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

# Pavement Core Data Summary

| | |
|---|---|
| PROJECT | FRA-70-22.85 |
| LOCATION | Brice Road Sta. 19+50, 48.6 LT |
| JOB No. | W-17-140 |
| BORING/CORE No. | X-058-0-19 |
| DATE CORE OBTAINED | 9/23/2020 |
| CORE OBTAINED BY | SB / TG / JP |

## Core Composition

| Core Number | Lift Thickness (in.) | Asphalt | | | Concrete | Aggregate/Granular Base | Other | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 404 | 402 | 301 | | | | | | |
| X-058-0-19 | 1.00 | ✓ | | | | | | | | |
| | 5.00 | | ✓ | | | | | | | |
| | 3.50 | | ✓ | | | | | | | |
| | 4.00 | | | | | ✓ | | | | |
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## Comments/Remarks

- Core is intact.
- Rounded aggregate and a few small voids throughout.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 9.50 | in. | Total Asphalt Thickness = | 9.50 | in. | Total Concrete Thickness = | 0.00 | in. | Total Base Thickness = | 4.00 | in. |

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

# Pavement Core Data Summary

| | |
|---|---|
| PROJECT | FRA-70-22.85 |
| LOCATION | Brice Road Sta. 27+67, 16.7 LT |
| JOB No. | W-17-140 |
| BORING/CORE No. | X-064-0-19 |
| DATE CORE OBTAINED | 9/23/2020 |
| CORE OBTAINED BY | SB / TG / JP |

## Core Composition

| Core Number | Lift Thickness (in.) | Asphalt: 404 | Asphalt: 402 | Asphalt: 301 | Concrete | Aggregate/Granular Base | Other | Other | Other | Other |
|---|---|---|---|---|---|---|---|---|---|---|
| X-064-0-19 | 1.00 | ✓ | | | | | | | | |
| | 3.00 | ✓ | | | | | | | | |
| | 2.50 | | ✓ | | | | | | | |
| | 2.75 | | | ✓ | | | | | | |
| | 2.50 | | | ✓ | | | | | | |
| | 5.00 | | | | | ✓ | | | | |
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## Comments/Remarks

- Core is broken at 9.25".
- Rounded aggregate and small voids throughout.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 11.75 | in. | Total Asphalt Thickness = | 11.75 | in. | Total Concrete Thickness = | 0.00 in. | Total Base Thickness = | 5.00 in. |

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

# Pavement Core Data Summary

| | |
|---|---|
| PROJECT | FRA-70-22.85 |
| LOCATION | Brice Road Sta. 37+29, 30.5 LT |
| JOB No. | W-17-140 |
| BORING/CORE No. | X-082-0-19 |
| DATE CORE OBTAINED | 9/23/2020 |
| CORE OBTAINED BY | SB / TG / JP |

## Core Composition

| Core Number | Lift Thickness (in.) | Asphalt: 404 | Asphalt: 402 | Asphalt: 301 | Concrete | Aggregate/Granular Base | Other | Other | Other | Other |
|---|---|---|---|---|---|---|---|---|---|---|
| X-082-0-19 | 1.00 | ✓ | | | | | | | | |
| | 2.00 | ✓ | | | | | | | | |
| | 2.50 | ✓ | | | | | | | | |
| | 3.50 | | | ✓ | | | | | | |
| | 3.00 | | | | ✓ | | | | | |
| | 5.00 | | | | | ✓ | | | | |
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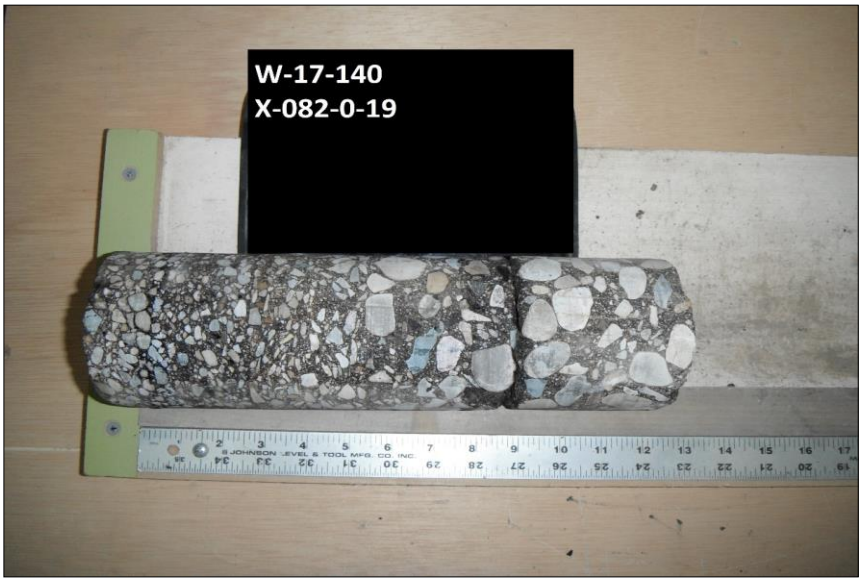
## Comments/Remarks

- Core is broken at 9.0".
- Rounded aggregate and small voids throughout.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 12.00 in. | Total Asphalt Thickness = | 9.00 in. | Total Concrete Thickness = | 3.00 in. | Total Base Thickness = | 5.00 in. |



6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

# Pavement Core Data Summary

| | |
|---|---|
| PROJECT | FRA-70-22.85 |
| LOCATION | I-70 Sta. 597+31, 41.6 LT |
| JOB No. | W-17-140 |
| BORING/CORE No. | X-093-0-19 |
| DATE CORE OBTAINED | 9/23/2020 |
| CORE OBTAINED BY | SB / TG / JP |

## Core Composition

| Core Number | Lift Thickness (in.) | Asphalt | | | Concrete | Aggregate/Granular Base | Other | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 404 | 402 | 301 | | | | | | |
| X-093-0-19 | 1.25 | ✓ | | | | | | | | |
| | 3.00 | ✓ | | | | | | | | |
| | 2.75 | | ✓ | | | | | | | |
| | 6.00 | | ✓ | | | | | | | |
| | 5.00 | | ✓ | | | | | | | |
| | 6.00 | | | | | ✓ | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
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| | | | | | | | | | | |

## Comments/Remarks

- Core is broken at 1.25", 7.0", and 13.0".
- Rounded aggregate and numerous small voids throughout.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 18.00 in. | Total Asphalt Thickness = | 18.00 in. | Total Concrete Thickness = | 0.00 in. | Total Base Thickness = | 6.00 in. |

# APPENDIX VI

CALCULATIONS – GB-1

# OHIO DEPARTMENT OF TRANSPORTATION

## OFFICE OF GEOTECHNICAL ENGINEERING

## PLAN SUBGRADES
## Geotechnical Bulletin GB1

**FRA-70-22.85**
**98232**

**Brice Road widening and pavement overlay, approximatel 4,110 linear feet. Includes one bridge structure and one CD road culvert structure.**

**Resource International, Inc.**

**Prepared By:** Michael D. Kennedy, P.E.
**Date prepared:** Monday, February 1, 2021

Resource International, Inc.
Michael D. Kennedy, P.E.
6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
michaelk@resourceinternational.com

**NO. OF BORINGS:** 12

| # | Boring ID | Alignment | Station | Offset | Dir | Drill Rig | ER | Boring EL. | Proposed Subgrade EL | Cut Fill |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B-048-0-19 | Brice Road | 2+73 | 49 | Lt | CME-55 | 84 | 787.0 | 784.6 | 2.4 C |
| 2 | B-049-0-19 | Brice Road | 4+08 | 25 | Rt | CME-55 | 84 | 784.6 | 784.2 | 0.4 C |
| 3 | B-050-0-19 | Brice Road | 5+98 | 59 | Lt | CME-55 | 84 | 785.0 | 783.7 | 1.3 C |
| 4 | B-051-0-19 | Brice Road | 8+12 | 58 | Rt | CME-55 | 84 | 783.5 | 784.6 | 1.1 F |
| 5 | B-053-0-19 | Brice Road | 9+84 | 38 | Lt | CME-55 | 84 | 786.4 | 785.8 | 0.6 C |
| 6 | B-057-0-19 | Brice Road | 15+96 | 45 | Rt | CME-55 | 84 | 788.1 | 787.2 | 0.9 C |
| 7 | B-059-0-19 | Brice Road | 20+01 | 36 | Rt | CME-55 | 84 | 799.5 | 799.0 | 0.5 C |
| 8 | B-060-0-19 | Brice Road | 23+86 | 43 | Rt | CME-55 | 84 | 810.8 | 810.7 | 0.1 C |
| 9 | B-061-0-19 | Brice Road | 25+22 | 83 | LT | CME-55 | 89 | 809.4 | 813.3 | 3.9 F |
| 10 | B-062-0-19 | Brice Road | 25+78 | 52 | Rt | CME-55 | 84 | 814.5 | 815.5 | 1.0 F |
| 11 | B-079-0-19 | Brice Road | 34+53 | 70 | Lt | CME-55 | 90 | 818.6 | 817.9 | 0.7 C |
| 12 | B-083-0-19 | Brice Road | 37+62 | 69 | Lt | CME-55 | 84 | 811.2 | 812.1 | 0.9 F |

OHIO DEPARTMENT OF TRANSPORTATION

# Subgrade Analysis

V. 14.5 1/18/2019

| # | Boring | Sample | Sample Depth | | Subgrade Depth | | Standard Penetration | | HP (tsf) | Physical Characteristics | | | | | | Moisture | | Ohio DOT | | Sulfate Content (ppm) | Problem | | Excavate and Replace (Item 204) | | Recommendation (Enter depth in inches) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | From | To | From | To | $N_{60}$ | $N_{60L}$ | | LL | PL | PI | % Silt | % Clay | P200 | $M_C$ | $M_{OPT}$ | Class | GI | | Unsuitable | Unstable | Unsuitable | Unstable | |
| 1 | B | SS-1 | 0.0 | 1.5 | -2.4 | -0.9 | 13 | | | | | | | | | 7 | 10 | A-2-4 | 0 | | | | | | 12" |
| | 048-0 | SS-2 | 1.5 | 3.0 | -0.9 | 0.6 | 13 | | 2.5 | 37 | 24 | 13 | 50 | 36 | 86 | 22 | 19 | A-6a | 9 | | | $N_{60}$ & Mc | | 12" | 204 Geotextile |
| | 19 | SS-3 | 3.0 | 4.5 | 0.6 | 2.1 | 9 | | 1.5 | | | | | | | 26 | 14 | A-6a | 10 | | | HP & Mc | | 12" | |
| | | SS-4 | 4.5 | 6.0 | 2.1 | 3.6 | 13 | 9 | 1.5 | | | | | | | 23 | 14 | A-6a | 10 | | | | | | |
| 2 | B | SS-1 | 1.5 | 3.0 | 1.1 | 2.6 | 28 | | 4 | 33 | 19 | 14 | 32 | 30 | 62 | 11 | 14 | A-6a | 7 | | | | | | |
| | 049-0 | SS-2 | 3.0 | 4.5 | 2.6 | 4.1 | 28 | | 3 | 32 | 18 | 14 | 30 | 30 | 60 | 13 | 14 | A-6a | 7 | | | | | | |
| | 19 | SS-3 | 4.5 | 6.0 | 4.1 | 5.6 | 19 | | 4 | | | | | | | 12 | 14 | A-6a | 10 | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 5.6 | 7.1 | 18 | 18 | 2 | | | | | | | 29 | 14 | A-6a | | | | | | | |
| 3 | B | SS-1 | 0.0 | 1.5 | -1.3 | 0.2 | 12 | | 3.5 | 38 | 18 | 20 | 35 | 26 | 61 | 17 | 16 | A-6b | 9 | | | | | | 18" |
| | 050-0 | SS-2 | 1.5 | 3.0 | 0.2 | 1.7 | 6 | | 1 | 36 | 22 | 14 | 16 | 21 | 37 | 17 | 17 | A-6a | 1 | | | HP | | 18" | 204 Geotextile |
| | 19 | SS-3 | 3.0 | 4.5 | 1.7 | 3.2 | 9 | | 4 | | | | | | | 17 | 14 | A-6a | 10 | | | $N_{60}$ & Mc | | | |
| | | SS-4 | 4.5 | 6.0 | 3.2 | 4.7 | 22 | 6 | 3 | | | | | | | 29 | 16 | A-6b | 16 | | | | | | |
| 4 | B | SS-1B | 0.3 | 1.5 | 1.4 | 2.6 | 11 | | 4.25 | 38 | 19 | 19 | 40 | 43 | 83 | 19 | 16 | A-6b | 12 | 80 | | $N_{60}$ & Mc | | | |
| | 051-0 | SS-2 | 1.5 | 3.0 | 2.6 | 4.1 | 8 | | 4.25 | 39 | 18 | 21 | 44 | 40 | 84 | 18 | 16 | A-6b | 12 | | | | | | |
| | 19 | SS-3 | 3.0 | 4.5 | 4.1 | 5.6 | 11 | | 4 | | | | | | | 16 | 16 | A-6b | 16 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 5.6 | 7.1 | 15 | 8 | 3.5 | | | | | | | 14 | 16 | A-6b | | | | | | | |
| 5 | B | SS-1 | 1.5 | 3.0 | 0.9 | 2.5 | 16 | | 4 | 34 | 18 | 16 | 28 | 34 | 62 | 13 | 16 | A-6b | 8 | | | | | | |
| | 053-0 | SS-2 | 3.0 | 4.5 | 2.5 | 4.0 | 7 | | 1.5 | 42 | 24 | 18 | 29 | 38 | 67 | 22 | 21 | A-7-6 | 10 | | | | | | |
| | 19 | SS-3 | 4.5 | 6.0 | 4.0 | 5.5 | 12 | | 1.5 | | | | | | | 22 | 18 | A-7-6 | 16 | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 5.5 | 7.0 | 15 | 7 | 1.5 | | | | | | | 23 | 14 | A-6a | | | | | | | |
| 6 | B | SS-1 | 0.0 | 1.5 | -0.9 | 0.6 | 18 | | 4.25 | 31 | 17 | 14 | 33 | 24 | 57 | 16 | 14 | A-6a | 6 | 60 | | | | | |
| | 057-0 | SS-2 | 1.5 | 3.0 | 0.6 | 2.1 | 15 | | 4.5 | 31 | 17 | 14 | 36 | 27 | 63 | 16 | 14 | A-6a | 7 | | | | | | |
| | 19 | SS-3 | 3.0 | 4.5 | 2.1 | 3.6 | 21 | | 4.25 | | | | | | | 23 | 14 | A-6a | 10 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 3.6 | 5.1 | 30 | 15 | 4.25 | | | | | | | 14 | 14 | A-6a | 10 | | | | | | |
| 7 | B | SS-1 | 1.5 | 3.0 | 1.0 | 2.5 | 15 | | 4 | 33 | 19 | 14 | 22 | 29 | 51 | 11 | 14 | A-6a | 5 | | | | | | |
| | 059-0 | SS-2 | 3.0 | 4.5 | 2.5 | 4.0 | 24 | | 4 | 29 | 18 | 11 | 24 | 25 | 49 | 15 | 14 | A-6a | 3 | | | | | | |
| | 19 | SS-3 | 4.5 | 6.0 | 4.0 | 5.5 | 49 | | 4 | | | | | | | 10 | 10 | A-4a | 8 | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 5.5 | 7.0 | 43 | 15 | 4 | | | | | | | 16 | 10 | A-4a | | | | | | | |
| 8 | B | SS-1 | 1.5 | 3.0 | 1.4 | 2.9 | 21 | | | | | | | | | 5 | 6 | A-1-b | 0 | 840 | | | | | |
| | 060-0 | SS-2 | 3.0 | 4.5 | 2.9 | 4.4 | 17 | | | | | | | | | 6 | 6 | A-1-b | 0 | | | | | | |
| | 19 | SS-3 | 4.5 | 6.0 | 4.4 | 5.9 | 26 | | 4.25 | 25 | 15 | 10 | 33 | 17 | 50 | 10 | 10 | A-4a | 3 | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 5.9 | 7.4 | 39 | 17 | 4.5 | | | | | | | 12 | 10 | A-4a | | | | | | | |
| 9 | B | SS-1 | 0.0 | 1.5 | 3.9 | 5.4 | 27 | | | | | | | | | 7 | 10 | A-2-6 | 4 | 100 | | | | | |
| | 061-0 | SS-2 | 1.5 | 3.0 | 5.4 | 6.9 | 27 | | | | | | | | | 16 | 10 | A-2-6 | | | | | | | |
| | 19 | SS-3 | 3.5 | 5.0 | 7.4 | 8.9 | 21 | | 4 | 39 | 23 | 16 | 30 | 38 | 68 | 14 | 18 | A-6b | | | | | | | |
| | | SS-4 | 5.0 | 6.5 | 8.9 | 10.4 | 21 | 27 | 4 | | | | | | | 13 | 16 | A-6b | | | | | | | |

OHIO DEPARTMENT OF TRANSPORTATION

# Subgrade Analysis

V. 14.5 1/18/2019

| # | Boring | Sample | Sample Depth | | Subgrade Depth | | Standard Penetration | | HP (tsf) | Physical Characteristics | | | | | | Moisture | | Ohio DOT | | Sulfate Content (ppm) | Problem | | Excavate and Replace (Item 204) | | Recommendation (Enter depth in inches) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | From | To | From | To | $N_{60}$ | $N_{60L}$ | | LL | PL | PI | % Silt | % Clay | P200 | $M_C$ | $M_{OPT}$ | Class | GI | | Unsuitable | Unstable | Unsuitable | Unstable | |
| 10 | B | SS-1 | 0.0 | 1.5 | 1.0 | 2.5 | 12 | | 4 | 31 | 16 | 15 | 37 | 28 | 65 | 16 | 14 | A-6a | 8 | 993 | | | | | |
| | 062-0 | SS-2 | 1.5 | 3.0 | 2.5 | 4.0 | 17 | | 3.5 | 31 | 16 | 15 | 32 | 25 | 57 | 16 | 14 | A-6a | 6 | | | | | | |
| | 19 | SS-3 | 3.0 | 4.5 | 4.0 | 5.5 | 27 | | 4 | | | | | | | 9 | 10 | A-4a | 8 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 5.5 | 7.0 | 50 | 12 | 4.25 | | | | | | | 9 | 10 | A-4a | | | | | | | |
| 11 | B | SS-1B | 0.0 | 1.5 | -0.7 | 0.8 | 21 | | 4.5 | 25 | 18 | 7 | 23 | 26 | 49 | 6 | 13 | A-4a | 3 | | | | | | |
| | 079-0 | SS-2 | 1.5 | 3.0 | 0.8 | 2.3 | 41 | | 4.5 | | | | | | | 10 | 14 | A-6a | 10 | | | | | | |
| | 19 | SS-3 | 3.5 | 5.0 | 2.8 | 4.3 | 33 | | 4.5 | 31 | 18 | 13 | 25 | 18 | 43 | 13 | 14 | A-6a | 2 | 267 | | | | | |
| | | | | | | | | 21 | | | | | | | | | | | | | | | | | |
| 12 | B | SS-1 | 0.0 | 1.5 | 0.9 | 2.4 | 12 | | 4.25 | 25 | 15 | 10 | 22 | 14 | 36 | 9 | 10 | A-4a | 0 | 180 | | | | | |
| | 083-0 | SS-2 | 1.5 | 3.0 | 2.4 | 3.9 | 12 | | 4.25 | 27 | 16 | 11 | 39 | 27 | 66 | 15 | 14 | A-6a | 7 | | | | | | |
| | 19 | SS-3 | 3.0 | 4.5 | 3.9 | 5.4 | 14 | | 1.75 | | | | | | | 21 | 14 | A-6a | 10 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 5.4 | 6.9 | 15 | 12 | 4.25 | | | | | | | 17 | 14 | A-6a | | | | | | | |

**PID:** 98232

**County-Route-Section:** FRA-70-22.85

**No. of Borings:** 12

**Geotechnical Consultant:** Resource International, Inc.

**Prepared By:** Michael D. Kennedy, P.E.

**Date prepared:** 2/1/2021

| Chemical Stabilization Options | | |
|---|---|---|
| 320 | Rubblize & Roll | Option |
| 206 | Cement Stabilization | Option |
| | Lime Stabilization | No |
| 206 | Depth | 12'' |

| Excavate and Replace Stabilization Options | |
|---|---|
| Global Geotextile Average(N60L): | 12'' |
| Average(HP): | 0'' |
| Global Geogrid Average(N60L): | 0'' |
| Average(HP): | 0'' |

| Design CBR | 7 |
|---|---|

| % Samples within 6 feet of subgrade | | | |
|---|---|---|---|
| $N_{60} \leq 5$ | 0% | HP ≤ 0.5 | 0% |
| $N_{60} < 12$ | 16% | 0.5 < HP ≤ 1 | 2% |
| $12 \leq N_{60} < 15$ | 18% | 1 < HP ≤ 2 | 16% |
| $N_{60} \geq 20$ | 41% | HP > 2 | 73% |
| M+ | 9% | | |
| Rock | 0% | | |
| Unsuitable | 0% | | |

| Excavate and Replace at Surface | |
|---|---|
| Average | 3'' |
| Maximum | 18'' |
| Minimum | 0'' |

