Resource International, Inc.

**MIA/DAR-36/721-22.56**
**INTERSECTION IMPROVEMENTS**
**MIAMI AND DARKE COUNTIES, OHIO**
**PID No. 118070**

# GEOTECHNICAL EXPLORATION REPORT

***Prepared For:***
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**Rii Project No. W-23-176**

**April 2026**

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Engineering

Construction Management

Technology

April 3, 2026

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**Re: Geotechnical Exploration Report**
**MIA/DAR-36/721-22.56 Intersection Improvements**
**Miami and Darke Counties, Ohio**
**PID No. 118070**
**Rii Project No. W-23-176**

Mr. Soroka:

Resource International, Inc. (Rii) is pleased to submit this geotechnical 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 proposed MIA/DAR-36/721-22.56 intersection improvements project in Miami and Darke Counties, Ohio. This report supersedes all previous submittal.

We sincerely appreciate the opportunity to be of service to you on this project. If you have any questions regarding the Geotechnical Exploration or this report, please contact us.

Sincerely,

**RESOURCE INTERNATIONAL, INC.**

Johnnatan Garcia-Ruiz, Ph.D.
Staff Engineer

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

Enclosure: Geotechnical Exploration Report

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## EXECUTIVE SUMMARY

Resource International, Inc. (Rii) has completed a geotechnical exploration report for the proposed MIA/DAR-36/721-22.56 intersection improvements project in Miami and Darke Counties, Ohio. The project will extend from approximately 430 feet west to approximately 600 feet east of the intersection along US 36, and approximately 500 feet south to 650 feet north along SR 721. It is understood that the proposed improvements will consist of replacing the existing intersection with a single lane roundabout.

### Exploration and Findings

On December 7, 2023, a total of six (6) roadway borings, designated as B-001-0-23 through B-006-0-23, were drilled to completion depths ranging from 7.0 to 8.5 feet below the existing grade/ground surface. Four (4) pavement cores where also collected, one at each of the tie in locations. The boring locations are illustrated on the boring plan presented in Appendix I of this report.

All roadway borings were performed in the area of the proposed intersection improvement. Borings B-001-0-23 and B-004-0-23 encountered a composite pavement (asphalt over concrete) section, borings B-002-0-23, B-005-0-23 and B-006-0-23 encountered an asphalt pavement section, while boring B-003-0-23 encountered topsoil at the existing surface. Aggregate base materials were encountered below the pavement section in borings B-001-0-23, B-005-0-23, and B-006-0-23.

Beneath pavement materials and topsoil encountered in the borings, natural cohesive soils were encountered to boring termination depths. The cohesive soils were described as gray to brown to brownish gray sandy silt, silt and clay, silty clay, and clay (ODOT A-4a, A-6a, A-6b, A-7-6).

Bedrock was not encountered in any of the borings performed for this investigation.

Groundwater was not encountered during drilling nor upon completion and removal of the auger, in any of the borings performed during this investigation.

### Analysis and Recommendations

*Pavement Subgrade Recommendations*

The subgrade soils are anticipated to consist of predominantly medium stiff to very stiff silt and clay, silty clay, and clay (ODOT A-6a, A-6b, A-7-6). Based on the soil conditions encountered during the drilling phase, it is estimated that approximately 60 percent of the subgrade soils within the upper portions of the anticipated subgrade will require some level of stabilization under ODOT GDM.

Based on the Subgrade Analysis performed according to ODOT GDM, the overall average site parameters are noted as follows:

**Overall Average Site Parameters**

| Average $N_{60L}$ | Average PI | Average Moisture | Average Optimum Moisture | Average Group Index | Average CBR |
|---|---|---|---|---|---|
| 11 | 20 | 16 | 15 | 12 | 5 |

Based on the Subgrade Analysis spreadsheet and the overall average site parameters, noted in the above table, global stabilization would be warranted for the proposed MIA/DAR-36/721-22.56 intersection improvement subgrade soils, per ODOT GDM.

However, based on comments from ODOT District 7, global stabilization has presented challenges in other projects of similar size and conditions. Such challenges have been attributed to potential maintenance of traffic (MOT) restrictions and existence of underground utilities. Therefore, considering these comments and the size of the MIA/DAR-36/721-22.56 improvements, the following "station by station" required excavation and replacement recommendations in reference to boring locations are presented:

**Subgrade Treatment Summary**

| Alignment | From Station [1,2] | To Station [1,2] | Length (feet) | Representative Boring(s) | ODOT Subgrade Stabilization [3] |
|---|---|---|---|---|---|
| US 36 | 1197+45 | 1199+60 | 215 | B-001-0-23 | Proof roll and excavate 15 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D. [4] |
| | 1199+60 | 1201+75 | 215 | B-002-0-23 | Proof roll and excavate 12 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D. [4] |
| | 0+00 | 6+06 | 606 | B-002-0-23, B-004-0-23. | Proof roll and excavate 12 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D. [4] |
| SR 721 | 148+00 | 159+50 | 1150 | B-005-0-23, B-002-0-23, B-006-0-23. | Proof roll and excavate 12 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D. [4] |
| Roundabout Widening | 0+25 (US 36) | 2+50 (US 36) | 225 | B-003-0-23 | No stabilization is anticipated. Remove topsoil. Then proceed to place engineered fill material to |

| Alignment | From Station [1,2] | To Station [1,2] | Length (feet) | Representative Boring(s) | ODOT Subgrade Stabilization [3] |
|---|---|---|---|---|---|
| Area– southeast of US 36 & SR 721 intersection | 151+75 | 153+25 | 150 | | achieve proposed grade (an estimated of 5.0 feet of engineered fill material is anticipated to be required). New subgrade should be compacted per ODOT Item 204. |

1. *Stations (Sta.) along US 36 were assumed to begin approximately 430 feet west of the existing intersection (Sta. 1197+45) and increase east until reaching the intersection (Sta. 1201+75), where the stations for US 36 is understood to reset (Sta. 0+00) and continue increasing east to end approximately 600 feet east of the intersection (Sta. 6+06). Stations along SR 721 were assumed to begin approximately 500 feet south of the existing intersection (Sta. 148+00) and increase north to end approximately 650 feet north of the intersection (Sta. 159+50).*
2. *Station limits estimated based on soil conditions encountered during the field exploration. Actual limits of stabilization may vary based on the conditions encountered during construction.*
3. *Depths of stabilization recommended are based on soil conditions encountered during the field exploration. Actual depths of stabilization may vary based on the conditions encountered during construction.*
4. *Excavation and replacement with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D geotextile in accordance with ODOT Item 204.*

Please note the excavation and replacement depths in the above table were measured from the assumed subgrade elevation, which is estimated to be generally approximately 1.6 feet below the existing grade. Please also note that the limits and depth of stabilization provided in the above table are estimated based on the soil conditions encountered in the borings performed during the field exploration. Actual limits and depth of stabilization may differ from the recommendations provided. Per ODOT GDM requirements, the entire subgrade should be proof rolled to identify the actual limits of unstable subgrade and depth of stabilization required. The actual depths and limits of Item 204 should be determined by the Geotechnical Engineer in the field based on the results of proof rolling and subgrade observations in accordance with ODOT CMS Item 204. Upon completion of the stabilization, the entire subgrade should be proof rolled in accordance with Item 204 to verify that stability has been achieved.

California Bearing Ratio (CBR) values for the entire project ranged from 3 to 6 with an average of 5. Based on the variable soil types and marginal conditions encountered in the borings performed for this investigation, **it is recommended that pavement design be based on a CBR of 5 with a corresponding resilient modulus, $M_R$, of 6,000 psi**. Correlation charts indicate a modulus of subgrade reaction (K) of 135 pci and a soil support value (SSV) of 3.8

Please note that the recommended design CBR of 5 consider that the subgrade has been stabilized in accordance to the recommendations provided in Section 5.1.1 of this report.

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

This report is a presentation of the geotechnical exploration performed for the proposed MIA/DAR-36/721-22.56 intersection improvements project in Miami and Darke Counties, Ohio. The project will extend from approximately 430 feet west to approximately 600 feet east of the intersection along US 36, and approximately 500 feet south to 650 feet north along SR 721. It is understood that the proposed improvements will consist of replacing the existing intersection with a single lane roundabout. A vicinity map depicting the location of the site is provided on the boring plan in Appendix I.

This exploration was performed in accordance with the latest Ohio Department of Transportation (ODOT) Specification for Geotechnical Explorations (SGE) and the ODOT Geotechnical Design Manual (GDM).