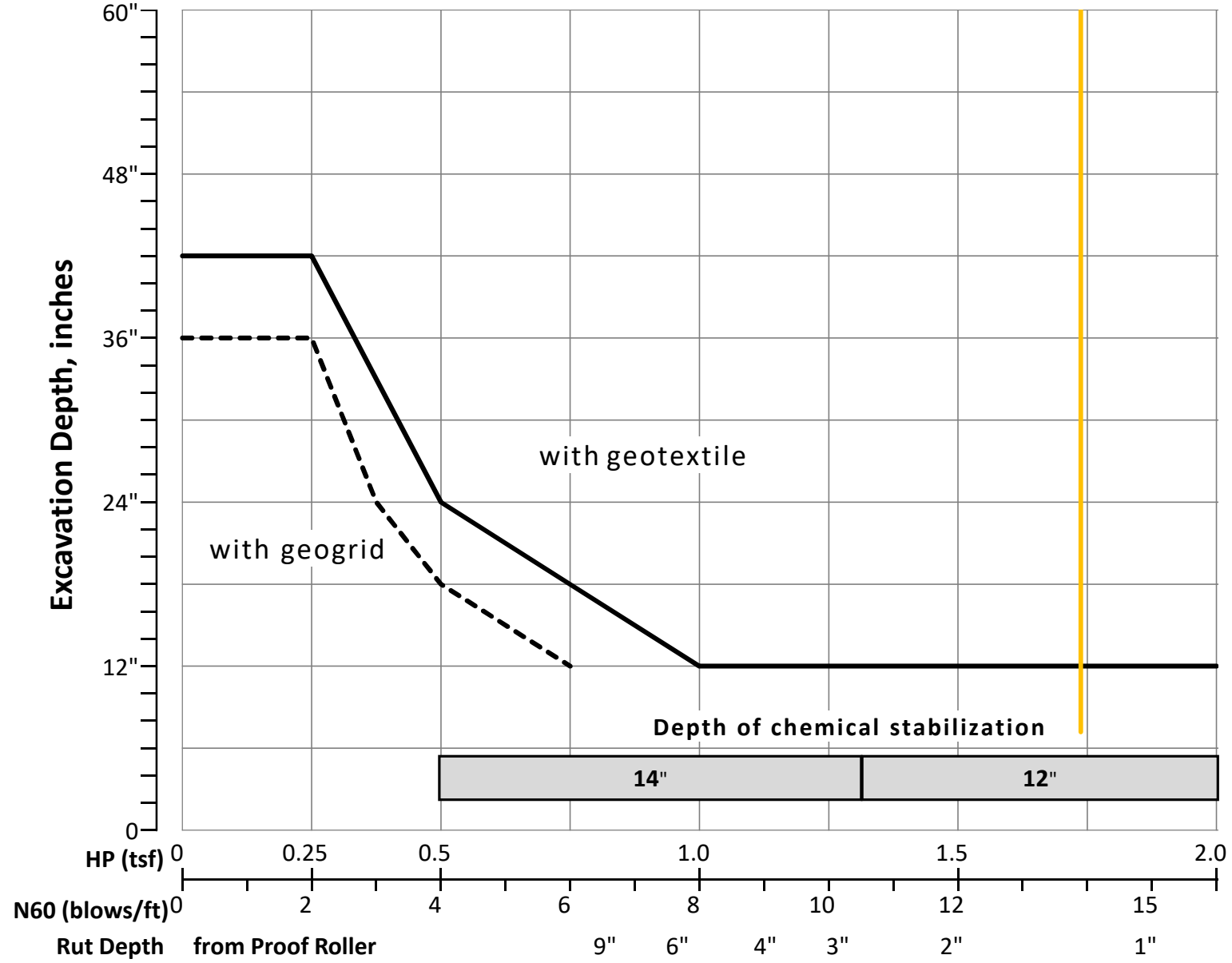
| % Proposed Subgrade Surface | |
|---|---|
| Unstable & Unsuitable | 19% |
| Unstable | 19% |
| Unsuitable | 0% |

| | $N_{60}$ | $N_{60L}$ | HP | LL | PL | PI | Silt | Clay | P 200 | $M_C$ | $M_{OPT}$ | GI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 20 | 14 | 3.53 | 33 | 18 | 14 | 31 | 28 | 60 | 15 | 14 | 8 |
| Maximum | 50 | 27 | 4.50 | 42 | 24 | 21 | 50 | 43 | 86 | 29 | 21 | 16 |
| Minimum | 6 | 6 | 1.00 | 25 | 15 | 7 | 16 | 14 | 36 | 5 | 6 | 0 |

**Classification Counts by Sample**

| ODOT Class | Rock | A-1-a | A-1-b | A-2-4 | A-2-5 | A-2-6 | A-2-7 | A-3 | A-3a | A-4a | A-4b | A-5 | A-6a | A-6b | A-7-5 | A-7-6 | A-8a | A-8b | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Count | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 8 | 0 | 0 | 23 | 9 | 0 | 2 | 0 | 0 | 46 |
| Percent | 0% | 0% | 4% | 0% | 0% | 4% | 0% | 0% | 0% | 17% | 0% | 0% | 50% | 20% | 0% | 4% | 0% | 0% | 100% |
| % Rock\|Granular\|Cohesive | 0% | 26% | | | | | | | | | 74% | | | | | | | | 100% |
| Surface Class Count | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 17 | 4 | 0 | 1 | 0 | 0 | 26 |
| Surface Class Percent | 0% | 0% | 4% | 4% | 0% | 0% | 0% | 0% | 0% | 8% | 0% | 0% | 65% | 15% | 0% | 4% | 0% | 0% | 100% |

## GB1 Figure B – Subgrade Stabilization




OVERRIDE TABLE

| Calculated Average | New Values | Check to Override |
|---|---|---|
| 3.53 | | ☐ HP |
| 13.92 | | ☐ N60L |

Average HP
Average $N_{60L}$

# OHIO DEPARTMENT OF TRANSPORTATION

## OFFICE OF GEOTECHNICAL ENGINEERING

## PLAN SUBGRADES
## Geotechnical Bulletin GB1

**FRA-70-22.85**
**98232**

**New Roadway construction for westbound collector distributor road (WB-CD) for IR-70, approximately 6,800 linear feet**

**Resource International, Inc.**

**Prepared By:** Michael D. Kennedy, P.E.
**Date prepared:** Monday, February 1, 2021

Resource International, Inc.
Michael D. Kennedy, P.E.
6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
michaelk@resourceinternational.com

**NO. OF BORINGS:** 16

| # | Boring ID | Alignment | Station | Offset | Dir | Drill Rig | ER | Boring EL. | Proposed Subgrade EL | Cut Fill |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B-012-0-19 | IR-70 WB CD | 1542+64 | 8 | LT | CME 55 | 90 | 784.8 | 786.2 | 1.4 F |
| 2 | B-015-0-19 | IR-70 WB CD | 1546+70 | 3 | RT | CME 55 | 90 | 788.3 | 787.9 | 0.4 C |
| 3 | B-019-0-19 | IR-70 WB CD | 1550+69 | 4 | RT | CME 55 | 90 | 787.0 | 789.1 | 2.1 F |
| 4 | B-023-0-19 | IR-70 WB CD | 1554+71 | 14 | RT | CME 55 | 90 | 789.5 | 790.0 | 0.5 F |
| 5 | B-026-0-19 | IR-70 WB CD | 1558+78 | 9 | RT | Mobile B53 | 81 | 786.6 | 791.0 | 4.4 F |
| 6 | B-028-0-19 | IR-70 WB CD | 1562+72 | 22 | RT | CME 55 | 90 | 786.0 | 791.9 | 5.9 F |
| 7 | B-030-0-19 | IR-70 WB CD | 1566+72 | 19 | RT | CME 55 | 90 | 790.0 | 792.9 | 2.9 F |
| 8 | B-033-0-19 | IR-70 WB CD | 1570+70 | 18 | RT | CME 55 | 90 | 795.0 | 793.3 | 1.7 C |
| 9 | B-037-0-19 | IR-70 WB CD | 1574+74 | 11 | RT | CME 55 | 90 | 790.8 | 791.6 | 0.8 F |
| 10 | B-039-0-19 | IR-70 WB CD | 1578+33 | 23 | LT | CME 55 | 90 | 788.6 | 789.1 | 0.5 F |
| 11 | B-040-0-19 | IR-70 WB CD | 1578+85 | 33 | RT | CME 750X | 80 | 788.6 | 789.0 | 0.4 F |
| 12 | B-090-019 | IR-70 WB CD | 1594+39 | 22 | RT | CME 55 | 90 | 801.0 | 801.5 | 0.5 F |
| 13 | B-094-0-19 | IR-70 WB CD | 1597+94 | 7 | RT | Mobile B53 | 81 | 803.3 | 802.8 | 0.5 C |
| 14 | B-097-0-19 | IR-70 WB CD | 1601+86 | 0 | CL | CME 55 | 90 | 806.1 | 805.0 | 1.1 C |
| 15 | B-100-0-19 | IR-70 WB CD | 1605+88 | 20 | RT | CME 55 | 90 | 809.1 | 808.8 | 0.3 C |
| 16 | B-101-0-19 | IR-70 WB CD | 1609+35 | 14 | RT | CME 55 | 90 | 811.2 | 812.3 | 1.0 F |

OHIO DEPARTMENT OF TRANSPORTATION

# Subgrade Analysis

V. 14.5 1/18/2019

| # | Boring | Sample | Sample Depth | | Subgrade Depth | | Standard Penetration | | HP (tsf) | Physical Characteristics | | | | | | Moisture | | Ohio DOT | | Sulfate Content (ppm) | Problem | | Excavate and Replace (Item 204) | | Recommendation (Enter depth in inches) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | From | To | From | To | $N_{60}$ | $N_{60L}$ | | LL | PL | PI | % Silt | % Clay | P200 | $M_C$ | $M_{OPT}$ | Class | GI | | Unsuitable | Unstable | Unsuitable | Unstable | |
| 1 | B | SS-1 | 0.0 | 1.5 | 1.4 | 2.9 | 18 | | 4.5 | | | | | | | 12 | 10 | A-4a | 8 | | | | | | |
| | 012-0 | SS-2 | 3.5 | 5.0 | 4.9 | 6.4 | 14 | | 3.25 | 39 | 18 | 21 | 39 | 39 | 78 | 18 | 16 | A-6b | 12 | 280 | | | | | |
| | 19 | SS-3 | 6.0 | 7.5 | 7.4 | 8.9 | 12 | | 3 | | | | | | | 25 | 16 | A-6b | | | | | | | |
| | | SS-4 | 8.5 | 10.0 | 9.9 | 11.4 | 30 | 14 | | | | | | | | 11 | 10 | A-4a | | | | | | | |
| 2 | B | SS-1 | 0.0 | 1.5 | -0.4 | 1.1 | 17 | | | | | | | | | 7 | 10 | A-2-4 | 0 | | | | | | |
| | 015-0 | SS-2 | 3.5 | 5.0 | 3.1 | 4.6 | 17 | | | | | | | | | 10 | 10 | A-2-4 | 0 | 190 | | | | | |
| | 19 | SS-3 | 6.0 | 7.5 | 5.6 | 7.1 | 6 | | 0.75 | 35 | 18 | 17 | 44 | 40 | 84 | 24 | 16 | A-6b | | | | | | | |
| | | SS-4 | 8.5 | 10.0 | 8.1 | 9.6 | 32 | 6 | 4.5 | | | | | | | 22 | 16 | A-6b | | | | | | | |
| 3 | B | SS-1 | 0.0 | 1.5 | 2.1 | 3.6 | 12 | | 4 | | | | | | | 11 | 14 | A-6a | 10 | | | | | | |
| | 019-0 | SS-2 | 3.5 | 5.0 | 5.6 | 7.1 | 14 | | 3.25 | 33 | 19 | 14 | 51 | 36 | 87 | 21 | 14 | A-6a | | 220 | | | | | |
| | 19 | SS-3 | 6.0 | 7.5 | 8.1 | 9.6 | 18 | | 3.5 | | | | | | | 21 | 14 | A-6a | | | | | | | |
| | | SS-4 | 8.5 | 10.0 | 10.6 | 12.1 | 27 | 12 | 4.5 | | | | | | | 14 | 14 | A-6a | | | | | | | |
| 4 | B | SS-1 | 0.0 | 1.5 | 0.5 | 2.0 | 12 | | 4 | | | | | | | 12 | 14 | A-6a | 10 | | | | | | |
| | 023-0 | SS-2 | 3.5 | 5.0 | 4.0 | 5.5 | 21 | | 3 | 41 | 18 | 23 | 41 | 41 | 82 | 21 | 18 | A-7-6 | 13 | 540 | | | | | |
| | 19 | SS-3 | 6.0 | 7.5 | 6.5 | 8.0 | 27 | | 4.25 | 50 | 22 | 28 | 36 | 50 | 86 | 22 | 19 | A-7-6 | | | | | | | |
| | | SS-4 | 8.5 | 10.0 | 9.0 | 10.5 | 21 | 12 | 4 | | | | | | | 13 | 14 | A-6a | | | | | | | |
| 5 | B | SS-1B | 0.6 | 1.5 | 5.0 | 6.0 | 9 | | 3.25 | | | | | | | 17 | 14 | A-6a | | 100 | | | | | |
| | 026-0 | SS-2 | 1.5 | 3.0 | 6.0 | 7.5 | 12 | | 3.5 | 30 | 17 | 13 | 29 | 30 | 59 | 18 | 14 | A-6a | | | | | | | |
| | 19 | SS-3 | 3.5 | 5.0 | 8.0 | 9.5 | 22 | | 3.75 | | | | | | | 13 | 14 | A-6a | | | | | | | |
| | | SS-4B | 6.9 | 7.5 | 11.4 | 12.0 | 8 | 9 | 2.5 | 30 | 18 | 12 | 19 | 6 | 25 | 13 | 10 | A-2-6 | | | | | | | |
| 6 | B | SS-1 | 0.0 | 1.5 | 5.9 | 7.4 | 17 | | 4 | | | | | | | 18 | 14 | A-6a | | | | | | | |
| | 028-0 | SS-2 | 3.5 | 5.0 | 9.4 | 10.9 | 27 | | 4 | 24 | 15 | 9 | 31 | 23 | 54 | 10 | 10 | A-4a | | 1000 | | | | | |
| | 19 | SS-3 | 6.0 | 7.5 | 11.9 | 13.4 | 23 | | 3.25 | | | | | | | 19 | 14 | A-6a | | | | | | | |
| | | SS-4 | 8.5 | 10.0 | 14.4 | 15.9 | 26 | 17 | 4.5 | | | | | | | 19 | 14 | A-6a | | | | | | | |
| 7 | B | SS-1 | 0.0 | 1.5 | 2.9 | 4.4 | 9 | | 3 | | | | | | | 14 | 14 | A-6a | 10 | | | | | | |
| | 030-0 | SS-2 | 3.5 | 5.0 | 6.4 | 7.9 | 33 | | 4.25 | 33 | 18 | 15 | 35 | 36 | 71 | 14 | 14 | A-6a | | 330 | | | | | |
| | 19 | SS-3 | 6.0 | 7.5 | 8.9 | 10.4 | 12 | | 1.25 | 39 | 18 | 21 | 26 | 25 | 51 | 19 | 16 | A-6b | | | | | | | |
| | | SS-4 | 8.5 | 10.0 | 11.4 | 12.9 | 20 | 9 | 0.75 | | | | | | | 15 | 10 | A-4a | | | | | | | |
| 8 | B | SS-1 | 0.0 | 1.5 | -1.7 | -0.2 | 11 | | 3.5 | 35 | 22 | 13 | 52 | 33 | 85 | 16 | 17 | A-6a | 9 | 140 | | | | | |
| | 033-0 | SS-2 | 3.5 | 5.0 | 1.8 | 3.3 | 23 | | 3.5 | | | | | | | 16 | 14 | A-6a | 10 | | | | | | |
| | 19 | SS-3 | 6.0 | 7.5 | 4.3 | 5.8 | 29 | | | | | | | | | 10 | 10 | A-4a | 8 | | | | | | |
| | | SS-4 | 8.5 | 10.0 | 6.8 | 8.3 | 23 | 23 | 2.5 | 20 | 16 | 4 | 39 | 15 | 54 | 17 | 11 | A-4a | | | | | | | |
| 9 | B | SS-1 | 0.0 | 1.5 | 0.8 | 2.3 | 9 | | 4.25 | | | | | | | 19 | 14 | A-6a | 10 | | | $N_{60}$ & Mc | | 12" | 12" |
| | 037-0 | SS-2 | 3.5 | 5.0 | 4.3 | 5.8 | 14 | | | 28 | 16 | 12 | 29 | 25 | 54 | 13 | 14 | A-6a | 5 | 300 | | | | | 204 Geotextile |
| | 19 | SS-3 | 6.0 | 7.5 | 6.8 | 8.3 | 17 | | 4.25 | | | | | | | 15 | 14 | A-6a | | | | | | | |
| | | SS-4 | 8.5 | 10.0 | 9.3 | 10.8 | 18 | 9 | 4 | 22 | 14 | 8 | 36 | 22 | 58 | 11 | 10 | A-4a | | | | | | | |

OHIO DEPARTMENT OF TRANSPORTATION

# Subgrade Analysis

V. 14.5 1/18/2019

| # | Boring | Sample | Sample Depth | | Subgrade Depth | | Standard Penetration | | HP (tsf) | Physical Characteristics | | | | | | Moisture | | Ohio DOT | | Sulfate Content (ppm) | Problem | | Excavate and Replace (Item 204) | | Recommendation (Enter depth in inches) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | From | To | From | To | $N_{60}$ | $N_{60L}$ | | LL | PL | PI | % Silt | % Clay | P200 | $M_C$ | $M_{OPT}$ | Class | GI | | Unsuitable | Unstable | Unsuitable | Unstable | |
| 10 | B | SS-1 | 1.5 | 3.0 | 2.0 | 3.5 | 15 | | 3 | | | | | | | 20 | 16 | A-6b | 16 | | | | | | |
| | 039-0 | SS-2 | 3.5 | 5.0 | 4.0 | 5.5 | 11 | | 3.5 | 51 | 29 | 22 | 36 | 39 | 75 | 32 | 24 | A-6b | 15 | | | | | | |
| | 19 | SS-3 | 6.0 | 7.5 | 6.5 | 8.0 | 11 | | 2 | | | | | | | 28 | 16 | A-6b | | | | | | | |
| | | SS-4 | 9.0 | 10.5 | 9.5 | 11.0 | 26 | 11 | 4.5 | | | | | | | 11 | 14 | A-6a | | | | | | | |
| 11 | B | SS-1B | 0.2 | 1.5 | 0.6 | 1.9 | 8 | | 2 | | | | | | | 16 | 16 | A-6b | 16 | | | $N_{60}$ | | 12" | 12" |
| | 040-0 | SS-2 | 1.5 | 3.0 | 1.9 | 3.4 | 15 | | 3.75 | | | | | | | 19 | 16 | A-6b | 16 | | | Mc | | | 204 Geotextile |
| | 19 | SS-3 | 3.5 | 5.0 | 3.9 | 5.4 | 11 | | 3.25 | | | | | | | 21 | 10 | A-4b | 8 | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 6.4 | 7.9 | 5 | 8 | 1.5 | 27 | 18 | 9 | 53 | 19 | 72 | 21 | 13 | A-4b | | | | | | | |
| 12 | B | SS-1 | 0.0 | 1.5 | 0.5 | 2.0 | 48 | | | | | | | | | | | | | | | | | | |
| | 090-0 | SS-2 | 1.5 | 3.0 | 2.0 | 3.5 | 23 | | 4.5 | | | | | | | 10 | 14 | A-6a | 10 | | | | | | |
| | 9 | SS-3 | 3.5 | 5.0 | 4.0 | 5.5 | 14 | | 3 | 31 | 20 | 11 | 40 | 46 | 86 | 19 | 15 | A-6a | 8 | 100 | | | | | |
| | | SS-4 | 6.0 | 7.5 | 6.5 | 8.0 | 21 | 14 | 3.5 | | | | | | | 17 | 14 | A-6a | | | | | | | |
| 13 | B | SS-1 | 0.0 | 1.5 | -0.5 | 1.0 | 47 | | 4.5 | | | | | | | 5 | 10 | A-4a | 8 | | | | | | |
| | 094-0 | SS-2 | 1.5 | 3.0 | 1.0 | 2.5 | 26 | | 4.5 | 26 | 18 | 8 | 26 | 13 | 39 | 7 | 13 | A-4a | 1 | 8000 | | | | | |
| | 19 | SS-3 | 3.5 | 5.0 | 3.0 | 4.5 | 7 | | 2.5 | | | | | | | 10 | 10 | A-4a | 8 | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 5.5 | 7.0 | 11 | 7 | 3 | 61 | 20 | 41 | 41 | 52 | 93 | 24 | 18 | A-7-6 | | | | | | | |
| 14 | B | SS-1B | 0.5 | 1.5 | -0.6 | 0.4 | 18 | | 4.5 | | | | | | | | 14 | A-6a | 10 | | | | | | |
| | 097-0 | SS-2 | 1.5 | 3.0 | 0.4 | 1.9 | 20 | | 4.5 | 31 | 18 | 13 | 29 | 19 | 48 | 11 | 14 | A-6a | 4 | 100 | | | | | |
| | 19 | SS-3 | 3.5 | 5.0 | 2.4 | 3.9 | 17 | | 3.5 | 27 | 18 | 9 | 34 | 19 | 53 | 14 | 13 | A-4a | 4 | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 4.9 | 6.4 | 15 | 15 | 3.5 | | | | | | | 21 | 16 | A-6b | 16 | | | | | | |
| 15 | B | SS-1 | 0.0 | 1.5 | -0.3 | 1.2 | 54 | | 4.5 | | | | | | | 7 | 10 | A-4a | 8 | | | | | | |
| | 100-0 | SS-2 | 1.5 | 3.0 | 1.2 | 2.7 | 21 | | 4 | 26 | 19 | 7 | 28 | 12 | 40 | 19 | 14 | A-4a | 1 | 1800 | | Mc | | | |
| | 19 | SS-3 | 3.5 | 5.0 | 3.2 | 4.7 | 17 | | 3 | 58 | 19 | 39 | 40 | 46 | 86 | 24 | 18 | A-7-6 | 20 | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 5.7 | 7.2 | 8 | 8 | 3 | | | | | | | 18 | 18 | A-7-6 | | | | | | | |
| 16 | B | SS-1B | 0.5 | 1.5 | 1.5 | 2.6 | 29 | | 4.5 | | | | | | | | 14 | A-6a | 10 | | | | | | |
| | 101-0 | SS-2 | 1.5 | 3.0 | 2.6 | 4.1 | 20 | | 4.5 | 31 | 18 | 13 | 32 | 25 | 57 | 11 | 14 | A-6a | 6 | 100 | | | | | |
| | 19 | SS-3 | 3.5 | 5.0 | 4.6 | 6.1 | 23 | | 4 | | | | | | | 18 | 16 | A-6b | 16 | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 7.1 | 8.6 | 24 | 20 | 4 | 25 | 15 | 10 | 33 | 26 | 59 | 13 | 10 | A-4a | | | | | | | |

**PID:** 98232

**County-Route-Section:** FRA-70-22.85

**No. of Borings:** 16

**Geotechnical Consultant:** Resource International, Inc.

**Prepared By:** Michael D. Kennedy, P.E.

**Date prepared:** 2/1/2021

| Chemical Stabilization Options | | |
|---|---|---|
| 320 | Rubblize & Roll | Option |
| 206 | Cement Stabilization | Option |
| | Lime Stabilization | No |
| 206 | Depth | 12'' |

| Excavate and Replace Stabilization Options | |
|---|---|
| Global Geotextile Average(N60L): | 12'' |
| Average(HP): | 0'' |
| Global Geogrid Average(N60L): | 0'' |
| Average(HP): | 0'' |

| Design CBR | 6 |
|---|---|

| % Samples within 6 feet of subgrade | | | |
|---|---|---|---|
| $N_{60} \leq 5$ | 0% | HP ≤ 0.5 | 0% |
| $N_{60} < 12$ | 25% | 0.5 < HP ≤ 1 | 3% |
| $12 \leq N_{60} < 15$ | 18% | 1 < HP ≤ 2 | 3% |
| $N_{60} \geq 20$ | 33% | HP > 2 | 83% |
| M+ | 8% | | |
| Rock | 0% | | |
| Unsuitable | 3% | | |

| Excavate and Replace at Surface | |
|---|---|
| Average | 1'' |
| Maximum | 12'' |
| Minimum | 0'' |

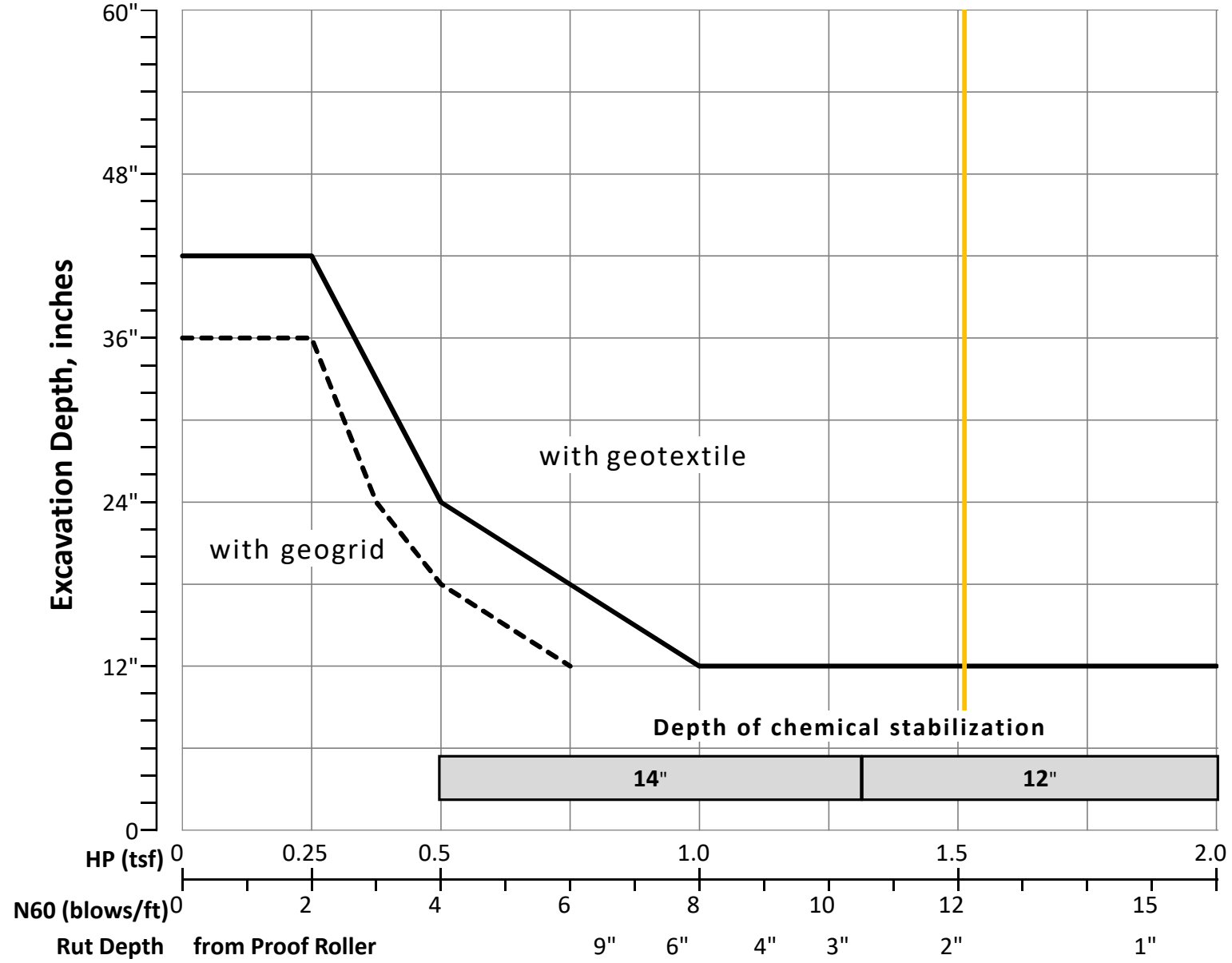
| % Proposed Subgrade Surface | |
|---|---|
| Unstable & Unsuitable | 20% |
| Unstable | 20% |
| Unsuitable | 0% |

| | $N_{60}$ | $N_{60L}$ | HP | LL | PL | PI | Silt | Clay | P 200 | $M_C$ | $M_{OPT}$ | GI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 19 | 12 | 3.50 | 34 | 18 | 16 | 35 | 29 | 65 | 16 | 14 | 9 |
| Maximum | 54 | 23 | 4.50 | 61 | 29 | 41 | 53 | 52 | 93 | 32 | 24 | 20 |
| Minimum | 5 | 6 | 0.75 | 20 | 14 | 4 | 19 | 6 | 25 | 5 | 10 | 0 |

**Classification Counts by Sample**

| ODOT Class | Rock | A-1-a | A-1-b | A-2-4 | A-2-5 | A-2-6 | A-2-7 | A-3 | A-3a | A-4a | A-4b | A-5 | A-6a | A-6b | A-7-5 | A-7-6 | A-8a | A-8b | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Count | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 14 | 2 | 0 | 26 | 12 | 0 | 5 | 0 | 0 | 62 |
| Percent | 0% | 0% | 0% | 3% | 0% | 2% | 0% | 0% | 0% | 23% | 3% | 0% | 42% | 19% | 0% | 8% | 0% | 0% | 100% |
| % Rock\|Granular\|Cohesive | 0% | 27% | | | | | | | | | 73% | | | | | | | | 100% |
| Surface Class Count | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 10 | 3 | 0 | 0 | 0 | 0 | 20 |
| Surface Class Percent | 0% | 0% | 0% | 5% | 0% | 0% | 0% | 0% | 0% | 30% | 0% | 0% | 50% | 15% | 0% | 0% | 0% | 0% | 100% |

## GB1 Figure B – Subgrade Stabilization




OVERRIDE TABLE

| Calculated Average | New Values | Check to Override |
|---|---|---|
| 3.50 | | ☐ HP |
| 12.13 | | ☐ N60L |

Average HP
Average $N_{60L}$

# OHIO DEPARTMENT OF TRANSPORTATION

## OFFICE OF GEOTECHNICAL ENGINEERING

## PLAN SUBGRADES
## Geotechnical Bulletin GB1

**FRA-70-22.85**
**98232**

**Chatford Drive realignment and profile changes, approximately 500 linear feet. Includes one box culvert structure.**

**Resource International, Inc.**

**Prepared By:** Daniel E. Karch, P.E.
**Date prepared:** Friday, December 23, 2022

Resource International, Inc.
Daniel E. Karch, P.E.
6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
danielk@resourceinternational.com

**NO. OF BORINGS:** 3

| # | Boring ID | Alignment | Station | Offset | Dir | Drill Rig | ER | Boring EL. | Proposed Subgrade EL | Cut Fill |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B-038-0-19 | BL IR 70 WB-CD | 1576+31 | 7 | Lt | CME 750X | 86 | 788.1 | 788.1 | 0.0 |
| 2 | B-039-0-19 | BL IR 70 WB-CD | 1578+33 | 23 | Lt | CME 55 | 84 | 788.6 | 790.4 | 1.8 F |
| 3 | B-040-1-21 | BL IR 70 WB-CD | 1579+47 | 51 | Lt | Mobile B53 | 84 | 788.7 | 790.2 | 1.5 F |

| # | Boring ID | Alignment | Station | Offset | Dir | Drill Rig | ER | Boring EL. | Proposed Subgrade EL | Cut Fill |
|---|---|---|---|---|---|---|---|---|---|---|

OHIO DEPARTMENT OF TRANSPORTATION

# Subgrade Analysis

V. 14.5 1/18/2019

| # | Boring | Sample | Sample Depth | | Subgrade Depth | | Standard Penetration | | HP (tsf) | Physical Characteristics | | | | | | Moisture | | Ohio DOT | | Sulfate Content (ppm) | Problem | | Excavate and Replace (Item 204) | | Recommendation (Enter depth in inches) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | From | To | From | To | $N_{60}$ | $N_{60L}$ | | LL | PL | PI | % Silt | % Clay | P200 | $M_C$ | $M_{OPT}$ | Class | GI | | Unsuitable | Unstable | Unsuitable | Unstable | |
| 1 | B | 1 | 1.0 | 2.5 | 1.0 | 2.5 | 11 | | 4.5 | | | | | | | 18 | 10 | A-4a | 8 | | | $N_{60}$ & Mc | | 12" | 14" 206 Cement or 204 Geotextile |
| | 038-0 | 2 | 3.5 | 5.0 | 3.5 | 5.0 | 4 | | 2 | | | | | | | 22 | 10 | A-4a | 8 | | | | | | |
| | 19 | 3 | 6.0 | 7.5 | 6.0 | 7.5 | 9 | | 1.75 | | | | | | | 15 | 10 | A-4a | | | | | | | |
| | | 4 | 8.5 | 10.0 | 8.5 | 10.0 | 22 | 4 | 4.5 | 25 | 14 | 11 | 31 | 20 | 51 | 9 | 14 | A-6a | | | | | | | |
| 2 | B | 1 | 1.0 | 2.5 | 2.8 | 4.3 | 14 | | 3 | | | | | | | 20 | 16 | A-6b | 16 | | | | | | 14" 206 Cement or 204 Geotextile |
| | 039-0 | 2 | 3.5 | 5.0 | 5.3 | 6.8 | 10 | | 3.5 | 51 | 29 | 22 | 36 | 39 | 75 | 32 | 24 | A-6b | | | | | | | |
| | 19 | 3 | 6.0 | 7.5 | 7.8 | 9.3 | 10 | | 2 | | | | | | | 28 | 16 | A-6b | | | | | | | |
| | | 4 | 8.5 | 10.0 | 10.3 | 11.8 | 24 | 10 | 4.5 | | | | | | | 11 | 10 | A-4a | | | | | | | |
| 3 | B | 1 | 1.0 | 2.5 | 2.5 | 4.0 | 8 | | 2.5 | | | | | | | 21 | 14 | A-6a | 10 | | | | | | 14" 206 Cement or 204 Geotextile |
| | 040-1 | 2 | 3.5 | 5.0 | 5.0 | 6.5 | 8 | | 1.75 | 37 | 18 | 19 | 44 | 27 | 71 | 25 | 16 | A-6b | 11 | | | | | | |
| | 21 | 3 | 6.0 | 7.5 | 7.5 | 9.0 | 17 | | | | | | | | | 11 | 6 | A-1-b | | | | | | | |
| | | 4 | 8.5 | 10.0 | 10.0 | 11.5 | 17 | 8 | | 22 | 16 | 6 | 14 | 6 | 20 | 11 | 6 | A-1-b | | | | | | | |

OHIO DEPARTMENT OF TRANSPORTATION

# Subgrade Analysis

V. 14.5 1/18/2019

**PID:** 98232

**County-Route-Section:** FRA-70-22.85
**No. of Borings:** 3

**Geotechnical Consultant:** Resource International, Inc.
**Prepared By:** Daniel E. Karch, P.E.
**Date prepared:** 12/23/2022

| Chemical Stabilization Options | | |
|---|---|---|
| 320 | Rubblize & Roll | No |
| 206 | Cement Stabilization | Option |
| | Lime Stabilization | No |
| 206 | Depth | 14" |

| Excavate and Replace Stabilization Options | |
|---|---|
| Global Geotextile Average(N60L): | 15" |
| Average(HP): | 0" |
| Global Geogrid Average(N60L): | 0" |
| Average(HP): | 0" |

| Design CBR | 6 |
|---|---|

| % Samples within 6 feet of subgrade | | | |
|---|---|---|---|
| $N_{60} \leq 5$ | 14% | HP ≤ 0.5 | 0% |
| $N_{60} < 12$ | 86% | 0.5 < HP ≤ 1 | 0% |
| $12 \leq N_{60} < 15$ | 14% | 1 < HP ≤ 2 | 43% |
| $N_{60} \geq 20$ | 0% | HP > 2 | 57% |
| M+ | 14% | | |
| Rock | 0% | | |
| Unsuitable | 0% | | |

| Excavate and Replace at Surface | |
|---|---|
| Average | |
| Maximum | 0" |
| Minimum | 0" |

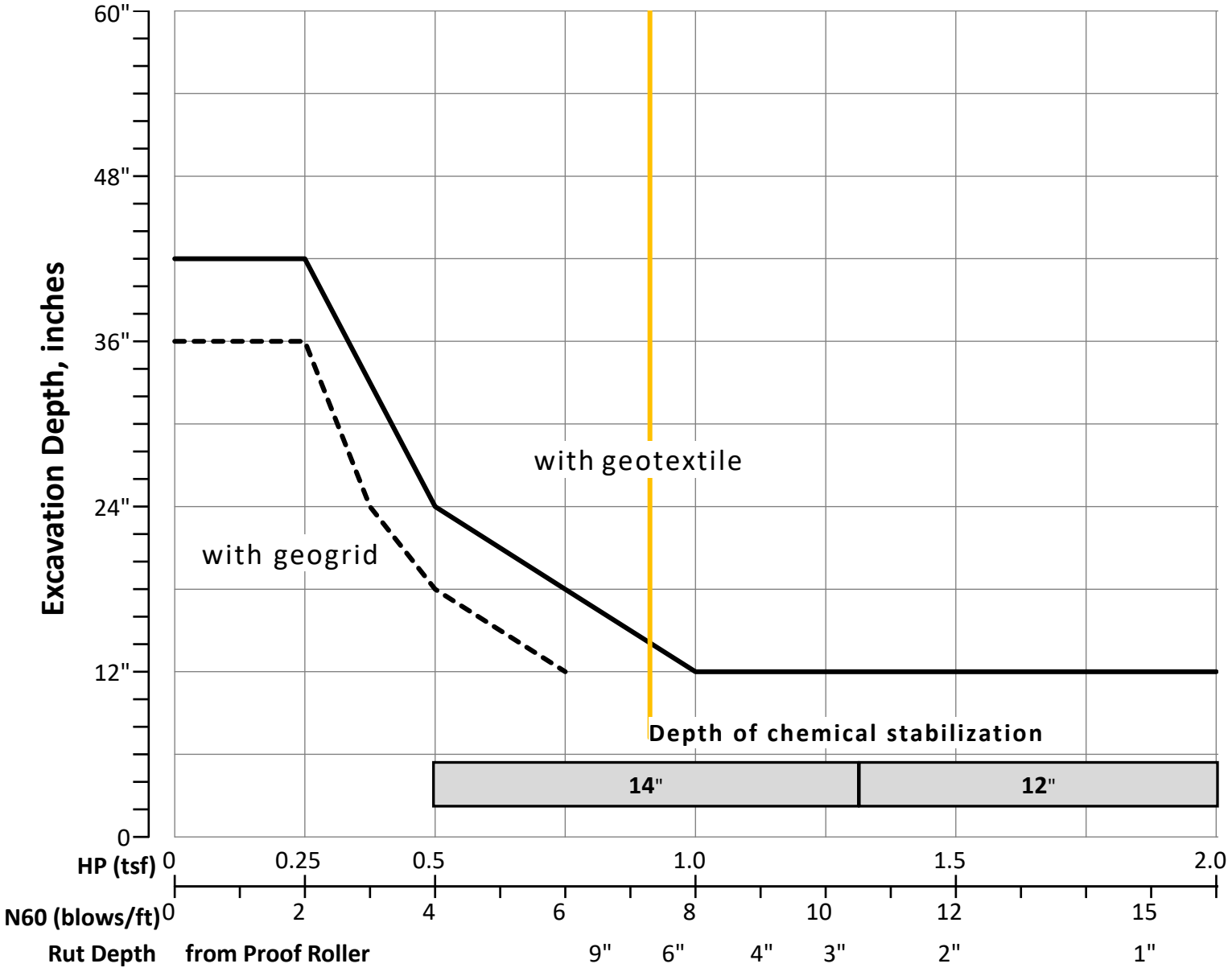
| % Proposed Subgrade Surface | |
|---|---|
| Unstable & Unsuitable | 33% |
| Unstable | 33% |
| Unsuitable | 0% |

| | $N_{60}$ | $N_{60L}$ | HP | LL | PL | PI | Silt | Clay | P 200 | $M_C$ | $M_{OPT}$ | GI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 13 | 7 | 3.00 | 34 | 19 | 15 | 31 | 23 | 54 | 19 | 13 | 11 |
| Maximum | 24 | 10 | 4.50 | 51 | 29 | 22 | 44 | 39 | 75 | 32 | 24 | 16 |
| Minimum | 4 | 4 | 1.75 | 22 | 14 | 6 | 14 | 6 | 20 | 9 | 6 | 8 |

**Classification Counts by Sample**

| ODOT Class | Rock | A-1-a | A-1-b | A-2-4 | A-2-5 | A-2-6 | A-2-7 | A-3 | A-3a | A-4a | A-4b | A-5 | A-6a | A-6b | A-7-5 | A-7-6 | A-8a | A-8b | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Count | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 12 |
| Percent | 0% | 0% | 17% | 0% | 0% | 0% | 0% | 0% | 0% | 33% | 0% | 0% | 17% | 33% | 0% | 0% | 0% | 0% | 100% |
| % Rock\|Granular\|Cohesive | 0% | 50% | | | | | | | | | 50% | | | | | | | | 100% |
| Surface Class Count | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 3 |
| Surface Class Percent | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 33% | 0% | 0% | 33% | 33% | 0% | 0% | 0% | 0% | 100% |

## GB1 Figure B – Subgrade Stabilization




OVERRIDE TABLE

| Calculated Average | New Values | Check to Override |
|---|---|---|
| 3.00 | | ☐ HP |
| 7.33 | | ☐ N60L |

Average HP
Average $N_{60L}$

# APPENDIX VII

CALCULATIONS – SHALLOW FOUNDATIONS – CULVERTS

FRA-70-22.85 Far East Freeway Culvert - IR-70 Sta. 606+42 Box Culvert

Shallow Foundation Analysis - Settlement

Calculated By: PPM Date: 4/14/2021

Checked By: MKD Date: 4/21/2021

Boring B-100-1-19

| | | | |
|---|---|---|---|
| B = | 6.0 | ft | Footing width |
| $D_w$ = | 34.0 | ft | Depth below bottom of footing |
| ΔP = | 28,780 | plf | Vertical load |
| q = | 4,797 | psf | Gross bearing pressure at bottom of wall |
| $q_{net}$ = | 4,557 | psf | Net bearing pressure at bottom of wall (considers initial overburden stress of 240 psf from 2-foot cut to bottom of footing elevation) |

| Soil Class. | Soil Type | Layer Depth (ft) | | Layer Thickness H (ft) | Depth to Midpoint (ft) | γ (pcf) | $\sigma_{vo}$ Bottom (psf) | $\sigma_{vo}$ Midpoint (psf) | $\sigma_{vo}'$ Midpoint (psf) | $\sigma_p'$ [1] (psf) | LL | $C_c$ [2] | $C_r$ [3] | $e_o$ [4] | $N_{60}$ | $(N1)_{60}$ [5] | C' [6] | $Z_f$/B | I [7] | $\Delta\sigma_v$ [8] (psf) | $\sigma_{vf}'$ Midpoint (psf) | $S_c$ [9,10] (ft) | $S_c$ (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-4a | C | 0.0 | 1.5 | 1.5 | 0.8 | 120 | 180 | 90 | 90 | 4,090 | 21 | 0.099 | 0.010 | 0.436 | | | | 0.13 | 0.994 | 4,529 | 4,619 | 0.023 | 0.271 |
| A-4a | C | 1.5 | 2.5 | 1.0 | 2.0 | 120 | 300 | 240 | 240 | 4,240 | 21 | 0.099 | 0.010 | 0.436 | | | | 0.33 | 0.919 | 4,190 | 4,430 | 0.010 | 0.119 |
| A-4a | C | 2.5 | 4.0 | 1.5 | 3.3 | 120 | 480 | 390 | 390 | 4,390 | 21 | 0.099 | 0.010 | 0.436 | | | | 0.54 | 0.792 | 3,608 | 3,998 | 0.010 | 0.125 |
| A-4a | C | 4.0 | 6.5 | 2.5 | 5.3 | 125 | 793 | 636 | 636 | 4,636 | 21 | 0.099 | 0.010 | 0.436 | | | | 0.88 | 0.605 | 2,756 | 3,392 | 0.013 | 0.150 |
| A-4a | C | 6.5 | 9.0 | 2.5 | 7.8 | 125 | 1,105 | 949 | 949 | 4,949 | 21 | 0.099 | 0.010 | 0.436 | | | | 1.29 | 0.449 | 2,048 | 2,997 | 0.009 | 0.103 |
| A-4a | C | 9.0 | 11.5 | 2.5 | 10.3 | 125 | 1,418 | 1,261 | 1,261 | 5,261 | 21 | 0.099 | 0.010 | 0.436 | | | | 1.71 | 0.353 | 1,608 | 2,869 | 0.006 | 0.074 |
| A-4a | C | 11.5 | 14.0 | 2.5 | 12.8 | 125 | 1,730 | 1,574 | 1,574 | 5,574 | 21 | 0.099 | 0.010 | 0.436 | | | | 2.13 | 0.289 | 1,317 | 2,891 | 0.005 | 0.055 |
| A-4a | C | 14.0 | 16.5 | 2.5 | 15.3 | 125 | 2,043 | 1,886 | 1,886 | 5,886 | 21 | 0.099 | 0.010 | 0.436 | | | | 2.54 | 0.244 | 1,113 | 2,999 | 0.003 | 0.042 |
| A-2-4 | G | 16.5 | 19.0 | 2.5 | 17.8 | 120 | 2,343 | 2,193 | 2,193 | 6,193 | | | | | 44 | 43 | 140 | 2.96 | 0.211 | 962 | 3,155 | 0.003 | 0.034 |
| A-1-b | G | 19.0 | 21.5 | 2.5 | 20.3 | 120 | 2,643 | 2,493 | 2,493 | 6,493 | | | | | 46 | 43 | 140 | 3.38 | 0.186 | 847 | 3,340 | 0.002 | 0.027 |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | Total Settlement: | | 1.000 | in |