## 2.0 GEOLOGY AND OBSERVATIONS OF THE PROJECT

### 2.1 Site Geology

Physiographically, the sites lie within the glaciated Union City-Bloomer Transitional Terrain District of the Southern Ohio Loamy Till Plains Region. This district is characterized by well-defined ground and end moraines with low relief comprised of loamy, high-lime till with a thin loess cover. Ground moraines are deposited during the retreat of a glacier, which results 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.

Based on the bedrock geology and topography maps obtained from the Ohio Department of Natural Resources (ODNR), the underlying bedrock in the vicinity of the site consists of the Lower Silurian-aged Lockport Dolomite Formation. The Lockport Dolomite consists of variegated white to gray, finely to coarsely crystalline dolomite, forming mostly in medium to massive beds. The unit contains fossils and is cherty in the lower portion of the unit. The bedrock surface appears very convoluted with some plateaus and broad and narrow valleys traversing the area. The bedrock beneath the intersection slopes from the southwest from an approximate elevation of 940 feet mean sea level (msl) to the northeast to an approximate elevation of 910 feet msl. According to bedrock topography mapping, the bedrock surface ranges between approximate elevations of 940 to 910 feet mean sea level (msl), from the southwest to northeast. This corresponds to approximate depths of 55 to 100 feet below existing ground surface in the vicinity of the intersection.

### 2.2 Existing Site Conditions

The project site is located in the limits between Miami and Darke counties, about 3.5 miles east from Gettysburg and 4.1 miles west from Covington (SR 48), and one mile south from Bradford, Ohio. The existing US 36 and SR 721 are two-way, bidirectional, asphalt paved roadway with partial shoulders (2.0 to 6.0 feet wide) within the project limits and spans predominantly rural farm lands. The total length of the project at each of the

alignment is approximately 1,030 and 1,150 feet at US 36 and SR 721, respectively. The existing pavement at the intersection appears to be in fair condition with longitudinal cracking observed, shoulder drop off near the pavement edges and areas of patching. Regionally, the site drains to the southeast toward Greenville Creek.

## 3.0 EXPLORATION

On December 7, 2023, a total of six (6) roadway borings, designated as B-001-0-23 through B-006-0-23, were advanced to depths ranging from 7.0 to 8.5 feet below the existing ground surface. Five (5) of the borings were conducted along the existing US 36 (B-001-0-23, B-002-0-23, and B-004-0-23) and SR 721 (B-005-0-23 and B-006-0-23) alignments. The remaining boring (B-003-0-23) was conducted off of the roadway, in a grass area southeast from the existing intersection, within the footprint area of the proposed roundabout. Four (4) pavement cores where also collected, one at each of the tie in locations. The borings locations are illustrated on the boring plan presented in Appendix I and summarized in Table 1.

**Table 1. Test Boring Summary**

| Boring Number | Reference Alignment | Station | Offset | Latitude | Longitud | Ground Elevation (feet msl)[1] | Boring Depth (feet)[1] |
|---|---|---|---|---|---|---|---|
| B-001-0-23 | CLX RW US 36 | 1197+87 | 9' RT | 40.114469 | -84.431751 | 999.4 | 7.5 |
| B-002-0-23 | | 1201+36 | 27' LT | 40.114903 | -84.430555 | 997.0 | 8.5 |
| B-003-0-23 | CLX RW SR 721 | 152+49 | 76' RT | 40.114700 | -84.430147 | 993.1 | 7.0 |
| B-004-0-23 | CLX RW US 36 | 6+06 | 9' RT | 40.115382 | -84.428391 | 994.9 | 7.5 |
| B-005-0-23 | CLX RW SR 721 | 148+39 | 8' RT | 40.113530 | -84.430381 | 989.1 | 8.5 |
| B-006-0-23 | | 159+45 | 10' RT | 40.116586 | -84.430446 | 1011.7 | 7.5 |

*1. Ground surface elevations were interpolated using topographic mapping information provided by B&N.*

Rii utilized a handheld GPS unit to obtain latitude and longitude coordinates at the boring locations. Approximate ground surface elevations at the boring locations were interpolated using topographic mapping information provided by Burgess & Niple (B&N).