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$. Estimate $\sigma_m$ of 4,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. $C_c = 0.009(LL-10)$; Ref. Table 26, FHWA GEC 5
3. $C_r = 0.15(C_c)$ for the existing fill and $0.10(C_c)$ for the natural soil deposits; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index (limited to a value of 300); Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesiv soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

28,780

1.0

Increment of B = 1.0 feet

FRA-70-22.85 Far East Freeway Culvert - Brice Road Box Culvert

Shallow Foundation Analysis - Settlement

Calculated By: MDK Date: 2/9/2021

Checked By: JPS Date: 2/9/2021

Boring B-083-1-19

| | | | |
|---|---|---|---|
| B = | 6.5 | ft | Footing width |
| $D_w$ = | 34.0 | ft | Depth below bottom of footing |
| ΔP = | 27,805 | plf | Vertical load |
| q = | 4,278 | psf | Gross bearing pressure at bottom of wall |
| $q_{net}$ = | 4,038 | psf | Net bearing pressure at bottom of wall (considers initial overburden stress of 240 psf from 2-foot cut to bottom of footing elevation) |

| Soil Class. | Soil Type | Layer Depth (ft) | | Layer Thickness H (ft) | Depth to Midpoint (ft) | γ (pcf) | $\sigma_{vo}$ Bottom (psf) | $\sigma_{vo}$ Midpoint (psf) | $\sigma_{vo}'$ Midpoint (psf) | $\sigma_p'$ [1] (psf) | LL | $C_c$ [2] | $C_r$ [3] | $e_o$ [4] | $N_{60}$ | $(N1)_{60}$ [5] | C' [6] | $Z_f$/B | I [7] | $\Delta\sigma_v$ [8] (psf) | $\sigma_{vf}'$ Midpoint (psf) | $S_c$ [9,10] (ft) | $S_c$ (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-4a | C | 0.0 | 1.5 | 1.5 | 0.8 | 120 | 180 | 90 | 90 | 4,090 | 24 | 0.126 | 0.013 | 0.460 | | | | 0.12 | 0.995 | 4,018 | 4,108 | 0.022 | 0.261 |
| A-4a | C | 1.5 | 3.0 | 1.5 | 2.3 | 120 | 360 | 270 | 270 | 4,270 | 24 | 0.126 | 0.013 | 0.460 | | | | 0.35 | 0.912 | 3,684 | 3,954 | 0.015 | 0.181 |
| A-4a | C | 3.0 | 4.5 | 1.5 | 3.8 | 120 | 540 | 450 | 450 | 4,450 | 24 | 0.126 | 0.013 | 0.460 | | | | 0.58 | 0.770 | 3,108 | 3,558 | 0.012 | 0.140 |
| A-4a | C | 4.5 | 6.5 | 2.0 | 5.5 | 125 | 790 | 665 | 665 | 4,665 | 24 | 0.126 | 0.013 | 0.460 | | | | 0.85 | 0.619 | 2,498 | 3,163 | 0.012 | 0.140 |
| A-2-4 | G | 6.5 | 9.0 | 2.5 | 7.8 | 125 | 1,103 | 946 | 946 | 4,946 | | | | | 42 | 53 | 180 | 1.19 | 0.480 | 1,937 | 2,884 | 0.007 | 0.080 |
| A-1-b | G | 9.0 | 11.5 | 2.5 | 10.3 | 125 | 1,415 | 1,259 | 1,259 | 5,259 | | | | | 39 | 45 | 149 | 1.58 | 0.379 | 1,530 | 2,789 | 0.006 | 0.069 |
| A-1-b | G | 11.5 | 15.5 | 4.0 | 13.5 | 125 | 1,915 | 1,665 | 1,665 | 5,665 | | | | | 50 | 53 | 183 | 2.08 | 0.295 | 1,192 | 2,857 | 0.005 | 0.062 |
| A-1-b | G | 15.5 | 18.5 | 3.0 | 17.0 | 125 | 2,290 | 2,103 | 2,103 | 6,103 | | | | | 26 | 26 | 87 | 2.62 | 0.238 | 960 | 3,062 | 0.006 | 0.067 |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | | | | | |

| | |
|---|---|
| Total Settlement: | 1.000 in |

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate $\sigma_m$ of 4,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. $C_c = 0.009(LL-10)$; Ref. Table 26, FHWA GEC 5
3. $C_r = 0.15(C_c)$ for the existing fill and $0.10(C_c)$ for the natural soil deposits; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index (limited to a value of 300); Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesiv soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

27,805

1.0

Increment of B = 1.0 feet

FRA-70-22.85 Culvert - Chatford Drive Box Culvert

Shallow Foundation Analysis - Settlement

Calculated By: LES Date: 3/23/2022

Checked By: JPS Date: 3/30/2022

Boring B-040-1-21

| | | | |
|---|---|---|---|
| B = | 7.0 | ft | Footing width |
| $D_w$ = | 0.0 | ft | Depth below bottom of footing |
| ΔP = | 25,825 | plf | Vertical load |
| q = | 3,689 | psf | Gross bearing pressure at bottom of wall |
| $q_{net}$ = | 3,449 | psf | Net bearing pressure at bottom of wall (considers initial overburden stress of 240 psf from 2-foot cut to bottom of footing elevation) |

| Soil Class. | Soil Type | Layer Depth (ft) | | Layer Thickness H (ft) | Depth to Midpoint (ft) | γ (pcf) | $\sigma_{vo}$ Bottom (psf) | $\sigma_{vo}$ Midpoint (psf) | $\sigma_{vo}'$ Midpoint (psf) | $\sigma_p'$ (psf) (1) | LL | $C_c$ (2) | $C_r$ (3) | $e_o$ (4) | $N_{60}$ | $(N1)_{60}$ (5) | C' (6) | $Z_f$/B | I (7) | $\Delta\sigma_v$ (8) (psf) | $\sigma_{vf}'$ Midpoint (psf) | $S_c$ (9,10) (ft) | $S_c$ (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-4a | C | 0.0 | 2.0 | 2.0 | 1.0 | 120 | 240 | 120 | 58 | 3,058 | 22 | 0.108 | 0.011 | 0.444 | | | | 0.14 | 0.991 | 3,418 | 3,476 | 0.034 | 0.410 |
| A-4a | C | 2.0 | 4.5 | 2.5 | 3.3 | 120 | 540 | 390 | 187 | 3,187 | 22 | 0.108 | 0.011 | 0.444 | | | | 0.46 | 0.841 | 2,901 | 3,088 | 0.023 | 0.273 |
| A-4a | C | 4.5 | 7.0 | 2.5 | 5.8 | 120 | 840 | 690 | 331 | 3,331 | 22 | 0.108 | 0.011 | 0.444 | | | | 0.82 | 0.631 | 2,176 | 2,507 | 0.016 | 0.197 |
| A-4a | C | 7.0 | 9.0 | 2.0 | 8.0 | 125 | 1,090 | 965 | 466 | 3,466 | 22 | 0.108 | 0.011 | 0.444 | | | | 1.14 | 0.496 | 1,712 | 2,178 | 0.010 | 0.120 |
| | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | | | | | |

Total Settlement: 1.000 in

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate $\sigma_m$ of 3,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. $C_c = 0.009(LL-10)$; Ref. Table 26, FHWA GEC 5
3. $C_r = 0.15(C_c)$ for the existing fill and $0.10(C_c)$ for the natural soil deposits; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index (limited to a value of 300); Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesiv soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-21-140 - FRA-70-22.85

FRA-BPDRW-41.060

4-sided Culvert Shallow Foundation Bearing Resistance

Borings B-054-0-19 (undrained)

| | | | |
|---|---|---|---|
| B = | 8.0 | ft | |
| L = | 20.00 | ft | |
| c = | 3,125 | psf | |
| γ = | 115 | pcf | |
| $D_f$ = | 12.0 | ft | |
| φ = | 0 | deg | |
| $D_w$ = | 9.0 | ft | Below ground surface |

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 18.00 \text{ ksf}$$

$N_{cm} = N_c s_c i_c$ = 5.54 $N_{qm} = N_q s_q d_q i_q$ = 1.00 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 0.00

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $N_c$ = | 5.14 | $s_c$ = | 1.078 | $i_c$ = | 1.000 | $d_q$ = | 1.000 |
| $N_q$ = | 1.00 | $s_q$ = | 1.000 | $i_q$ = | 1.000 | $C_{wq}$ = | 0.500 |
| $N_\gamma$ = | 0.00 | $s_\gamma$ = | 0.840 | $i_\gamma$ = | 1.000 | $C_{w\gamma}$ = | 0.500 |

$$q_R = q_n \cdot \phi_b = 8.10 \text{ ksf}$$

| | | |
|---|---|---|
| $\varphi_b$ = | 0.45 | Ref. Table 10.5.5.2.2-1 AASHTO LRFD BDS |

W-21-140 - FRA-70-22.85

FRA-BPDRW-41.060

4-sided Culvert Shallow Foundation Bearing Resistance

Borings B-054-0-19 (drained)

| | | | |
|---|---|---|---|
| B = | 8.0 | ft | |
| L = | 20.00 | ft | |
| c = | 0 | psf | |
| γ = | 115 | pcf | |
| $D_f$ = | 12.0 | ft | |
| φ = | 28 | deg | |
| $D_w$ = | 9.0 | ft | Below ground surface |

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 19.17 \text{ ksf}$$

$N_{cm} = N_c s_c i_c$ = 31.69 $N_{qm} = N_q s_q d_q i_q$ = 23.10 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 14.04

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $N_c$ = | 25.80 | $s_c$ = | 1.228 | $i_c$ = | 1.000 | $d_q$ = | 1.294 |
| $N_q$ = | 14.72 | $s_q$ = | 1.213 | $i_q$ = | 1.000 | $C_{wq}$ = | 0.500 |
| $N_\gamma$ = | 16.72 | $s_\gamma$ = | 0.840 | $i_\gamma$ = | 1.000 | $C_{w\gamma}$ = | 0.500 |

$$q_R = q_n \cdot \phi_b = 8.63 \text{ ksf}$$

$\varphi_b$ = 0.45 Ref. Table 10.5.5.2.2-1 AASHTO LRFD BDS

W-21-140 - FRA-70-22.85

FRA-BPDRW-41.060

4-sided Culvert Shallow Foundation Bearing Resistance

Borings B-055-0-19 (undrained)

| | | | |
|---|---|---|---|
| B = | 8.0 | ft | |
| L = | 125.00 | ft | |
| c = | 3,000 | psf | |
| γ = | 120 | pcf | |
| $D_f$ = | 3.0 | ft | |
| φ = | 0 | deg | |
| $D_w$ = | 0.0 | ft | Below ground surface |

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 15.79 \text{ ksf}$$

$N_{cm} = N_c s_c i_c$ = 5.20 $N_{qm} = N_q s_q d_q i_q$ = 1.00 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 0.00

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $N_c$ = | 5.14 | $s_c$ = | 1.012 | $i_c$ = | 1.000 | $d_q$ = | 1.000 |
| $N_q$ = | 1.00 | $s_q$ = | 1.000 | $i_q$ = | 1.000 | $C_{wq}$ = | 0.500 |
| $N_\gamma$ = | 0.00 | $s_\gamma$ = | 0.974 | $i_\gamma$ = | 1.000 | $C_{w\gamma}$ = | 0.500 |

$$q_R = q_n \cdot \phi_b = 8.69 \text{ ksf}$$

$\varphi_b$ = 0.55 Ref. Table 11.5.7-1 AASHTO LRFD BDS

W-21-140 - FRA-70-22.85

FRA-BPDRW-41.060

4-sided Culvert Shallow Foundation Bearing Resistance

Borings B-055-0-19 (drained)

| | | | |
|---|---|---|---|
| B = | 8.0 | ft | |
| L = | 125.00 | ft | |
| c = | 0 | psf | |
| γ = | 120 | pcf | |
| $D_f$ = | 3.0 | ft | |
| φ = | 28 | deg | |
| $D_w$ = | 0.0 | ft | Below ground surface |

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 6.94 \text{ ksf}$$

$N_{cm} = N_c s_c i_c$ = 26.74 $N_{qm} = N_q s_q d_q i_q$ = 16.86 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 16.29

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $N_c$ = | 25.80 | $s_c$ = | 1.037 | $i_c$ = | 1.000 | $d_q$ = | 1.107 |
| $N_q$ = | 14.72 | $s_q$ = | 1.034 | $i_q$ = | 1.000 | $C_{wq}$ = | 0.500 |
| $N_\gamma$ = | 16.72 | $s_\gamma$ = | 0.974 | $i_\gamma$ = | 1.000 | $C_{w\gamma}$ = | 0.500 |

$$q_R = q_n \cdot \phi_b = 3.82 \text{ ksf}$$

$\varphi_b$ = 0.55 Ref. Table 11.5.7-1 AASHTO LRFD BDS

W-21-140 - FRA-70-22.85

FRA-BPDRW-41.060

Settlement - CONTINUOUS SHALLOW FOOTINGS

**Boring B-054-0-19**

Calculated By: DEK Date: 1/5/2023

Checked By: JPS Date: 1/6/2023

B = 8.0 ft

$D_w$ = 9.0 ft

$q_{gross}$ = 7,300 psf

$q_{net}$ = 5,920 psf

| Layer | Soil Class. | Soil Type | Layer Depth (ft) | | Layer Elevation (ft. msl) | | Layer Thickness H (ft) | Depth to Midpoint (ft) | γ (pcf) | $\sigma_{vo}$ Bottom (psf) | $\sigma_{vo}$ Midpoint (psf) | $\sigma_{vo}'$ Midpoint (psf) | $\sigma_p'$ (1) (psf) | MC | LL | $C_c$ (2) | $C_r$ (3) | $e_o$ (4) | $N_{60}$ | $(N1)_{60}$ (5) | C' (6) | $Z_f$/B | I (7) | $\Delta\sigma_v$ (8) (psf) | $\sigma_{vf}'$ Midpoint (psf) | $S_c$ (9,10) (ft) | $S_c$ (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A-6a | C | 0.0 | 1.5 | 774.0 | 772.5 | 1.5 | 0.8 | 120 | 180 | 90 | 90 | 4,090 | 11 | 26 | 0.051 | 0.008 | 0.394 | | | | 0.09 | 0.997 | 5,904 | 5,994 | 0.023 | 0.273 |
| | A-6a | C | 1.5 | 3.0 | 772.5 | 771.0 | 1.5 | 2.3 | 120 | 360 | 270 | 270 | 4,270 | 11 | 26 | 0.051 | 0.008 | 0.394 | | | | 0.28 | 0.946 | 5,599 | 5,869 | 0.017 | 0.209 |
| | A-6a | C | 3.0 | 5.0 | 771.0 | 769.0 | 2.0 | 4.0 | 120 | 600 | 480 | 480 | 4,480 | 12 | 26 | 0.060 | 0.006 | 0.402 | | | | 0.50 | 0.818 | 4,844 | 5,324 | 0.015 | 0.177 |
| | A-6a | C | 5.0 | 7.0 | 769.0 | 767.0 | 2.0 | 6.0 | 120 | 840 | 720 | 720 | 4,720 | 12 | 25 | 0.058 | 0.006 | 0.400 | | | | 0.75 | 0.668 | 3,955 | 4,675 | 0.007 | 0.081 |
| 2 | A-4a | C | 7.0 | 9.0 | 767.0 | 765.0 | 2.0 | 8.0 | 125 | 1,090 | 965 | 965 | 4,965 | 11 | 25 | 0.049 | 0.005 | 0.393 | | | | 1.00 | 0.550 | 3,255 | 4,220 | 0.005 | 0.054 |
| | A-4a | C | 9.0 | 11.0 | 765.0 | 763.0 | 2.0 | 10.0 | 125 | 1,340 | 1,215 | 1,153 | 5,153 | 11 | 25 | 0.049 | 0.005 | 0.393 | | | | 1.25 | 0.462 | 2,734 | 3,886 | 0.004 | 0.045 |
| | A-4a | C | 11.0 | 13.0 | 763.0 | 761.0 | 2.0 | 12.0 | 125 | 1,590 | 1,465 | 1,278 | 5,278 | 11 | 25 | 0.049 | 0.005 | 0.393 | | | | 1.50 | 0.396 | 2,343 | 3,621 | 0.003 | 0.038 |
| | A-4a | C | 13.0 | 15.0 | 761.0 | 759.0 | 2.0 | 14.0 | 125 | 1,840 | 1,715 | 1,403 | 5,403 | 8 | 25 | 0.022 | 0.002 | 0.369 | | | | 1.75 | 0.345 | 2,044 | 3,447 | 0.001 | 0.015 |
| | A-4a | C | 15.0 | 17.0 | 759.0 | 757.0 | 2.0 | 16.0 | 125 | 2,090 | 1,965 | 1,528 | 5,528 | 8 | 25 | 0.022 | 0.002 | 0.369 | | | | 2.00 | 0.306 | 1,810 | 3,338 | 0.001 | 0.013 |
| | A-4a | C | 17.0 | 19.0 | 757.0 | 755.0 | 2.0 | 18.0 | 125 | 2,340 | 2,215 | 1,653 | 5,653 | 8 | 25 | 0.022 | 0.002 | 0.369 | | | | 2.25 | 0.274 | 1,622 | 3,276 | 0.001 | 0.011 |
| | A-4a | C | 19.0 | 21.0 | 755.0 | 753.0 | 2.0 | 20.0 | 125 | 2,590 | 2,465 | 1,779 | 5,779 | 9 | 25 | 0.031 | 0.003 | 0.377 | | | | 2.50 | 0.248 | 1,469 | 3,247 | 0.001 | 0.014 |
| 3 | A-4a | C | 21.0 | 23.0 | 753.0 | 751.0 | 2.0 | 22.0 | 130 | 2,850 | 2,720 | 1,909 | 5,909 | 9 | 25 | 0.031 | 0.003 | 0.377 | | | | 2.75 | 0.227 | 1,341 | 3,250 | 0.001 | 0.012 |
| | A-4a | C | 23.0 | 25.0 | 751.0 | 749.0 | 2.0 | 24.0 | 130 | 3,110 | 2,980 | 2,044 | 6,044 | 11 | 25 | 0.049 | 0.005 | 0.393 | | | | 3.00 | 0.208 | 1,234 | 3,278 | 0.001 | 0.017 |
| | A-4a | C | 25.0 | 27.0 | 749.0 | 747.0 | 2.0 | 26.0 | 130 | 3,370 | 3,240 | 2,179 | 6,179 | 11 | 25 | 0.049 | 0.005 | 0.393 | | | | 3.25 | 0.193 | 1,142 | 3,321 | 0.001 | 0.015 |
| | A-4a | C | 27.0 | 29.0 | 747.0 | 745.0 | 2.0 | 28.0 | 130 | 3,630 | 3,500 | 2,314 | 6,314 | 10 | 25 | 0.040 | 0.004 | 0.385 | | | | 3.50 | 0.179 | 1,062 | 3,377 | 0.001 | 0.011 |

Total Settlement: 0.987 in

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate $\sigma_m$ of 4,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Cc = 0.009wn+0.002wL-0.10; Ref. Table 4, "Regression Analysis of Soil Compressibility" Azzouz et al., 1976, Soils and Foundations Vol. 16, No. 2s
3. $C_r = 0.15(C_c)$ for medium stiff to stiff natural soil deposits and existing fill material, 0.075 to 0.10($C_c$) for very stiff to hard natural soil deposits, and 0.05(Cc) for new embankment fill; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for continuous footing
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-21-140 - FRA-70-22.85