The borings were drilled with a Mobile B-53 rotary drilling machine, utilizing a 4.5-inch outside diameter continuous flight auger to advance the holes. In general, standard penetration test (SPT) and continuous split spoon sampling was performed to boring termination depths. The SPT, per the American Society for Testing and Materials (ASTM) designation D1586, is conducted by letting a 140-pound hammer free fall 30.0 inches to drive a 2.0-inch outer diameter (O.D.) split spoon sampler 18.0 inches. Driving resistance is recorded on the boring logs in terms of blows per 6.0-inch interval of the driving distance. The second and third intervals are added to obtain the number of blows per foot (N). SPT blow counts aid in estimating soil characteristics used to calculate bearing

capacities and settlement potential. 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 the boring logs presented in Appendix III.

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

Where:

$N_{60}$ = energy corrected number of blows required to drive split spoon sampler final 12 inches in 1.5-foot sampling intervals

$N_m$ = measured N value

ER = drill rod energy ratio, expressed as a percent, for the system used

The automatic hammer for the Mobile B-53 drill rig used for this project was calibrated on March 31, 2022 and have a drill rod energy ratio of 79.0 percent.

Hand penetrometer readings, which provide a rough estimate of the unconfined compressive strength 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 sample 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.

Upon completion of the drilling operations, the boreholes were backfilled with a mixture of bentonite chips or soil cuttings or the combination of both. The pavement surface at the boring locations performed within the existing pavement were patched with asphalt cold patch.

During drilling, Rii 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 soil samples were visually classified and select samples have been 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 | 25 |
| Plastic and Liquid Limits | AASHTO T89, T90 | 12 |
| Gradation – Sieve/Hydrometer | AASHTO T88 | 12 |
| Loss on Ignition | ASTM D2974 | 1 |
| Sulfate Content - Colorimetric Method | ODOT S1122 | 6 |

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

## 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 current version of the ODOT SGE. 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 performed for the proposed intersection improvements encountered either a composite (HMA over concrete) pavement section, a full depth asphalt pavement section, or topsoil at the ground surface. Borings B-001-0-23 and B-004-0-23 performed within the driving lanes along US 36 encountered 9.0 and 9.5 inches of asphalt, respectively, overlying 7.0 inches of concrete. Borings B-005-0-23 and B-006-0-23 performed within the driving lanes along SR 721 encountered 16.0 and 7.75 inches of asphalt, respectively. Boring B-002-0-23 performed within the shoulder curve at the northwest side of the intersection encountered 9.75 inches of asphalt, while boring B-003-0-23 performed in a grass area southeast from the existing intersection encountered 6.0 inches of topsoil at the existing surface. Aggregate base materials ranging from 3.0 to 12.0 inches was encountered below the pavement section in borings B-001-0-23, B-005-0-23, and B-006-0-23. Surface material found at each boring and pavement core location are summarized in Table 3.

**Table 3. Surface Material Summary**

| Boring ID | Topsoil (in) | Asphalt Thickness (in) | Concrete Thickness (in) | Aggregate Base (in) |
|---|---|---|---|---|
| B-001-0-23 | - | 9.0 | 7.0 | 3.0 |
| B-002-0-23 [1] | - | 9.75 | - | - |
| B-003-0-23 | 6.0 | - | - | - |
| B-004-0-23 | - | 9.5 | 7.0 | - |
| B-005-0-23 | - | 16.0 | - | 12.0 |
| B-006-0-23 | - | 7.75 | - | 11.25 |

1. *No pavement cores were obtained at borings B-002-0-23. Pavement thickness was measured from within the borehole.*

It should be noted that in general the pavement cores collected exhibited considerably deterioration of the bottom asphalt layers, as well as of the concrete section in those where composite section was encountered.

For further details please see the boring logs in Appendix III and the pavement core logs in Appendix V.

## 4.2 Subsurface Soils

Beneath pavement materials and topsoil encountered in the borings, natural cohesive soils were encountered to boring termination depths. The cohesive soils were described as gray to brown to brownish gray sandy silt, silt and clay, silty clay, and clay (ODOT A-4a, A-6a, A-6b, A-7-6).