FRA-BPDRW-41.060

Settlement - CONTINUOUS SHALLOW FOOTINGS

**Boring B-054-0-19**

Calculated By: DEK Date: 1/5/2023

Checked By: JPS Date: 1/6/2023

B = 8.0 ft

$D_w$ = 9.0 ft

$q_{gross}$ = 9,480 psf

$q_{net}$ = 8,100 psf

| Layer | Soil Class. | Soil Type | Layer Depth (ft) | | Layer Elevation (ft. msl) | | Layer Thickness H (ft) | Depth to Midpoint (ft) | γ (pcf) | $\sigma_{vo}$ Bottom (psf) | $\sigma_{vo}$ Midpoint (psf) | $\sigma_{vo}'$ Midpoint (psf) | $\sigma_p'$ (1) (psf) | MC | LL | $C_c$ (2) | $C_r$ (3) | $e_o$ (4) | $N_{60}$ | $(N1)_{60}$ (5) | C' (6) | $Z_f$/B | I (7) | $\Delta\sigma_v$ (8) (psf) | $\sigma_{vf}'$ Midpoint (psf) | $S_c$ (9,10) (ft) | $S_c$ (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A-6a | C | 0.0 | 1.5 | 774.0 | 772.5 | 1.5 | 0.8 | 120 | 180 | 90 | 90 | 4,090 | 11 | 26 | 0.051 | 0.008 | 0.394 | | | | 0.09 | 0.997 | 8,078 | 8,168 | 0.030 | 0.361 |
| | A-6a | C | 1.5 | 3.0 | 772.5 | 771.0 | 1.5 | 2.3 | 120 | 360 | 270 | 270 | 4,270 | 11 | 26 | 0.051 | 0.008 | 0.394 | | | | 0.28 | 0.946 | 7,661 | 7,931 | 0.025 | 0.295 |
| | A-6a | C | 3.0 | 5.0 | 771.0 | 769.0 | 2.0 | 4.0 | 120 | 600 | 480 | 480 | 4,480 | 12 | 26 | 0.060 | 0.006 | 0.402 | | | | 0.50 | 0.818 | 6,628 | 7,108 | 0.025 | 0.306 |
| | A-6a | C | 5.0 | 7.0 | 769.0 | 767.0 | 2.0 | 6.0 | 120 | 840 | 720 | 720 | 4,720 | 12 | 25 | 0.058 | 0.006 | 0.400 | | | | 0.75 | 0.668 | 5,412 | 6,132 | 0.016 | 0.194 |
| 2 | A-4a | C | 7.0 | 9.0 | 767.0 | 765.0 | 2.0 | 8.0 | 125 | 1,090 | 965 | 965 | 4,965 | 11 | 25 | 0.049 | 0.005 | 0.393 | | | | 1.00 | 0.550 | 4,454 | 5,419 | 0.008 | 0.092 |
| | A-4a | C | 9.0 | 11.0 | 765.0 | 763.0 | 2.0 | 10.0 | 125 | 1,340 | 1,215 | 1,153 | 5,153 | 11 | 25 | 0.049 | 0.005 | 0.393 | | | | 1.25 | 0.462 | 3,740 | 4,893 | 0.004 | 0.053 |
| | A-4a | C | 11.0 | 13.0 | 763.0 | 761.0 | 2.0 | 12.0 | 125 | 1,590 | 1,465 | 1,278 | 5,278 | 11 | 25 | 0.049 | 0.005 | 0.393 | | | | 1.50 | 0.396 | 3,206 | 4,484 | 0.004 | 0.046 |
| | A-4a | C | 13.0 | 15.0 | 761.0 | 759.0 | 2.0 | 14.0 | 125 | 1,840 | 1,715 | 1,403 | 5,403 | 8 | 25 | 0.022 | 0.002 | 0.369 | | | | 1.75 | 0.345 | 2,797 | 4,200 | 0.002 | 0.018 |
| | A-4a | C | 15.0 | 17.0 | 759.0 | 757.0 | 2.0 | 16.0 | 125 | 2,090 | 1,965 | 1,528 | 5,528 | 8 | 25 | 0.022 | 0.002 | 0.369 | | | | 2.00 | 0.306 | 2,477 | 4,005 | 0.001 | 0.016 |
| | A-4a | C | 17.0 | 19.0 | 757.0 | 755.0 | 2.0 | 18.0 | 125 | 2,340 | 2,215 | 1,653 | 5,653 | 8 | 25 | 0.022 | 0.002 | 0.369 | | | | 2.25 | 0.274 | 2,220 | 3,873 | 0.001 | 0.014 |
| | A-4a | C | 19.0 | 21.0 | 755.0 | 753.0 | 2.0 | 20.0 | 125 | 2,590 | 2,465 | 1,779 | 5,779 | 9 | 25 | 0.031 | 0.003 | 0.377 | | | | 2.50 | 0.248 | 2,010 | 3,788 | 0.001 | 0.018 |
| 3 | A-4a | C | 21.0 | 23.0 | 753.0 | 751.0 | 2.0 | 22.0 | 130 | 2,850 | 2,720 | 1,909 | 5,909 | 9 | 25 | 0.031 | 0.003 | 0.377 | | | | 2.75 | 0.227 | 1,835 | 3,744 | 0.001 | 0.016 |
| | A-4a | C | 23.0 | 25.0 | 751.0 | 749.0 | 2.0 | 24.0 | 130 | 3,110 | 2,980 | 2,044 | 6,044 | 11 | 25 | 0.049 | 0.005 | 0.393 | | | | 3.00 | 0.208 | 1,688 | 3,732 | 0.002 | 0.022 |
| | A-4a | C | 25.0 | 27.0 | 749.0 | 747.0 | 2.0 | 26.0 | 130 | 3,370 | 3,240 | 2,179 | 6,179 | 11 | 25 | 0.049 | 0.005 | 0.393 | | | | 3.25 | 0.193 | 1,562 | 3,741 | 0.002 | 0.020 |
| | A-4a | C | 27.0 | 29.0 | 747.0 | 745.0 | 2.0 | 28.0 | 130 | 3,630 | 3,500 | 2,314 | 6,314 | 10 | 25 | 0.040 | 0.004 | 0.385 | | | | 3.50 | 0.179 | 1,454 | 3,768 | 0.001 | 0.015 |

Total Settlement: 1.487 in

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate $\sigma_m$ of 4,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Cc = 0.009wn+0.002wL-0.10; Ref. Table 4, "Regression Analysis of Soil Compressibility" Azzouz et al., 1976, Soils and Foundations Vol. 16, No. 2s
3. $C_r$ = 0.15($C_c$) for medium stiff to stiff natural soil deposits and existing fill material, 0.075 to 0.10($C_c$) for very stiff to hard natural soil deposits, and 0.05(Cc) for new embankment fill; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for continuous footing
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-21-140 - FRA-70-22.85

FRA-BPDRW-41.060

Settlement - CONTINUOUS SHALLOW FOOTINGS

**Boring B-055-0-19**

Calculated By: DEK Date: 1/5/2023

Checked By: JPS Date: 1/6/2023

B = 8.0 ft

$D_w$ = 0.0 ft

q = 730 psf

| Layer | Soil Class. | Soil Type | Layer Depth (ft) | | Layer Elevation (ft. msl) | | Layer Thickness H (ft) | Depth to Midpoint (ft) | γ (pcf) | $\sigma_{vo}$ Bottom (psf) | $\sigma_{vo}$ Midpoint (psf) | $\sigma_{vo}'$ Midpoint (psf) | $\sigma_p'$ (1) (psf) | MC | LL | $C_c$ (2) | $C_r$ (3) | $e_o$ (4) | $N_{60}$ | $(N1)_{60}$ (5) | C' (6) | $Z_f$/B | I (7) | $\Delta\sigma_v$ (8) (psf) | $\sigma_{vf}'$ Midpoint (psf) | $S_c$ (9,10) (ft) | $S_c$ (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A-6a | C | 0.0 | 0.5 | 774.0 | 773.5 | 0.5 | 0.3 | 120 | 60 | 30 | 14 | 4,014 | 11 | 34 | 0.067 | 0.010 | 0.408 | | | | 0.03 | 1.000 | 730 | 744 | 0.006 | 0.073 |
| 2 | A-6b | C | 0.5 | 2.5 | 773.5 | 771.5 | 2.0 | 1.5 | 125 | 310 | 185 | 91 | 4,091 | 11 | 35 | 0.069 | 0.010 | 0.410 | | | | 0.19 | 0.981 | 716 | 807 | 0.014 | 0.167 |
| | A-6b | C | 2.5 | 4.5 | 771.5 | 769.5 | 2.0 | 3.5 | 125 | 560 | 435 | 217 | 4,217 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 0.44 | 0.858 | 626 | 843 | 0.006 | 0.069 |
| | A-6b | C | 4.5 | 6.5 | 769.5 | 767.5 | 2.0 | 5.5 | 125 | 810 | 685 | 342 | 4,342 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 0.69 | 0.703 | 513 | 855 | 0.004 | 0.047 |
| | A-6b | C | 6.5 | 8.5 | 767.5 | 765.5 | 2.0 | 7.5 | 125 | 1,060 | 935 | 467 | 4,467 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 0.94 | 0.576 | 421 | 888 | 0.002 | 0.029 |
| | A-6b | C | 8.5 | 10.5 | 765.5 | 763.5 | 2.0 | 9.5 | 125 | 1,310 | 1,185 | 592 | 4,592 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 1.19 | 0.481 | 351 | 944 | 0.002 | 0.021 |
| | A-6b | C | 10.5 | 12.5 | 763.5 | 761.5 | 2.0 | 11.5 | 125 | 1,560 | 1,435 | 717 | 4,717 | 10 | 35 | 0.060 | 0.009 | 0.402 | | | | 1.44 | 0.411 | 300 | 1,017 | 0.002 | 0.023 |
| | A-6b | C | 12.5 | 14.5 | 761.5 | 759.5 | 2.0 | 13.5 | 125 | 1,810 | 1,685 | 843 | 4,843 | 10 | 35 | 0.060 | 0.009 | 0.402 | | | | 1.69 | 0.357 | 260 | 1,103 | 0.002 | 0.018 |
| | A-6b | C | 14.5 | 16.5 | 759.5 | 757.5 | 2.0 | 15.5 | 125 | 2,060 | 1,935 | 968 | 4,968 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 1.94 | 0.315 | 230 | 1,198 | 0.001 | 0.010 |
| | A-6b | C | 16.5 | 18.5 | 757.5 | 755.5 | 2.0 | 17.5 | 125 | 2,310 | 2,185 | 1,093 | 5,093 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 2.19 | 0.281 | 205 | 1,298 | 0.001 | 0.008 |
| | A-6b | C | 18.5 | 20.5 | 755.5 | 753.5 | 2.0 | 19.5 | 125 | 2,560 | 2,435 | 1,218 | 5,218 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 2.44 | 0.254 | 186 | 1,404 | 0.001 | 0.007 |
| | A-6b | C | 20.5 | 22.5 | 753.5 | 751.5 | 2.0 | 21.5 | 125 | 2,810 | 2,685 | 1,343 | 5,343 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 2.69 | 0.232 | 169 | 1,512 | 0.001 | 0.006 |
| 3 | A-6a | C | 22.5 | 24.5 | 751.5 | 749.5 | 2.0 | 23.5 | 130 | 3,070 | 2,940 | 1,474 | 5,474 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 2.94 | 0.213 | 155 | 1,629 | 0.000 | 0.006 |
| | A-6a | C | 24.5 | 26.5 | 749.5 | 747.5 | 2.0 | 25.5 | 130 | 3,330 | 3,200 | 1,609 | 5,609 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 3.19 | 0.197 | 143 | 1,752 | 0.000 | 0.005 |
| | A-6a | C | 24.5 | 29.5 | 749.5 | 744.5 | 5.0 | 27.0 | 130 | 3,720 | 3,395 | 1,710 | 5,710 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 3.38 | 0.186 | 136 | 1,846 | 0.001 | 0.011 |

Total Settlement: 0.499 in

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate $\sigma_m$ of 4,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Cc = 0.009wn+0.002wL-0.10; Ref. Table 4, "Regression Analysis of Soil Compressibility" Azzouz et al., 1976, Soils and Foundations Vol. 16, No. 2s
3. $C_r = 0.15(C_c)$ for medium stiff to stiff natural soil deposits and existing fill material, 0.075 to 0.10($C_c$) for very stiff to hard natural soil deposits, and 0.05(Cc) for new embankment fill; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for continuous footing
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-21-140 - FRA-70-22.85

FRA-BPDRW-41.060

Settlement - CONTINUOUS SHALLOW FOOTINGS

**Boring B-055-0-19**

Calculated By: DEK Date: 1/5/2023

Checked By: JPS Date: 1/6/2023

B = 8.0 ft

$D_w$ = 0.0 ft

q = 2,800 psf

| Layer | Soil Class. | Soil Type | Layer Depth (ft) | | Layer Elevation (ft. msl) | | Layer Thickness H (ft) | Depth to Midpoint (ft) | γ (pcf) | $\sigma_{vo}$ Bottom (psf) | $\sigma_{vo}$ Midpoint (psf) | $\sigma_{vo}$' Midpoint (psf) | $\sigma_p$' [1] (psf) | MC | LL | $C_c$ [2] | $C_r$ [3] | $e_o$ [4] | $N_{60}$ | $(N1)_{60}$ [5] | C' [6] | $Z_f$/B | I [7] | $\Delta\sigma_v$ [8] (psf) | $\sigma_{vf}$' Midpoint (psf) | $S_c$ [9,10] (ft) | $S_c$ (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A-6a | C | 0.0 | 0.5 | 774.0 | 773.5 | 0.5 | 0.3 | 120 | 60 | 30 | 14 | 4,014 | 11 | 34 | 0.067 | 0.010 | 0.408 | | | | 0.03 | 1.000 | 2,800 | 2,814 | 0.008 | 0.098 |
| 2 | A-6b | C | 0.5 | 2.5 | 773.5 | 771.5 | 2.0 | 1.5 | 125 | 310 | 185 | 91 | 4,091 | 11 | 35 | 0.069 | 0.010 | 0.410 | | | | 0.19 | 0.981 | 2,747 | 2,838 | 0.022 | 0.263 |
| | A-6b | C | 2.5 | 4.5 | 771.5 | 769.5 | 2.0 | 3.5 | 125 | 560 | 435 | 217 | 4,217 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 0.44 | 0.858 | 2,402 | 2,619 | 0.011 | 0.127 |
| | A-6b | C | 4.5 | 6.5 | 769.5 | 767.5 | 2.0 | 5.5 | 125 | 810 | 685 | 342 | 4,342 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 0.69 | 0.703 | 1,969 | 2,311 | 0.008 | 0.097 |
| | A-6b | C | 6.5 | 8.5 | 767.5 | 765.5 | 2.0 | 7.5 | 125 | 1,060 | 935 | 467 | 4,467 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 0.94 | 0.576 | 1,614 | 2,081 | 0.006 | 0.067 |
| | A-6b | C | 8.5 | 10.5 | 765.5 | 763.5 | 2.0 | 9.5 | 125 | 1,310 | 1,185 | 592 | 4,592 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 1.19 | 0.481 | 1,348 | 1,940 | 0.004 | 0.053 |
| | A-6b | C | 10.5 | 12.5 | 763.5 | 761.5 | 2.0 | 11.5 | 125 | 1,560 | 1,435 | 717 | 4,717 | 10 | 35 | 0.060 | 0.009 | 0.402 | | | | 1.44 | 0.411 | 1,150 | 1,867 | 0.005 | 0.064 |
| | A-6b | C | 12.5 | 14.5 | 761.5 | 759.5 | 2.0 | 13.5 | 125 | 1,810 | 1,685 | 843 | 4,843 | 10 | 35 | 0.060 | 0.009 | 0.402 | | | | 1.69 | 0.357 | 999 | 1,842 | 0.004 | 0.052 |
| | A-6b | C | 14.5 | 16.5 | 759.5 | 757.5 | 2.0 | 15.5 | 125 | 2,060 | 1,935 | 968 | 4,968 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 1.94 | 0.315 | 881 | 1,849 | 0.002 | 0.029 |
| | A-6b | C | 16.5 | 18.5 | 757.5 | 755.5 | 2.0 | 17.5 | 125 | 2,310 | 2,185 | 1,093 | 5,093 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 2.19 | 0.281 | 788 | 1,881 | 0.002 | 0.024 |
| | A-6b | C | 18.5 | 20.5 | 755.5 | 753.5 | 2.0 | 19.5 | 125 | 2,560 | 2,435 | 1,218 | 5,218 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 2.44 | 0.254 | 712 | 1,930 | 0.002 | 0.023 |
| | A-6b | C | 20.5 | 22.5 | 753.5 | 751.5 | 2.0 | 21.5 | 125 | 2,810 | 2,685 | 1,343 | 5,343 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 2.69 | 0.232 | 648 | 1,992 | 0.002 | 0.020 |
| 3 | A-6a | C | 22.5 | 24.5 | 751.5 | 749.5 | 2.0 | 23.5 | 130 | 3,070 | 2,940 | 1,474 | 5,474 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 2.94 | 0.213 | 595 | 2,069 | 0.002 | 0.019 |
| | A-6a | C | 24.5 | 26.5 | 749.5 | 747.5 | 2.0 | 25.5 | 130 | 3,330 | 3,200 | 1,609 | 5,609 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 3.19 | 0.197 | 550 | 2,159 | 0.001 | 0.017 |
| | A-6a | C | 24.5 | 29.5 | 749.5 | 744.5 | 5.0 | 27.0 | 130 | 3,720 | 3,395 | 1,710 | 5,710 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 3.38 | 0.186 | 521 | 2,231 | 0.003 | 0.038 |

| Total Settlement: | 0.992 in |
|---|---|

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate $\sigma_m$ of 4,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Cc = 0.009wn+0.002wL-0.10; Ref. Table 4, "Regression Analysis of Soil Compressibility" Azzouz et al., 1976, Soils and Foundations Vol. 16, No. 2s
3. $C_r = 0.15(C_c)$ for medium stiff to stiff natural soil deposits and existing fill material, 0.075 to 0.10($C_c$) for very stiff to hard natural soil deposits, and 0.05(Cc) for new embankment fill; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for continuous footing
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-21-140 - FRA-70-22.85

FRA-BPDRW-41.060

Settlement - CONTINUOUS SHALLOW FOOTINGS

**Boring B-055-0-19**

Calculated By: DEK Date: 1/5/2023

Checked By: JPS Date: 1/6/2023

B = 8.0 ft

$D_w$ = 0.0 ft

q = 3,300 psf

Improved soil

| Layer | Soil Class. | Soil Type | Layer Depth (ft) | | Layer Elevation (ft. msl) | | Layer Thickness H (ft) | Depth to Midpoint (ft) | γ (pcf) | $\sigma_{vo}$ Bottom (psf) | $\sigma_{vo}$ Midpoint (psf) | $\sigma_{vo}'$ Midpoint (psf) | $\sigma_p'$ (1) (psf) | MC | LL | $C_c$ (2) | $C_r$ (3) | $e_o$ (4) | $N_{60}$ | $(N1)_{60}$ (5) | C' (6) | $Z_f$/B | I (7) | $\Delta\sigma_v$ (8) (psf) | $\sigma_{vf}'$ Midpoint (psf) | $S_c$ (9,10) (ft) | $S_c$ (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A-2-4 | G | 0.0 | 0.5 | 774.0 | 773.5 | 0.5 | 0.3 | 120 | 60 | 30 | 14 | 14 | 11 | | | | | 50 | 100 | 469 | 0.03 | 1.000 | 3,300 | 3,314 | 0.003 | 0.030 |
| | A-6b | C | 0.5 | 2.5 | 773.5 | 771.5 | 2.0 | 1.5 | 125 | 310 | 185 | 91 | 4,091 | 11 | 35 | 0.069 | 0.010 | 0.410 | | | | 0.19 | 0.981 | 3,237 | 3,328 | 0.023 | 0.275 |
| | A-6b | C | 2.5 | 4.5 | 771.5 | 769.5 | 2.0 | 3.5 | 125 | 560 | 435 | 217 | 4,217 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 0.44 | 0.858 | 2,831 | 3,048 | 0.011 | 0.135 |
| | A-6b | C | 4.5 | 6.5 | 769.5 | 767.5 | 2.0 | 5.5 | 125 | 810 | 685 | 342 | 4,342 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 0.69 | 0.703 | 2,320 | 2,662 | 0.009 | 0.105 |
| | A-6b | C | 6.5 | 8.5 | 767.5 | 765.5 | 2.0 | 7.5 | 125 | 1,060 | 935 | 467 | 4,467 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 0.94 | 0.576 | 1,902 | 2,369 | 0.006 | 0.072 |
| | A-6b | C | 8.5 | 10.5 | 765.5 | 763.5 | 2.0 | 9.5 | 125 | 1,310 | 1,185 | 592 | 4,592 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 1.19 | 0.481 | 1,589 | 2,181 | 0.005 | 0.058 |
| 2 | A-6b | C | 10.5 | 12.5 | 763.5 | 761.5 | 2.0 | 11.5 | 125 | 1,560 | 1,435 | 717 | 4,717 | 10 | 35 | 0.060 | 0.009 | 0.402 | | | | 1.44 | 0.411 | 1,355 | 2,072 | 0.006 | 0.071 |
| | A-6b | C | 12.5 | 14.5 | 761.5 | 759.5 | 2.0 | 13.5 | 125 | 1,810 | 1,685 | 843 | 4,843 | 10 | 35 | 0.060 | 0.009 | 0.402 | | | | 1.69 | 0.357 | 1,177 | 2,020 | 0.005 | 0.058 |
| | A-6b | C | 14.5 | 16.5 | 759.5 | 757.5 | 2.0 | 15.5 | 125 | 2,060 | 1,935 | 968 | 4,968 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 1.94 | 0.315 | 1,039 | 2,007 | 0.003 | 0.033 |
| | A-6b | C | 16.5 | 18.5 | 757.5 | 755.5 | 2.0 | 17.5 | 125 | 2,310 | 2,185 | 1,093 | 5,093 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 2.19 | 0.281 | 928 | 2,021 | 0.002 | 0.027 |
| | A-6b | C | 18.5 | 20.5 | 755.5 | 753.5 | 2.0 | 19.5 | 125 | 2,560 | 2,435 | 1,218 | 5,218 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 2.44 | 0.254 | 839 | 2,057 | 0.002 | 0.027 |
| | A-6b | C | 20.5 | 22.5 | 753.5 | 751.5 | 2.0 | 21.5 | 125 | 2,810 | 2,685 | 1,343 | 5,343 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 2.69 | 0.232 | 764 | 2,108 | 0.002 | 0.023 |
| | A-6a | C | 22.5 | 24.5 | 751.5 | 749.5 | 2.0 | 23.5 | 130 | 3,070 | 2,940 | 1,474 | 5,474 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 2.94 | 0.213 | 702 | 2,175 | 0.002 | 0.022 |
| 3 | A-6a | C | 24.5 | 26.5 | 749.5 | 747.5 | 2.0 | 25.5 | 130 | 3,330 | 3,200 | 1,609 | 5,609 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 3.19 | 0.197 | 649 | 2,257 | 0.002 | 0.019 |
| | A-6a | C | 24.5 | 29.5 | 749.5 | 744.5 | 5.0 | 27.0 | 130 | 3,720 | 3,395 | 1,710 | 5,710 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 3.38 | 0.186 | 614 | 2,324 | 0.004 | 0.044 |

Total Settlement: 1.000 in

1. $\sigma_p' = \sigma_{vo}'+\sigma_m$; Estimate $\sigma_m$ of 4,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Cc = 0.009wn+0.002wL-0.10; Ref. Table 4, "Regression Analysis of Soil Compressibility" Azzouz et al., 1976, Soils and Foundations Vol. 16, No. 2s
3. $C_r$ = 0.15($C_c$) for medium stiff to stiff natural soil deposits and existing fill material, 0.075 to 0.10($C_c$) for very stiff to hard natural soil deposits, and 0.05(Cc) for new embankment fill; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for continuous footing
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-21-140 - FRA-70-22.85

FRA-BPDRW-41.060

Settlement - CONTINUOUS SHALLOW FOOTINGS

**Boring B-055-0-19**

Calculated By: DEK Date: 1/5/2023

Checked By: JPS Date: 1/6/2023

B = 8.0 ft

$D_w$ = 0.0 ft

q = 3,800 psf

| Layer | Soil Class. | Soil Type | Layer Depth (ft) | | Layer Elevation (ft. msl) | | Layer Thickness H (ft) | Depth to Midpoint (ft) | γ (pcf) | $\sigma_{vo}$ Bottom (psf) | $\sigma_{vo}$ Midpoint (psf) | $\sigma_{vo}$' Midpoint (psf) | $\sigma_p$' (1) (psf) | MC | LL | $C_c$ (2) | $C_r$ (3) | $e_o$ (4) | $N_{60}$ | $(N1)_{60}$ (5) | C' (6) | $Z_f$/B | I (7) | $\Delta\sigma_v$ (8) (psf) | $\sigma_{vf}$' Midpoint (psf) | $S_c$ (9,10) (ft) | $S_c$ (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A-6a | C | 0.0 | 0.5 | 774.0 | 773.5 | 0.5 | 0.3 | 120 | 60 | 30 | 14 | 4,014 | 11 | 34 | 0.067 | 0.010 | 0.408 | | | | 0.03 | 1.000 | 3,800 | 3,814 | 0.009 | 0.104 |
| 2 | A-6b | C | 0.5 | 2.5 | 773.5 | 771.5 | 2.0 | 1.5 | 125 | 310 | 185 | 91 | 4,091 | 11 | 35 | 0.069 | 0.010 | 0.410 | | | | 0.19 | 0.981 | 3,727 | 3,819 | 0.024 | 0.286 |
| | A-6b | C | 2.5 | 4.5 | 771.5 | 769.5 | 2.0 | 3.5 | 125 | 560 | 435 | 217 | 4,217 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 0.44 | 0.858 | 3,260 | 3,477 | 0.012 | 0.142 |
| | A-6b | C | 4.5 | 6.5 | 769.5 | 767.5 | 2.0 | 5.5 | 125 | 810 | 685 | 342 | 4,342 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 0.69 | 0.703 | 2,672 | 3,014 | 0.009 | 0.111 |
| | A-6b | C | 6.5 | 8.5 | 767.5 | 765.5 | 2.0 | 7.5 | 125 | 1,060 | 935 | 467 | 4,467 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 0.94 | 0.576 | 2,190 | 2,657 | 0.006 | 0.078 |
| | A-6b | C | 8.5 | 10.5 | 765.5 | 763.5 | 2.0 | 9.5 | 125 | 1,310 | 1,185 | 592 | 4,592 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 1.19 | 0.481 | 1,829 | 2,421 | 0.005 | 0.063 |
| | A-6b | C | 10.5 | 12.5 | 763.5 | 761.5 | 2.0 | 11.5 | 125 | 1,560 | 1,435 | 717 | 4,717 | 10 | 35 | 0.060 | 0.009 | 0.402 | | | | 1.44 | 0.411 | 1,560 | 2,278 | 0.006 | 0.077 |
| | A-6b | C | 12.5 | 14.5 | 761.5 | 759.5 | 2.0 | 13.5 | 125 | 1,810 | 1,685 | 843 | 4,843 | 10 | 35 | 0.060 | 0.009 | 0.402 | | | | 1.69 | 0.357 | 1,356 | 2,198 | 0.005 | 0.064 |
| | A-6b | C | 14.5 | 16.5 | 759.5 | 757.5 | 2.0 | 15.5 | 125 | 2,060 | 1,935 | 968 | 4,968 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 1.94 | 0.315 | 1,196 | 2,164 | 0.003 | 0.036 |
| | A-6b | C | 16.5 | 18.5 | 757.5 | 755.5 | 2.0 | 17.5 | 125 | 2,310 | 2,185 | 1,093 | 5,093 | 10 | 35 | 0.060 | 0.006 | 0.402 | | | | 2.19 | 0.281 | 1,069 | 2,162 | 0.003 | 0.030 |
| | A-6b | C | 18.5 | 20.5 | 755.5 | 753.5 | 2.0 | 19.5 | 125 | 2,560 | 2,435 | 1,218 | 5,218 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 2.44 | 0.254 | 966 | 2,184 | 0.002 | 0.030 |
| | A-6b | C | 20.5 | 22.5 | 753.5 | 751.5 | 2.0 | 21.5 | 125 | 2,810 | 2,685 | 1,343 | 5,343 | 11 | 35 | 0.069 | 0.007 | 0.410 | | | | 2.69 | 0.232 | 880 | 2,223 | 0.002 | 0.026 |
| 3 | A-6a | C | 22.5 | 24.5 | 751.5 | 749.5 | 2.0 | 23.5 | 130 | 3,070 | 2,940 | 1,474 | 5,474 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 2.94 | 0.213 | 808 | 2,282 | 0.002 | 0.025 |
| | A-6a | C | 24.5 | 26.5 | 749.5 | 747.5 | 2.0 | 25.5 | 130 | 3,330 | 3,200 | 1,609 | 5,609 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 3.19 | 0.197 | 747 | 2,356 | 0.002 | 0.022 |
| | A-6a | C | 24.5 | 29.5 | 749.5 | 744.5 | 5.0 | 27.0 | 130 | 3,720 | 3,395 | 1,710 | 5,710 | 12 | 35 | 0.078 | 0.008 | 0.418 | | | | 3.38 | 0.186 | 707 | 2,417 | 0.004 | 0.050 |

| Total Settlement: | 1.142 in |
|---|---|

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate $\sigma_m$ of 4,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Cc = 0.009wn+0.002wL-0.10; Ref. Table 4, "Regression Analysis of Soil Compressibility" Azzouz et al., 1976, Soils and Foundations Vol. 16, No. 2s
3. $C_r = 0.15(C_c)$ for medium stiff to stiff natural soil deposits and existing fill material, 0.075 to 0.10($C_c$) for very stiff to hard natural soil deposits, and 0.05(Cc) for new embankment fill; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for continuous footing
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

# APPENDIX VIII

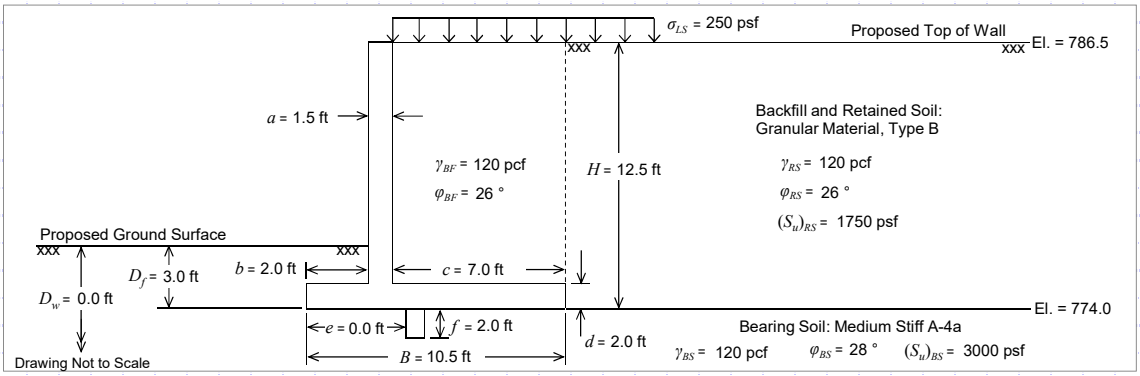
CALCULATIONS - CIP WALL

RESOURCE INTERNATIONAL, INC.
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
PHONE: (614) 823-4949
FAX: (614) 823-4990
WWW.RESOURCEINTERNATIONAL.COM

| | | | |
|---|---|---|---|
| JOB | FRA-70-22.85 FEF | NO. | W-17-140 |
| SHEET NO. | 1 | OF | 6 |
| CALCULATED BY | DEK | DATE | 1/6/2023 |
| CHECKED BY | BRT | DATE | 1/6/2023 |

Culvert FRA-BPDRW-41.060 Headwall Sta. 12+28.18

**FRA-BPDRW-41.060 Headwall - Sta. 12+28.18 - CIP Wall w/ Shear Key - Level Backslope - B-055-0-19 - 12.5 ft. Wall Height**




**CIP Wall Dimensions and Surcharge Loading**

| | | |
|---|---|---|
| Wall Height, ($H$) = | 12.5 | ft |
| Foundation Width (Entire Base Width), ($B$) = | 10.5 | ft |
| Stem Width, ($a$) = | 1.5 | ft |
| Toe Width, ($b$) = | 2.0 | ft |
| Heel Width, ($c$) = | 7.0 | ft |
| Footing Thickness, ($d$) = | 2.0 | ft |
| Location of Shear Key, ($e$) = | 0.0 | ft |
| Depth of Shear Key, ($f$) = | 2.0 | ft |
| Embedment Depth, ($D_f$) = | 3.0 | ft |
| Wall Length, ($L$) = | 70 | ft |
| Live Surcharge Load, ($\sigma_{LS}$) = | 250 | psf |
| Depth to Groundwater, ($D_w$) = | 0.0 | ft |

**Bearing and Retained/Backfill Soil Properties:**

| | | |
|---|---|---|
| Bearing Soil Unit Weight, ($\gamma_{BS}$) = | 120 | pcf |
| Bearing Soil Friction Angle, ($\varphi_{BS}$) = | 28 | ° |
| Bearing Soil Undrained Shear Strength, [$(s_u)_{BS}$] = | 3000 | psf |
| Backfill and Retained Soil Unit Weight, ($\gamma_{BF}$, $\gamma_{RS}$) = | 120 | pcf |
| Retained Soil Friction Angle, ($\varphi_{RS}$) = | 26 | ° |
| Retained Soil Undrained Shear Strength, [$(s_u)_{RS}$] = | 1750 | psf |
| Active Earth Pressure Coefficient, ($K_a$) = | 0.347 | |
| Passive Earth Pressure Coefficient, ($K_p$) = | 5.065 | |

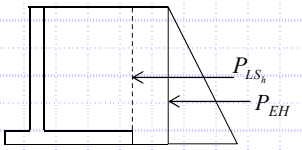
**LRFD Load Factors**

| | DC | EV | EH | LS | EP |
|---|---|---|---|---|---|
| Strength Ia | 0.90 | 1.00 | 1.50 | 1.75 | 0.90 |
| Strength Ib | 1.25 | 1.35 | 1.50 | 1.75 | 0.90 |
| Service I | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

*(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)*

**Check Sliding (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 10.6.3.4**

Sliding Force:




$$P_H = P_{EH} + P_{LS_h}$$

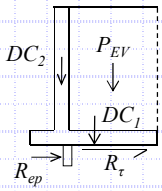
$$P_{EH} = \tfrac{1}{2}\gamma_{RS} H^2 K_a \gamma_{EH} = \text{½(120 pcf)(12.5 ft)²(0.347)(1.50)} = 4.88 \text{ kip/ft}$$

$$P_{LS_h} = \sigma_{LS} H K_a \gamma_{LS} \quad \text{(250 psf)(12.5 ft)(0.347)(1.75)} = 1.9 \text{ kip/ft}$$

$P_H$ = 4.88 kip/ft + 1.9 kip/ft = 6.78 kip/ft

**Check Sliding Resistance**

Nominal Sliding Resisting: $R_n = R_\tau + R_{ep}$




$$R_{ep} = \gamma_{BS} D_f f K_p \gamma_{ep} + \tfrac{1}{2}\gamma_{BS} f^2 K_p \gamma_{ep}$$

$R_{ep}$ = (120 pcf)(3.0 ft)(2.0 ft)(5.07)(0.90) + ½(120 pcf)(2.0 ft)²(5.07)(0.90) = 4.38 kip/ft

Check Drained Condition: $R_\tau = P_V \tan\delta$

$$P_V = DC_1 + DC_2 + P_{EV} = \gamma_c \cdot \left[B \cdot d + (H-d) \cdot a\right] \cdot \gamma_{DC} + \gamma_{BF} \cdot (H-d) \cdot c \cdot \gamma_{EV}$$

$P_V$ = (150 pcf) [(10.5 ft)(2.0 ft) + (12.5 ft - 2.0 ft)(1.5 ft)] (0.90) + (120 pcf)(12.5 ft - 2.0 ft)(7.0 ft)(1.00) = 13.78 kip/ft

$\tan\delta = \tan\varphi_{BS}$ = tan(28) = 0.53

$R_\tau$ = (13.78 kip/ft)(0.53) = 7.30 kip/ft

**Verify Sliding Force Less Than Factored Sliding Resistance - Drained Condition**

$P_H \le \phi_n \cdot R_n \longrightarrow P_H \le \phi_\tau \cdot R_\tau + \phi_{ep} \cdot R_{ep} \longrightarrow$ 6.78 kip/ft ≤ (7.30 kip/ft)(1.00) + (4.38 kip/ft)(0.50) = 9.49 kip/ft

= 6.78 kip/ft ≤ 9.49 kip/ft **OK**

Use $\varphi_\tau$ = **1.00** Use $\varphi_{ep}$ = **0.50** *(Per AASHTO LRFD BDM Tables 10.5.5.2.2-1 and 11.5.7-1)*

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| | | | |
|---|---|---|---|
| JOB | FRA-70-22.85 FEF | NO. | W-17-140 |
| SHEET NO. | 2 | OF | 6 |
| CALCULATED BY | DEK | DATE | 1/6/2023 |
| CHECKED BY | BRT | DATE | 1/6/2023 |

Culvert FRA-BPDRW-41.060 Headwall Sta. 12+28.18

**CIP Wall Dimensions and Surcharge Loading**

| | | |
|---|---|---|
| Wall Height, ($H$) = | 12.5 | ft |
| Foundation Width (Entire Base Width), ($B$) = | 10.5 | ft |
| Stem Width, ($a$) = | 1.5 | ft |
| Toe Width, ($b$) = | 2.0 | ft |
| Heel Width, ($c$) = | 7.0 | ft |
| Footing Thickness, ($d$) = | 2.0 | ft |
| Location of Shear Key, ($e$) = | 0.0 | ft |
| Depth of Shear Key, ($f$) = | 2.0 | ft |
| Embedment Depth, ($D_f$) = | 3.0 | ft |
| Wall Length, ($L$) = | 70 | ft |
| Live Surcharge Load, ($\sigma_{LS}$) = | 250 | psf |
| Depth to Groundwater, ($D_w$) = | 0.0 | ft |

**Bearing and Retained/Backfill Soil Properties:**

| | | |
|---|---|---|
| Bearing Soil Unit Weight, ($\gamma_{BS}$) = | 120 | pcf |
| Bearing Soil Friction Angle, ($\varphi_{BS}$) = | 28 | ° |
| Bearing Soil Undrained Shear Strength, [($s_u$)$_{BS}$] = | 3000 | psf |
| Backfill and Retained Soil Unit Weight, ($\gamma_{BF}$, $\gamma_{RS}$) = | 120 | pcf |
| Retained Soil Friction Angle, ($\varphi_{RS}$) = | 26 | ° |
| Retained Soil Undrained Shear Strength, [($s_u$)$_{RS}$] = | 1750 | psf |
| Active Earth Pressure Coefficient, ($K_a$) = | 0.347 | |
| Passive Earth Pressure Coefficient, ($K_p$) = | 5.065 | |

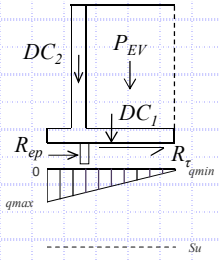
**LRFD Load Factors**

| | DC | EV | EH | LS | EP |
|---|---|---|---|---|---|
| Strength Ia | 0.90 | 1.00 | 1.50 | 1.75 | 0.90 |
| Strength Ib | 1.25 | 1.35 | 1.50 | 1.75 | 0.90 |
| Service I | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

*(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)*

**Check Sliding (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 10.6.3.4** ***(Continued)***

Check Undrained Condition: $R_\tau = \left( (S_u)_{BS} \le q_s \right) \cdot B$




$(S_u)_{BS}$ = 3.00 ksf

$q_{max} = \frac{1}{2}\sigma_{vmax}$ = (2.52 ksf) / 2 = 1.26 ksf

$q_{min} = \frac{1}{2}\sigma_{vmin}$ = (0.11 ksf) / 2 = 0.06 ksf

$\sigma_{vmax} = \frac{P_V}{B}\left(1 + 6\frac{e}{B}\right)$ = (13.78 kip/ft / 10.5 ft)[1 + 6(1.60 ft / 10.5 ft)] = 2.52 ksf

$\sigma_{vmin} = \frac{P_V}{B}\left(1 - 6\frac{e}{B}\right)$ = (13.78 kip/ft / 10.5 ft)[1 - 6(1.60 ft / 10.5 ft)] = 0.11 ksf

$R_\tau$ = 0.5(1.26 ksf - 0.06 ksf)(10.5 ft) + (0.06 ksf)(10.5 ft) = 6.93 kip/ft

**Verify Sliding Force Less Than Factored Sliding Resistance - Undrained Condition**

$P_H \le \phi_n \cdot R_n \longrightarrow P_H \le \phi_\tau \cdot R_\tau + \phi_{ep} \cdot R_{ep} \longrightarrow$ 6.78 kip/ft ≤ (6.93 kip/ft)(1.00) + (4.38 kip/ft)(0.50) = 9.12

= 6.78 kip/ft ≤ 9.12 kip/ft **OK**

Use $\varphi_\tau$ = **1.00** Use $\varphi_{ep}$ = **0.50** *(Per AASHTO LRFD BDM Tables 10.5.5.2.2-1 and 11.5.7-1)*

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|---|---|---|---|
| JOB | FRA-70-22.85 FEF | NO. | W-17-140 |
| SHEET NO. | 3 | OF | 6 |
| CALCULATED BY | DEK | DATE | 1/6/2023 |
| CHECKED BY | BRT | DATE | 1/6/2023 |

Culvert FRA-BPDRW-41.060 Headwall Sta. 12+28.18

**CIP Wall Dimensions and Surcharge Loading**

| | | |
|---|---|---|
| Wall Height, ($H$) = | 12.5 | ft |
| Foundation Width (Entire Base Width), ($B$) = | 10.5 | ft |
| Stem Width, ($a$) = | 1.5 | ft |
| Toe Width, ($b$) = | 2.0 | ft |
| Heel Width, ($c$) = | 7.0 | ft |
| Footing Thickness, ($d$) = | 2.0 | ft |
| Location of Shear Key, ($e$) = | 0.0 | ft |
| Depth of Shear Key, ($f$) = | 2.0 | ft |
| Embedment Depth, ($D_f$) = | 3.0 | ft |
| Wall Length, ($L$) = | 70 | ft |
| Live Surcharge Load, ($\sigma_{LS}$) = | 250 | psf |
| Depth to Groundwater, ($D_w$) = | 0.0 | ft |

**Bearing and Retained/Backfill Soil Properties:**

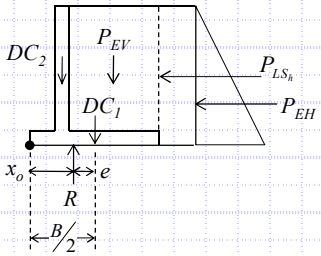
| | | |
|---|---|---|
| Bearing Soil Unit Weight, ($\gamma_{BS}$) = | 120 | pcf |
| Bearing Soil Friction Angle, ($\varphi_{BS}$) = | 28 | ° |
| Bearing Soil Undrained Shear Strength, [($s_u$)$_{BS}$] = | 3000 | psf |
| Backfill and Retained Soil Unit Weight, ($\gamma_{BF}$, $\gamma_{RS}$) = | 120 | pcf |
| Retained Soil Friction Angle, ($\varphi_{RS}$) = | 26 | ° |
| Retained Soil Undrained Shear Strength, [($s_u$)$_{RS}$] = | 1750 | psf |
| Active Earth Pressure Coefficient, ($K_a$) = | 0.347 | |
| Passive Earth Pressure Coefficient, ($K_p$) = | 5.065 | |

**LRFD Load Factors**

| | DC | EV | EH | LS | EP |
|---|---|---|---|---|---|
| Strength Ia | 0.90 | 1.00 | 1.50 | 1.75 | 0.90 |
| Strength Ib | 1.25 | 1.35 | 1.50 | 1.75 | 0.90 |
| Service I | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

*(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)*

**Check Eccentricity (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 11.6.3.3**




$$e = B/2 - x_o$$

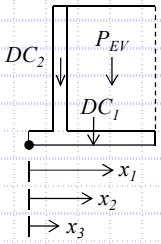
$$x_o = \frac{M_V - M_H}{P_V} = \text{(82.47 kip·ft/ft - 32.22 kip·ft/ft) / (13.78 kip/ft)} = 3.65 \text{ ft}$$

$M_V$ = 82.47 kip·ft/ft
$M_H$ = 32.22 kip·ft/ft — Defined below

$P_V = P_{EV} + DC_1 + DC_2$ = 8.82 kip/ft + 2.84 kip/ft + 2.13 kip/ft = 13.78 kip/ft

$e =$ (10.5 ft / 2) - 3.65 ft = 1.60 ft

Resisting Moment, $M_V$:




$$M_V = P_{EV}(x_1) + DC_1(x_2) + DC_2(x_3)$$

$P_{EV} = \gamma_{BF} \cdot (H - d) \cdot c \cdot \gamma_{EV}$ = (120 pcf)(12.5 ft - 2.0 ft)(7.0 ft)(1.00) = 8.82 kip/ft

$DC_1 = \gamma_c \cdot B \cdot d \cdot \gamma_{DC}$ = (150 pcf)(10.5 ft)(2.0 ft)(0.90) = 2.84 kip/ft

$DC_2 = \gamma_c \cdot (H - d) \cdot a \cdot \gamma_{DC}$ = (150 pcf)(12.5 ft - 2.0 ft)(1.5 ft)(0.90) = 2.13 kip/ft