The shear strength and consistency of the cohesive soils are primarily derived from the hand penetrometer values (HP). The cohesive soils encountered across the site ranged from medium stiff ($0.5 < HP \leq 1.0$ tsf) to hard ($HP > 4.5$ tsf). The unconfined compressive strength of the cohesive soil samples tested, obtained from the hand penetrometer, ranged from 1.0 tsf to over 4.5 tsf (limit of instrument). Overall blow counts recorded from the SPT blow count ($N_{60}$) sampling ranged from 7 bpf to 40 bpf.

Natural moisture contents of the soil samples tested ranged from 12 to 31 percent. The natural moisture contents of the cohesive soil samples tested for plasticity index ranged from 3 percent below to 10 percent above their corresponding plastic limits. In general, the soils exhibited natural moisture contents estimated to be moderately below to significantly above optimum moisture levels.

Sulfate testing was performed in the upper soil samples obtained at each boring location. Based on the results of the testing performed, the sulfate contents of the subgrade soils ranged from less than 100 to 160 parts per million (ppm or mg/kg of material). Results of

the sulfate testing at the boring location tested are provided on the respective boring log in Appendix III.

Soil samples observed to contain organic matter in boring B-003-0-23, were tested by loss on ignition (LOI) with results of 3.3 percent.

### 4.3 Bedrock

Bedrock was not encountered in any of the borings performed for this investigation.

### 4.4 Groundwater

Groundwater was not encountered during drilling nor upon completion and removal of the auger, in any of the borings performed during this investigation. Please note that short-term water level readings 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 boring logs in Appendix III.

## 5.0 ANALYSES AND RECOMMENDATIONS

Data obtained from the drilling and testing program have been used to determine pavement foundation and support capabilities for the soils encountered at the site. These parameters have been used to provide guidelines for the design of the pavement foundation systems, as well as the construction specifications related to the placement of the pavement and general earthwork recommendations, which are discussed in the following paragraphs. This report, and the recommendations contained herein, has been written under the consideration that the construction will be performed in accordance with the latest version of the ODOT Construction and Materials Specifications (CMS).

### 5.1 Pavement Subgrade Recommendations

The soils at the anticipated subgrade elevation will consist predominantly of natural cohesive soils described as medium stiff to very stiff silt and clay, silty clay, and clay (ODOT A-6a, A-6b, A-7-6). Based on the soil conditions encountered during the drilling phase, it is estimated that sections of the subgrade soils will require some level of stabilization under ODOT GDM.

A subgrade analysis based on ODOT GDM, was performed using the proposed profile information provided by Burgess & Niple, as well as the assumption that the thickness of the existing and proposed pavement buildup at the roundabout and its legs along US 36 and SR 721 will be similar (approximately 18 inches) and therefore, the proposed subgrade is considered to be approximately 1.6 feet below existing grade. It should be

noted that due to the existing ground/grade elevation a smaller amount of cut (approximately 0.3 feet) and approximately 5.0 feet of fill are anticipated that would be required in the vicinity of borings B-002-0-23 and B-003-0-23, respectively, to achieve the proposed subgrade elevations at the roundabout. The GDM subgrade analysis spreadsheet summary is presented in Appendix III.

### *5.1.1 Subgrade Stabilization*

Based on the ODOT GDM, when approximately 30 percent or more of the subgrade requires stabilization, consideration should be given to utilizing a global stabilization option. For this project, based on the soil borings performed, approximately 60 percent of the subgrade area within the proposed roundabout project limits, is anticipated to require stabilization. Therefore, based on the Subgrade Analysis spreadsheet and the overall average site parameters, noted in Table 4, global stabilization would be warranted for the proposed MIA/DAR-36/721-22.56 intersection improvement subgrade soils, per ODOT GDM..

**Table 4. Average Site Parameters**

| Average $N_{60L}$ | Average PI | Average Moisture | Average Optimum Moisture | Average Group Index | Average CBR |
|---|---|---|---|---|---|
| 11 | 20 | 16 | 15 | 12 | 5 |

However, based on comments from ODOT District 7, received on April 2, 2024, global stabilization has presented challenges in other projects of similar size and conditions. Such challenges have been attributed to potential maintenance of traffic (MOT) restrictions and existence of underground utilities. Therefore, considering these comments and the size of the MIA/DAR-36/721-22.56 improvements, our previous recommendations for global stabilization have been revised. In accordance with these considerations, and based on the subgrade analysis spreadsheet per ODOT GDM, a summary of “station by station” required excavation and replacement recommendations in reference to boring locations are presented in Table 5. A complete subgrade analysis of each soil boring – per ODOT GDM – looking at the subgrade conditions encountered at each location, is presented in Appendix VI. Please note that the excavation and replacement depths in Table 5 were measured from the assumed subgrade elevation, which is estimated to be generally approximately 1.6 feet below the existing grade.