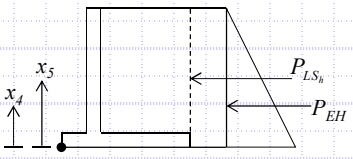
$x_1 = a + b + c/2$ = 1.5 ft + 2.0 ft + (7.0 ft / 2) = 7.0 ft

$x_2 = B/2$ = 10.5 ft / 2 = 5.3 ft

$x_3 = b + a/2$ = 2.0 ft + (1.5 ft / 2) = 2.8 ft

$M_V =$ (8.82 kip/ft)(7.0 ft) + (2.84 kip/ft)(5.3 ft) + (2.13 kip/ft)(2.8 ft) = 82.47 kip·ft/ft

Overturning Moment, $M_H$:




$$M_H = P_{EH}(x_2) + P_{LS_h}(x_3)$$

$P_{EH} = \frac{1}{2} \gamma_{RS} H^2 K_a \gamma_{EH}$ = ½(120 pcf)(12.5 ft)²(0.347)(1.50) = 4.88 kip/ft

$P_{LS_h} = \sigma_{LS} H K_a \gamma_{LS}$ = (250 psf)(12.5 ft)(0.347)(1.75) = 1.9 kip/ft

$x_2 = H/3$ = (12.5 ft) / 3 = 4.17 ft

$x_3 = H/2$ = (12.5 ft) / 2 = 6.25 ft

$M_H =$ (4.88 kip/ft)(4.17 ft) + (1.9 kip/ft)(6.25 ft) = 32.22 kip·ft/ft

Limiting Eccentricity:

$e_{max} = B/3 \longrightarrow e_{max} =$ (10.5 ft) / 3 = 3.50 ft

**Check Eccentricity**

$e < e_{max} \longrightarrow$ 1.60 ft < 3.50 ft **OK**

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|---|---|---|---|
| JOB | FRA-70-22.85 FEF | NO. | W-17-140 |
| SHEET NO. | 4 | OF | 6 |
| CALCULATED BY | DEK | DATE | 1/6/2023 |
| CHECKED BY | BRT | DATE | 1/6/2023 |

Culvert FRA-BPDRW-41.060 Headwall Sta. 12+28.18

**CIP Wall Dimensions and Surcharge Loading**

| | | |
|---|---|---|
| Wall Height, ($H$) = | 12.5 | ft |
| Foundation Width (Entire Base Width), ($B$) = | 10.5 | ft |
| Stem Width, ($a$) = | 1.5 | ft |
| Toe Width, ($b$) = | 2.0 | ft |
| Heel Width, ($c$) = | 7.0 | ft |
| Footing Thickness, ($d$) = | 2.0 | ft |
| Location of Shear Key, ($e$) = | 0.0 | ft |
| Depth of Shear Key, ($f$) = | 2.0 | ft |
| Embedment Depth, ($D_f$) = | 3.0 | ft |
| Wall Length, ($L$) = | 70 | ft |
| Live Surcharge Load, ($\sigma_{LS}$) = | 250 | psf |
| Depth to Groundwater, ($D_w$) = | 0.0 | ft |

**Bearing and Retained/Backfill Soil Properties:**

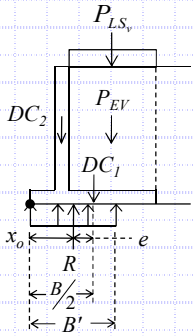
| | | |
|---|---|---|
| Bearing Soil Unit Weight, ($\gamma_{BS}$) = | 120 | pcf |
| Bearing Soil Friction Angle, ($\varphi_{BS}$) = | 28 | ° |
| Bearing Soil Undrained Shear Strength, [($s_u$)$_{BS}$] = | 3000 | psf |
| Backfill and Retained Soil Unit Weight, ($\gamma_{BF}$, $\gamma_{RS}$) = | 120 | pcf |
| Retained Soil Friction Angle, ($\varphi_{RS}$) = | 26 | ° |
| Retained Soil Undrained Shear Strength, [($s_u$)$_{RS}$] = | 1750 | psf |
| Active Earth Pressure Coefficient, ($K_a$) = | 0.347 | |
| Passive Earth Pressure Coefficient, ($K_p$) = | 5.065 | |

**LRFD Load Factors**

| | DC | EV | EH | LS | EP |
|---|---|---|---|---|---|
| Strength Ia | 0.90 | 1.00 | 1.50 | 1.75 | 0.90 |
| Strength Ib | 1.25 | 1.35 | 1.50 | 1.75 | 0.90 |
| Service I | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

*(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)*

**Check Bearing Capacity (Loading Case - Strength Ib) - AASHTO LRFD BDM Section 11.6.3.2**




$$q_{eq} = P_V / B'$$

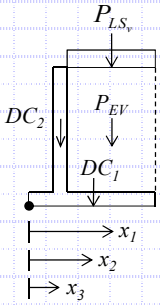
$B' = B - 2e$ = 10.5 ft - 2(0.46 ft) = 9.58 ft (For $e$ < 0, Use $B$)

$e = B/2 - x_o$ = (10.5 ft / 2) - 4.79 ft = 0.46 ft

$x_o = \dfrac{M_V - M_H}{P_V}$ = (144.30 kip·ft/ft - 32.22 kip·ft/ft) / (23.39 kip/ft) = 4.79 ft

$q_{eq}$ = (23.39 kip/ft) / (9.58 ft) = 2.44 ksf

Resisting Moment, $M_V$:




$M_V = P_{EV}(x_1) + P_{LS_v}(x_1) + DC_1(x_2) + DC_2(x_3)$

$P_{EV} = \gamma_{BF} \cdot (H - d) \cdot c \cdot \gamma_{EV}$ = (120 pcf)(12.5 ft - 2.0 ft)(7.0 ft)(1.35) = 11.91 kip/ft

$P_{LS_v} = \sigma_{LS} \cdot B \cdot \gamma_{LS}$ = (250 psf)(10.5 ft)(1.75) = 4.594 kip/ft

$DC_1 = \gamma_c \cdot B \cdot d \cdot \gamma_{DC}$ = (150 pcf)(10.5 ft)(2.0 ft)(1.25) = 3.94 kip/ft

$DC_2 = \gamma_c \cdot (H - d) \cdot a \cdot \gamma_{DC}$ = (150 pcf)(12.5 ft - 2.0 ft)(1.5 ft)(1.25) = 2.95 kip/ft

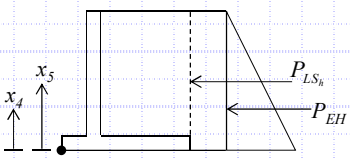
$x_1 = a + b + c/2$ = 1.5 ft + 2.0 ft + (7.0 ft / 2) = 7.0 ft

$x_2 = B/2$ = 10.5 ft / 2 = 5.3 ft

$x_3 = b + a/2$ = 2.0 ft + (1.5 ft / 2) = 2.8 ft

$M_V$ = (11.91 kip/ft)(7.0 ft) + (4.59 kip/ft)(7.0 ft) + (3.94 kip/ft)(5.3 ft) + (2.95 kip/ft)(2.8 ft) = 144.30 kip·ft/ft

Overturning Moment, $M_H$:




$M_H = P_{EH}(x_4) + P_{LS_h}(x_5)$

$P_{EH} = \frac{1}{2} \gamma_{RS} H^2 K_a \gamma_{EH}$ = ½(120 pcf)(12.5 ft)²(0.347)(1.50) = 4.88 kip/ft

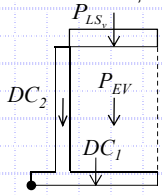
$P_{LS_h} = \sigma_{LS} H K_a \gamma_{LS}$ = (250 psf)(12.5 ft)(0.347)(1.75) = 1.9 kip/ft

$x_4 = H/3$ = (12.5 ft) / 3 = 4.17 ft

$x_5 = H/2$ = (12.5 ft) / 2 = 6.25 ft

$M_H$ = (4.88 kip/ft)(4.17 ft) + (1.9 kip/ft)(6.25 ft) = 32.22 kip·ft/ft

Vertical Force, $P_V$:




$P_V = P_{EV} + P_{LS_v} + DC_1 + DC_2$

$P_V$ = 11.91 kip/ft + 4.59 kip/ft + 3.94 kip/ft + 2.95 kip/ft

$P_V$ = 23.39 kip/ft

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|---|---|---|---|
| JOB | FRA-70-22.85 FEF | NO. | W-17-140 |
| SHEET NO. | 5 | OF | 6 |
| CALCULATED BY | DEK | DATE | 1/6/2023 |
| CHECKED BY | BRT | DATE | 1/6/2023 |

Culvert FRA-BPDRW-41.060 Headwall Sta. 12+28.18

**CIP Wall Dimensions and Surcharge Loading**

| | | |
|---|---|---|
| Wall Height, ($H$) = | 12.5 | ft |
| Foundation Width (Entire Base Width), ($B$) = | 10.5 | ft |
| Stem Width, ($a$) = | 1.5 | ft |
| Toe Width, ($b$) = | 2.0 | ft |
| Heel Width, ($c$) = | 7.0 | ft |
| Footing Thickness, ($d$) = | 2.0 | ft |
| Location of Shear Key, ($e$) = | 0.0 | ft |
| Depth of Shear Key, ($f$) = | 2.0 | ft |
| Embedment Depth, ($D_f$) = | 3.0 | ft |
| Wall Length, ($L$) = | 70 | ft |
| Live Surcharge Load, ($\sigma_{LS}$) = | 250 | psf |
| Depth to Groundwater, ($D_w$) = | 0.0 | ft |

**Bearing and Retained/Backfill Soil Properties:**

| | | |
|---|---|---|
| Bearing Soil Unit Weight, ($\gamma_{BS}$) = | 120 | pcf |
| Bearing Soil Friction Angle, ($\varphi_{BS}$) = | 28 | ° |
| Bearing Soil Undrained Shear Strength, [($s_u$)$_{BS}$] = | 3000 | psf |
| Backfill and Retained Soil Unit Weight, ($\gamma_{BF}$, $\gamma_{RS}$) = | 120 | pcf |
| Retained Soil Friction Angle, ($\varphi_{RS}$) = | 26 | ° |
| Retained Soil Undrained Shear Strength, [($s_u$)$_{RS}$] = | 1750 | psf |
| Active Earth Pressure Coefficient, ($K_a$) = | 0.347 | |
| Passive Earth Pressure Coefficient, ($K_p$) = | 5.065 | |

**LRFD Load Factors**

| | DC | EV | EH | LS | EP |
|---|---|---|---|---|---|
| Strength Ia | 0.90 | 1.00 | 1.50 | 1.75 | 0.90 |
| Strength Ib | 1.25 | 1.35 | 1.50 | 1.75 | 0.90 |
| Service I | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

*(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)*

**Check Bearing Capacity (Loading Case - Strength Ib) - AASHTO LRFD BDM Section 11.6.3.2** ***(Continued)***

**Check Bearing Resistance - Drained Condition**

Nominal Bearing Resistance: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \frac{1}{2}\gamma B' N_{\gamma m} C_{w\gamma}$

$N_{cm} = N_c s_c i_c$ = 27.816 $N_{qm} = N_q s_q d_q i_q$ = 17.232 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 15.798

$N_c$ = 25.803
$s_c$ = 1+(9.58 ft/70 ft)(14.72/25.803) = 1.078
$i_c$ = 1.000 (Assumed)

$N_q$ = 14.72
$s_q$ = 1+(9.58 ft/70 ft)tan(28°) = 1.073
$d_q$ = 1+2tan(28°)[1-sin(28°)]$^2$tan$^{-1}$(3.0 ft/9.58 ft) = 1.091
$i_q$ = 1.000 (Assumed)
$C_{wq}$ = 0.0 ft < 3.0 ft = 0.500

$N_\gamma$ = 16.717
$s_\gamma$ = 1-0.4(9.58 ft/70 ft) = 0.945
$i_\gamma$ = 1.000 (Assumed)
$C_{w\gamma}$ = 0.0 ft < 1.5(9.58 ft) + 3.0 ft = 0.500

$q_n$ = (0 psf)(27.816) + (120 pcf)(3.0 ft)(17.232)(0.500) + ½(120 pcf)(9.6 ft)(15.798)(0.500) = 7.64 ksf

**Verify Equivalent Pressure Less Than Factored Bearing Resistance**

$q_{eq} \le q_n \cdot \phi_b$ ⟶ 2.44 ksf ≤ (7.64 ksf)(0.55) = 4.20 ksf ⟶ 2.44 ksf ≤ 4.20 ksf **OK**

Use $\varphi_b$ = **0.55** *(Per AASHTO LRFD BDM Table 11.5.7-1)*

**Check Bearing Resistance - Undrained Condition**

Nominal Bearing Resistance: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \frac{1}{2}\gamma B' N_{\gamma m} C_{w\gamma}$

$N_{cm} = N_c s_c i_c$ = 5.541 $N_{qm} = N_q s_q d_q i_q$ = 1.000 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 0.000

$N_c$ = 5.140
$s_c$ = 1+(9.58 ft/[(5)(70 ft)]) = 1.078
$i_c$ = 1.000 (Assumed)

$N_q$ = 1.000
$s_q$ = 1.000
$d_q$ = 1+2tan(0°)[1-sin(0°)]$^2$tan$^{-1}$(3.0 ft/9.58 ft) = 1.000
$i_q$ = 1.000 (Assumed)
$C_{wq}$ = 0.0 ft < 3.0 ft = 0.500

$N_\gamma$ = 0.000
$s_\gamma$ = 1.000
$i_\gamma$ = 1.000 (Assumed)
$C_{w\gamma}$ = 0.0 ft < 1.5(9.58 ft) + 3.0 ft = 0.500

$q_n$ = (3000 psf)(5.541) + (120 pcf)(3.0 ft)(1.000)(0.500) + ½(120 pcf)(9.6 ft)(0.000)(0.500) = 16.80 ksf

**Verify Equivalent Pressure Less Than Factored Bearing Resistance**

$q_{eq} \le q_n \cdot \phi_b$ ⟶ 2.44 ksf ≤ (16.80 ksf)(0.55) = 9.24 ksf ⟶ 2.44 ksf ≤ 9.24 ksf **OK**

Use $\varphi_b$ = **0.55** *(Per AASHTO LRFD BDM Table 11.5.7-1)*

RESOURCE INTERNATIONAL, INC.
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
PHONE: (614) 823-4949
FAX: (614) 823-4990
WWW.RESOURCEINTERNATIONAL.COM

| | | | |
|---|---|---|---|
| JOB | FRA-70-22.85 FEF | NO. | W-17-140 |
| SHEET NO. | 6 | OF | 6 |
| CALCULATED BY | DEK | DATE | 1/6/2023 |
| CHECKED BY | BRT | DATE | 1/6/2023 |

Culvert FRA-BPDRW-41.060 Headwall Sta. 12+28.18

**CIP Wall Dimensions and Surcharge Loading**

| | | |
|---|---|---|
| Wall Height, ($H$) = | 12.5 | ft |
| Foundation Width (Entire Base Width), ($B$) = | 10.5 | ft |
| Stem Width, ($a$) = | 1.5 | ft |
| Toe Width, ($b$) = | 2.0 | ft |
| Heel Width, ($c$) = | 7.0 | ft |
| Footing Thickness, ($d$) = | 2.0 | ft |
| Location of Shear Key, ($e$) = | 0.0 | ft |
| Depth of Shear Key, ($f$) = | 2.0 | ft |
| Embedment Depth, ($D_f$) = | 3.0 | ft |
| Wall Length, ($L$) = | 70 | ft |
| Live Surcharge Load, ($\sigma_{LS}$) = | 250 | psf |
| Depth to Groundwater, ($D_w$) = | 0.0 | ft |

**Bearing and Retained/Backfill Soil Properties:**

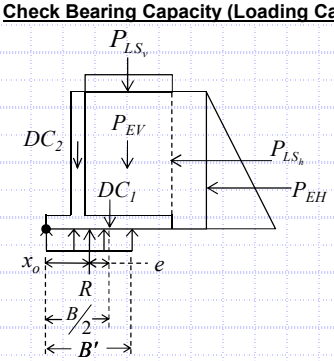
| | | |
|---|---|---|
| Bearing Soil Unit Weight, ($\gamma_{BS}$) = | 120 | pcf |
| Bearing Soil Friction Angle, ($\varphi_{BS}$) = | 28 | ° |
| Bearing Soil Undrained Shear Strength, [($s_u$)$_{BS}$] = | 3000 | psf |
| Backfill and Retained Soil Unit Weight, ($\gamma_{BF}$, $\gamma_{RS}$) = | 120 | pcf |
| Retained Soil Friction Angle, ($\varphi_{RS}$) = | 26 | ° |
| Retained Soil Undrained Shear Strength, [($s_u$)$_{RS}$] = | 1750 | psf |
| Active Earth Pressure Coefficient, ($K_a$) = | 0.347 | |
| Passive Earth Pressure Coefficient, ($K_p$) = | 5.065 | |

**LRFD Load Factors**

| | DC | EV | EH | LS | EP |
|---|---|---|---|---|---|
| Strength Ia | 0.90 | 1.00 | 1.50 | 1.75 | 0.90 |
| Strength Ib | 1.25 | 1.35 | 1.50 | 1.75 | 0.90 |
| Service I | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

*(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)*

**Check Bearing Capacity (Loading Case - Strength Ib) - AASHTO LRFD BDM Section 11.6.3.2**




$$q_{eq} = P_V / B'$$

$B' = B - 2e$ = 10.5 ft - 2(0.37 ft) = 9.76 ft (For $e$ < 0, Use $B$)

$e = B/2 - x_o$ = (10.5 ft / 2) - 4.88 ft = 0.37 ft

$x_o = \dfrac{M_V - M_H}{P_V}$ = (103.15 kip·ft/ft - 20.33 kip·ft/ft) / (16.96 kip/ft) = 4.88 ft

$q_{eq}$ = (16.96 kip/ft) / (9.76 ft) = 1.74 ksf

$$M_V = [(\gamma_{BF} \cdot (H-d) \cdot c \cdot \gamma_{EV}) + (\sigma_{LS} \cdot B \cdot \gamma_{LS})]\left(a + b + c/2\right) + (\gamma_c \cdot B \cdot d \cdot \gamma_{DC})\left(B/2\right) + (\gamma_c \cdot (H-d) \cdot a \cdot \gamma_{DC})\left(b + a/2\right)$$

$M_V$ = [(120 pcf)(12.5 ft - 2.0 ft)(7.0 ft)(1.00) + (250 psf)(10.5 ft)(1.00)](1.5 ft + 2.0 ft + (7.0 ft / 2)) = 103.15 kip·ft/ft
+ [(150 pcf)(10.5 ft)(2.0 ft)(1.00)](10.5 ft / 2) + [(150 pcf)(12.5 ft - 2.0 ft)(1.5 ft)(1.00)](2.0 ft + (1.5 ft / 2))

$$M_H = \left(\tfrac{1}{2} \gamma_{RS} \cdot H^2 \cdot K_a \cdot \gamma_{EH}\right)\left(H/3\right) + (\sigma_{LS} \cdot H \cdot K_a \cdot \gamma_{LS})\left(H/2\right)$$

$M_H$ = [½(120 pcf)(12.5 ft)²(0.347)(1.00)](12.5 ft / 3) + [(250 psf)(12.5 ft)(0.347)(1.00)](12.5 ft / 2) = 20.33 kip·ft/ft

$$P_V = (\gamma_{BF} \cdot (H-d) \cdot c \cdot \gamma_{EV}) + (\sigma_{LS} \cdot B \cdot \gamma_{LS}) + (\gamma_c \cdot B \cdot d \cdot \gamma_{DC}) + (\gamma_c \cdot (H-d) \cdot a \cdot \gamma_{DC})$$

$P_V$ = (120 pcf)(12.5 ft - 2.0 ft)(7.0 ft)(1.00) + (250 psf)(10.5 ft)(1.00) + (150 pcf)(10.5 ft)(2.0 ft)(1.00) = 16.96 kip/ft
+ (150 pcf)(12.5 ft - 2.0 ft)(1.5 ft)(1.00)

**Settlement (See Attached Spreadsheet Calculations):**

Maximum Settlement Along Wall Alignment: ($S_t$)$_{max}$ = **0.766** in

Minimum Settlement Along Wall Alignment: ($S_t$)$_{min}$ = **0.645** in

Differential Settlement Along Wall Alignment: $\delta_s$ = 0.121 in / 70 ft ⟶ 1 in / 579 ft

$\delta_s < 1/500$ ⟶ 1 in / 579 ft < 1/500 **OK**

# APPENDIX IX

CALCULATIONS – NOISE BARRIER FOUNDATION DEPTHS

# OHIO DEPARTMENT OF TRANSPORTATION

## OFFICE OF GEOTECHNICAL ENGINEERING

## Noise Wall Design

**FRA-70-22.85**
**96232**

## Noise Wall Along IR 270 Sta. 1040+66 to 1059+60

## Noise Wall 1

## Rii

| | |
|---|---|
| **Prepared By:** | **Peyman P. Majidi, PE** |
| **Date prepared:** | **Thursday, February 3, 2022** |
| **Checked By:** | **Jonathan P. Sterenberg** |
| **Date Checked:** | **Wednesday, March 23, 2022** |

**No. of Borings:** **10**

## Noise Wall ID: Noise Wall 1

| Boring ID | Boring STA. (ft) | Mid-Boring STA. (ft) | Boring Elev. (ft) | Shaft Elev. (ft) | Ex. Ground Elev. (ft) | Rock Elev. (ft) | Rock UCS (psi) | Post Spacing (ft) | Barrier Height (ft) | Cross Slope | | From DS STA. | To DS STA. | From Post No. | To Post No. | DS Length (ft) | Bottom of DS Elev. (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-004-0-19 | 10+38.80 | 11+42.80 | 785.00 | 784.00 | 785.00 | | | 24 | 16.00 | 0.0 | Level | 10+00.00 | 11+20.00 | 1 | 8 | 9.00 | 775.00 |
| B-003-0-19 | 12+46.80 | 13+48.40 | 785.00 | 784.00 | 785.00 | | | 24 | 16.00 | 0.0 | Level | 11+44.00 | 13+36.00 | 9 | 17 | 9.00 | 775.00 |
| B-002-0-19 | 14+50.00 | 15+36.80 | 785.00 | 784.00 | 785.00 | | | 24 | 16.00 | 0.0 | Level | 13+60.00 | 15+28.00 | 18 | 25 | 9.00 | 775.00 |
| B-001-7-19 | 16+23.60 | 17+42.15 | 785.00 | 784.00 | 785.00 | | | 24 | 16.00 | 0.0 | Level | 15+52.00 | 17+20.00 | 26 | 33 | 9.00 | 775.00 |
| B-001-6-19 | 18+60.70 | 19+55.33 | 786.00 | 786.00 | 786.00 | | | 24 | 16.00 | 0.0 | Level | 17+44.00 | 19+36.00 | 34 | 42 | 9.00 | 777.00 |
| B-001-5-19 | 20+49.96 | 21+47.39 | 788.00 | 787.00 | 788.00 | | | 24 | 16.00 | 0.0 | Level | 19+60.00 | 21+28.00 | 43 | 50 | 9.00 | 778.00 |
| B-001-4-19 | 22+44.82 | 23+43.55 | 788.00 | 788.00 | 788.00 | | | 24 | 16.00 | 0.0 | Level | 21+52.00 | 23+20.00 | 51 | 58 | 9.00 | 779.00 |
| B-001-3-19 | 24+42.28 | 25+45.10 | 787.00 | 788.00 | 787.00 | | | 24 | 16.00 | 0.0 | Level | 23+44.00 | 25+36.00 | 59 | 67 | 9.00 | 779.00 |
| B-001-2-19 | 26+47.91 | 27+42.24 | 784.00 | 787.00 | 784.00 | | | 24 | 17.00 | 0.0 | Level | 25+60.00 | 27+28.00 | 68 | 75 | 13.00 | 774.00 |
| B-001-1-19 | 28+36.56 | 28+36.56 | 786.00 | 789.00 | 786.00 | | | 24 | 17.00 | 2.0 | 2:1 | 27+52.00 | 29+44.00 | 76 | 90 | 15.00 | 774.00 |

# OHIO DEPARTMENT OF TRANSPORTATION

## OFFICE OF GEOTECHNICAL ENGINEERING

## Noise Wall Design

**FRA-70-22.85**
**96232**

## Noise Wall Along IR 270 Sta. 1529+94 to 1558+58

## Noise Wall 2

## Rii

**Prepared By:** Daniel E. Karch, P.E.
**Date prepared:** Thursday, December 22, 2022

**Checked By:** Brian R. Trenner, P.E.
**Date Checked:** Friday, January 6, 2023

**No. of Borings:** 11

## Noise Wall ID: Noise Wall 2

| Boring ID | Boring STA. (ft) | Mid-Boring STA. (ft) | Boring Elev. (ft) | Shaft Elev. (ft) | Ex. Ground Elev. (ft) | Rock Elev. (ft) | Rock UCS (psi) | Post Spacing (ft) | Barrier Height (ft) | Cross Slope | | From DS STA. | To DS STA. | From Post No. | To Post No. | DS Length (ft) | Bottom of DS Elev. (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-010-0-19 | 11+19.00 | 12+38.00 | 778.80 | 776.94 | 778.23 | 21.00 | | 24 | 16.00 | 6.0 | 5:1 | 10+00.00 | 12+28.00 | 1 | 11 | 11.00 | 765.94 |
| B-011-0-19 | 13+57.00 | 14+64.00 | 782.70 | 780.94 | 783.21 | | | 24 | 16.00 | 5.0 | 5:1 | 12+52.00 | 14+48.00 | 12 | 21 | 9.00 | 771.94 |
| B-013-0-19 | 15+71.00 | 16+56.00 | 781.80 | 780.94 | 782.46 | | | 24 | 17.00 | 3.0 | 3:1 | 14+72.00 | 16+52.00 | 22 | 30 | 12.50 | 768.44 |
| B-014-0-19 | 17+41.00 | 18+37.50 | 781.40 | 784.94 | 783.48 | | | 24 | 15.00 | 2.0 | 2:1 | 16+76.00 | 18+32.00 | 31 | 39 | 10.00 | 774.94 |
| B-016-0-19 | 19+34.00 | 20+31.50 | 782.10 | 786.94 | 784.50 | | | 24 | 15.00 | 3.0 | 3:1 | 18+56.00 | 20+24.00 | 40 | 47 | 9.50 | 777.44 |
| B-018-0-19 | 21+29.00 | 22+27.50 | 784.60 | 786.94 | 785.23 | | | 24 | 15.00 | 3.0 | 3:1 | 20+48.00 | 22+16.00 | 48 | 55 | 9.50 | 777.44 |
| B-020-0-19 | 23+26.00 | 24+27.00 | 786.10 | 797.84 | 784.69 | | | 24 | 15.00 | 2.0 | 2:1 | 22+40.00 | 24+08.00 | 56 | 63 | 16.00 | 781.84 |
| B-021-0-19 | 25+28.00 | 26+33.00 | 786.40 | 783.00 | 785.10 | | | 24 | 15.00 | 2.0 | 2:1 | 24+32.00 | 26+24.00 | 64 | 72 | 10.00 | 773.00 |
| B-022-0-19 | 27+38.00 | 28+24.50 | 785.60 | 783.00 | 785.54 | | | 24 | 15.00 | 2.0 | 2:1 | 26+48.00 | 28+16.00 | 73 | 80 | 14.00 | 769.00 |
| B-024-0-19 | 29+11.00 | 29+97.50 | 787.60 | 783.00 | 787.88 | | | 24 | 15.00 | 2.0 | 2:1 | 28+40.00 | 29+84.00 | 81 | 87 | 14.00 | 769.00 |
| B-025-0-19 | 30+84.00 | 30+84.00 | 789.10 | 783.00 | 788.94 | | | 24 | 15.00 | 2.0 | 2:1 | 30+00.00 | 31+92.00 | 88 | 96 | 14.00 | 769.00 |

# OHIO DEPARTMENT OF TRANSPORTATION

## OFFICE OF GEOTECHNICAL ENGINEERING

## Noise Wall Design

**FRA-70-22.85**
**96232**

## Noise Wall Along IR 70 WB-CD Sta. 1598+97+94 to 1606+18

## Noise Wall 4

## Rii

**Prepared By:** Peyman P. Majidi, PE
**Date prepared:** Thursday, February 3, 2022

**Checked By:** Jonathan P. Sterenberg
**Date Checked:** Thursday, February 3, 2022

**No. of Borings:** 4

## Noise Wall ID: Noise Wall 4

| Boring ID | Boring STA. (ft) | Mid-Boring STA. (ft) | Boring Elev. (ft) | Shaft Elev. (ft) | Ex. Ground Elev. (ft) | Rock Elev. (ft) | Rock UCS (psi) | Post Spacing (ft) | Barrier Height (ft) | Cross Slope | | From DS STA. | To DS STA. | From Post No. | To Post No. | DS Length (ft) | Bottom of DS Elev. (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-095-0-19 | 10+00.00 | 11+00.40 | 801.00 | 800.00 | 801.00 | | | 24 | 15.00 | 3.0 | 3:1 | 10+00.00 | 10+96.00 | 1 | 5 | 15.00 | 785.00 |
| B-096-0-19 | 12+00.80 | 12+99.90 | 802.00 | 801.00 | 802.00 | | | 24 | 15.00 | 3.0 | 3:1 | 11+20.00 | 12+88.00 | 6 | 13 | 22.00 | 779.00 |
| B-098-0-19 | 13+99.00 | 15+02.00 | 804.00 | 803.00 | 804.00 | | | 24 | 16.00 | 3.0 | 3:1 | 13+12.00 | 14+80.00 | 14 | 21 | 15.00 | 788.00 |
| B-099-0-19 | 16+05.00 | 16+05.00 | 806.00 | 805.00 | 806.00 | | | 24 | 16.00 | 3.0 | 3:1 | 15+04.00 | 34+68.20 | 22 | 113 | 15.00 | 790.00 |

# APPENDIX X

CALCULATIONS – EMBANKMENT SETTLEMENT

B-058-1-21 - FRA-70-22.85 Brice Road

Embankment Settlement - Station 20+00

Calculated By: DEK Date: 3/30/2022

Checked By: JPS Date: 4/1/2022

Borings B-058-1-21 & B-059-1-21

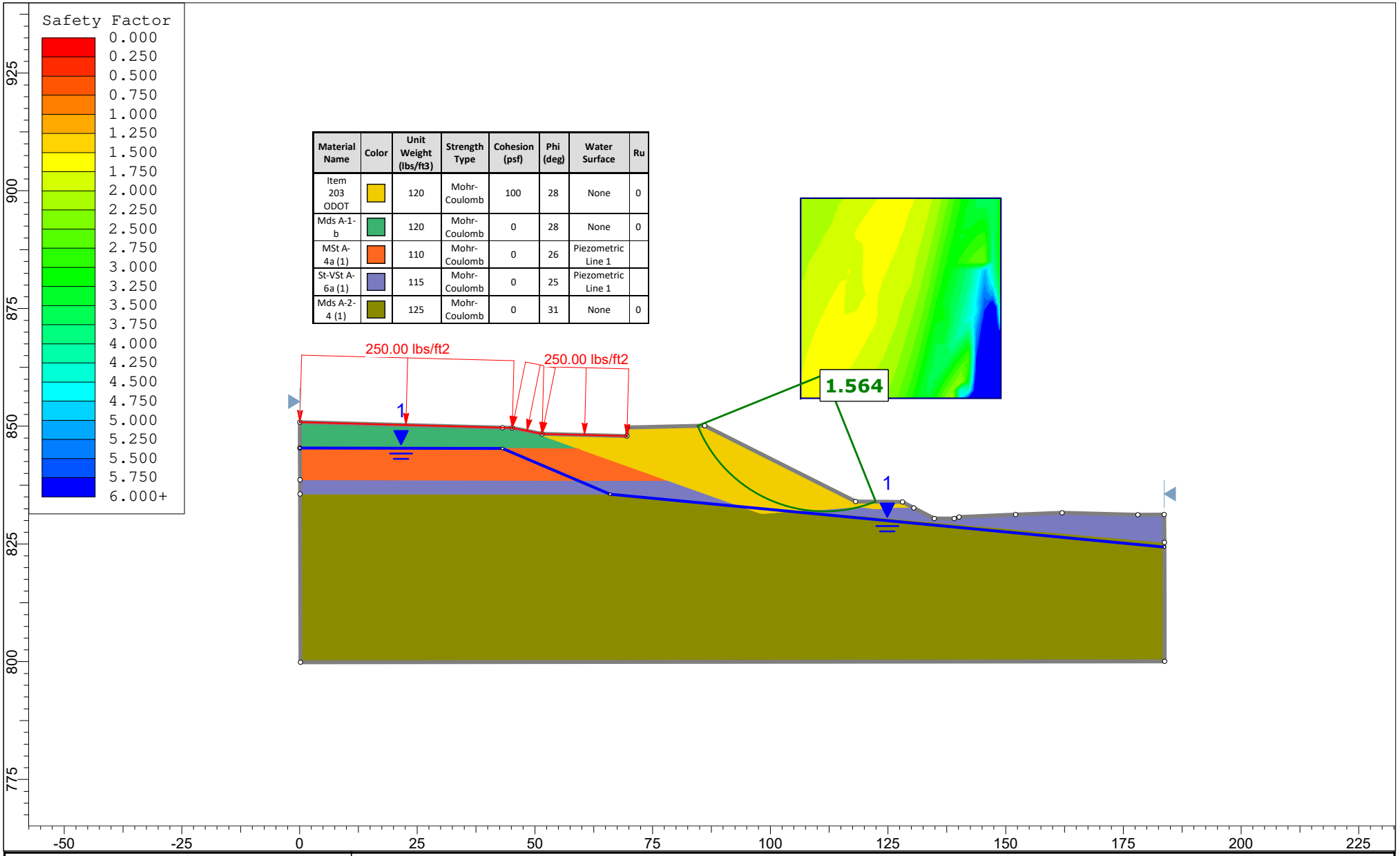
| | | | |
|---|---|---|---|
| H = | 10.0 | ft | Embankment Height |
| B = | 53.0 | ft | Embankment Width to Midslope |
| $D_w$ = | 0.0 | ft | Depth Below Bottom of Embankment |
| γ = | 125 | pcf | Unit Weight of Embankment |
| q = | 1,250 | psf | Applied Pressure from Embankment Loading |

| | | | | | | | | | | | | | | | | | | | | | Total Embankment Settlement | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Layer | Soil Class. | Soil Type | Layer Depth (ft) | | Layer Thickness H (ft) | Depth to Midpoint (ft) | γ (pcf) | $\sigma_{vo}$ Bottom (psf) | $\sigma_{vo}$ Midpoint (psf) | $\sigma_{vo}'$ Midpoint (psf) | $\sigma_p'$ [1] (psf) | LL | $C_c$ [2] | $C_r$ [3] | $e_o$ [4] | $N_{60}$ | $(N1)_{60}$ [5] | C' [6] | $Z_f/B$ | | | I [7] | $\Delta\sigma_v$ [8] (psf) | $\sigma_{vf}'$ Midpoint (psf) | $S_c$ [9,10] (ft) | $S_c$ (in) |
| 1 | A-6A | C | 0.0 | 2.0 | 2.0 | 1.0 | 115 | 230 | 115 | 53 | 3,053 | 30 | 0.170 | 0.017 | 0.498 | | | | 0.02 | -1.53 | 3.07 | 1.000 | 1,250 | 1,303 | 0.032 | 0.380 |
| | A-6A | C | 2.0 | 4.0 | 2.0 | 3.0 | 115 | 460 | 345 | 158 | 3,158 | 30 | 0.100 | 0.010 | 0.437 | | | | 0.06 | -1.46 | 2.92 | 0.999 | 1,249 | 1,407 | 0.013 | 0.159 |
| 2 | A-3a | G | 4.0 | 5.0 | 1.0 | 4.5 | 125 | 585 | 523 | 242 | 3,242 | | | | | 13 | 22 | 71 | 0.08 | -1.40 | 2.81 | 0.998 | 1,247 | 1,489 | 0.011 | 0.133 |
| | A-3a | G | 5.0 | 7.5 | 2.5 | 6.3 | 125 | 898 | 741 | 351 | 3,351 | | | | | 24 | 38 | 106 | 0.12 | -1.34 | 2.68 | 0.995 | 1,243 | 1,595 | 0.016 | 0.186 |
| | A-3a | G | 7.5 | 10.0 | 2.5 | 8.8 | 125 | 1,210 | 1,054 | 508 | 3,508 | | | | | 24 | 35 | 98 | 0.17 | -1.25 | 2.50 | 0.987 | 1,233 | 1,741 | 0.014 | 0.164 |
| | A-2-4 | G | 10.0 | 12.5 | 2.5 | 11.3 | 125 | 1,523 | 1,366 | 664 | 3,664 | | | | | 25 | 34 | 112 | 0.21 | -1.17 | 2.34 | 0.973 | 1,217 | 1,881 | 0.010 | 0.122 |
| | A-2-4 | G | 12.5 | 15.0 | 2.5 | 13.8 | 125 | 1,835 | 1,679 | 821 | 3,821 | | | | | 25 | 32 | 106 | 0.26 | -1.09 | 2.18 | 0.956 | 1,194 | 2,015 | 0.009 | 0.110 |
| | A-2-4 | G | 15.0 | 17.5 | 2.5 | 16.3 | 125 | 2,148 | 1,991 | 977 | 3,977 | | | | | 25 | 31 | 102 | 0.31 | -1.02 | 2.04 | 0.934 | 1,167 | 2,144 | 0.008 | 0.101 |
| | A-2-4 | G | 17.5 | 20.0 | 2.5 | 18.8 | 125 | 2,460 | 2,304 | 1,134 | 4,134 | | | | | 25 | 30 | 98 | 0.35 | -0.96 | 1.91 | 0.908 | 1,135 | 2,269 | 0.008 | 0.092 |
| | A-2-4 | G | 20.0 | 22.5 | 2.5 | 21.3 | 125 | 2,773 | 2,616 | 1,290 | 4,290 | | | | | 25 | 29 | 95 | 0.40 | -0.89 | 1.79 | 0.880 | 1,101 | 2,391 | 0.007 | 0.084 |
| | A-2-4 | G | 22.5 | 25.0 | 2.5 | 23.8 | 125 | 3,085 | 2,929 | 1,447 | 4,447 | | | | | 25 | 28 | 93 | 0.45 | -0.84 | 1.68 | 0.851 | 1,064 | 2,511 | 0.006 | 0.077 |
| | | | | | | | | | | | | | | | | | | | | | | | | Total Settlement: | | 1.608 in |

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$, Estimate $\sigma_m$ of 3,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. $C_c = 0.009(LL-10)$; Ref. Table 26, FHWA GEC 5
3. $C_r = 0.15(C_c)$ for medium stiff to stiff natural soil deposits and existing fill material, 0.075 to $0.10(C_c)$ for very stiff to hard natural soil deposits, and 0.05(Cc) for new embankment fill; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for continuous footing
8. $\Delta\sigma_v = q_o(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

# APPENDIX XI

CALCULATIONS – SLOPE STABILITY ANALYSIS




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Ru |
|---|---|---|---|---|---|---|---|
| Item 203 ODOT | | 120 | Mohr-Coulomb | 100 | 28 | None | 0 |
| Mds A-1-b | | 120 | Mohr-Coulomb | 0 | 28 | None | 0 |
| MSt A-4a (1) | | 110 | Mohr-Coulomb | 0 | 26 | Piezometric Line 1 | |
| St-VSt A-6a (1) | | 115 | Mohr-Coulomb | 0 | 25 | Piezometric Line 1 | |
| Mds A-2-4 (1) | | 125 | Mohr-Coulomb | 0 | 31 | None | 0 |

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SLIDEINTERPRET 9.019

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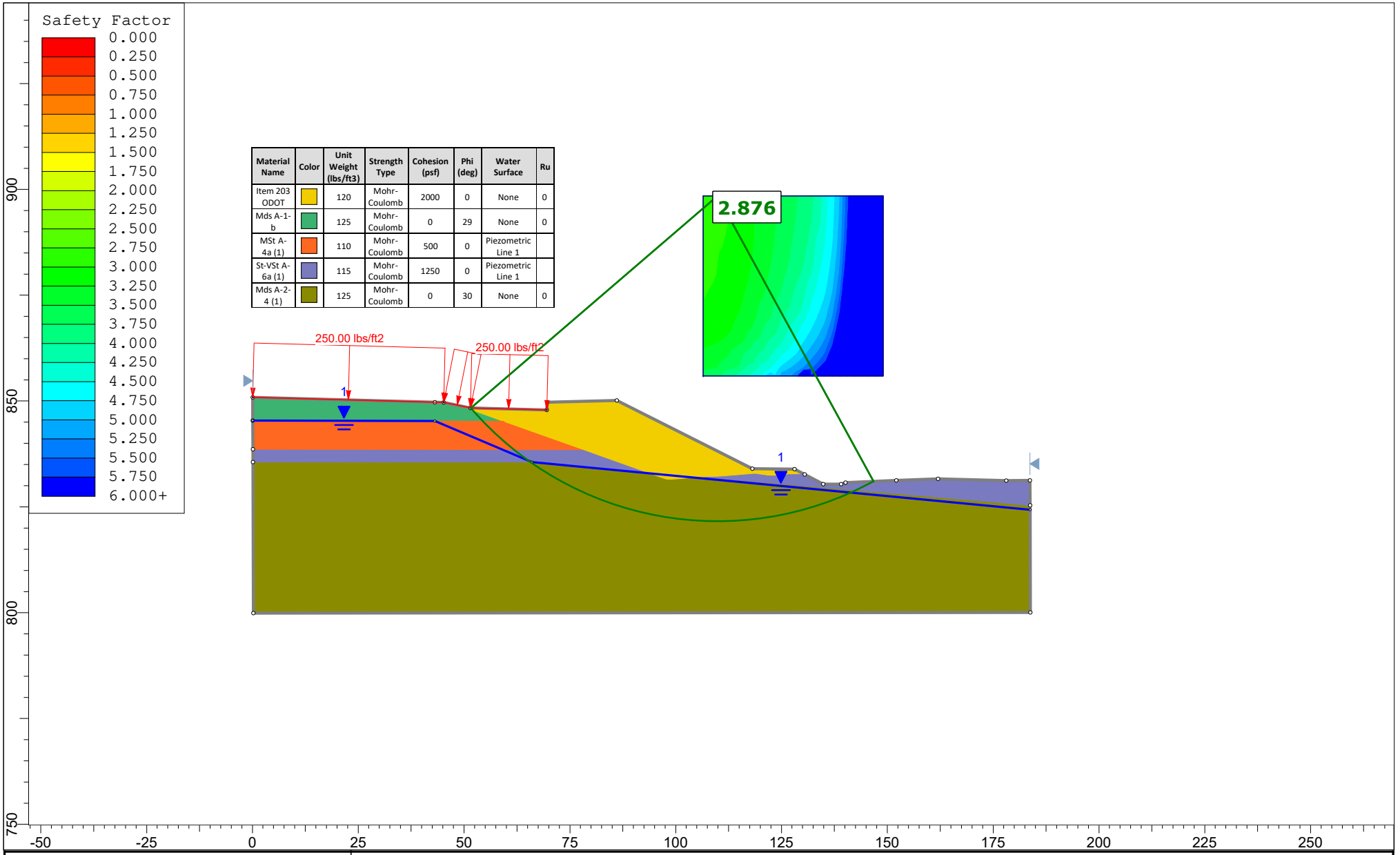
|---|---|---|---|
| *Project* | FRA-70-22.85 | | |
| *Group* | Group 1 | *Scenario* | Master Scenario |
| *Drawn By* | DEK | *Company* | Resource International, Inc. |
| *Date* | 3/29/2022, 2:49:14 PM | *File Name* | STA 23+50.00 drained.slmd |

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SLIDEINTERPRET 9.019

| | | | |
|---|---|---|---|
| *Project* | FRA-70-22.85 | | |
| *Group* | Group 1 | *Scenario* | Master Scenario |
| *Drawn By* | DEK | *Company* | Resource International, Inc. |
| *Date* | 3/29/2022, 2:49:14 PM | *File Name* | STA 23+50.00 undrained.slmd |