**Table 5. Subgrade Treatment Summary**

| Alignment | From Station [1,2] | To Station [1,2] | Length (feet) | Representative Boring(s) | ODOT Subgrade Stabilization [3] |
|---|---|---|---|---|---|
| US 36 | 1197+45 | 1199+60 | 215 | B-001-0-23 | Proof roll and excavate 15 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D. [4] |
| | 1199+60 | 1201+75 | 215 | B-002-0-23 | Proof roll and excavate 12 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D. [4] |
| | 0+00 | 6+06 | 606 | B-002-0-23, B-004-0-23. | Proof roll and excavate 12 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D. [4] |
| SR 721 | 148+00 | 159+50 | 1150 | B-005-0-23, B-002-0-23, B-006-0-23. | Proof roll and excavate 12 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D. [4] |
| Roundabout Widening Area– southeast of US 36 & SR 721 intersection | 0+25 (US 36) | 2+50 (US 36) | 225 | B-003-0-23 | No stabilization is anticipated. Remove topsoil. Then proceed to place engineered fill material to achieve proposed grade (an estimated of 5.0 feet of engineered fill material is anticipated to be required). New subgrade should be compacted per ODOT Item 204. |
| | 151+75 | 153+25 | 150 | | |

1. *Stations (Sta.) along US 36 were assumed to begin approximately 430 feet west of the existing intersection (Sta. 1197+45) and increase east until reaching the intersection (Sta. 1201+75), where the stations for US 36 is understood to reset (Sta. 0+00) and continue increasing east to end approximately 600 feet east of the intersection (Sta. 6+06). Stations along SR 721 were assumed to begin approximately 500 feet south of the existing intersection (Sta. 148+00) and increase north to end approximately 650 feet north of the intersection (Sta. 159+50).*
2. *Station limits estimated based on soil conditions encountered during the field exploration. Actual limits of stabilization may vary based on the conditions encountered during construction.*
3. *Depths of stabilization recommended are based on soil conditions encountered during the field exploration. Actual depths of stabilization may vary based on the conditions encountered during construction.*
4. *Excavation and replacement with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D geotextile in accordance with ODOT Item 204.*

Please note that the limits and depth of stabilization provided in Table 5 are estimated based on the soil conditions encountered in the borings performed during the field exploration. Actual limits and depth of stabilization may differ from the recommendations provided. Per ODOT GDM requirements, the entire subgrade should be proof rolled to identify the actual limits of unstable subgrade and depth of stabilization required. The actual depths and limits of Item 204 should be determined by the Geotechnical Engineer in the field based on the results of proof rolling and subgrade observations in accordance

with ODOT CMS Item 204. Upon completion of the stabilization, the entire subgrade should be proof rolled in accordance with Item 204 to verify that stability has been achieved.

### *5.1.2 Subgrade Design Considerations*

California Bearing Ratio (CBR) values for the entire project ranged from 3 to 6 with an average of 5. Based on the variable soil types and marginal conditions encountered in the borings performed for this investigation, **it is recommended that pavement design be based on a CBR of 5 with a corresponding resilient modulus, $M_R$, of 6,000 psi**. Correlation charts indicate a modulus of subgrade reaction (K) of 135 pci and a soil support value (SSV) of 3.8.

As previously discussed, the exposed subgrade soil should be observed and proof rolled to identify any soft, wet or weak zones prior to placement of new aggregate base or pavement materials. If the subgrade presents evidence of soft, wet or weak soils, then it is recommended that the soils be stabilized via the methods discussed in Section 5.1.1. Please note that the recommended design CBR of 5 consider that the subgrade has been stabilized in accordance to the recommendations provided in Section 5.1.1.

Where excavation and replacement with engineered fill is selected as stabilization method, and due to the weak nature of the soils, the geotextile fabric should be placed at the bottom of the over excavation prior to the placement of the backfill materials.

Please note that the recommended design CBR of 5 also assume that the materials utilized for the road 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 of 5.

Per ODOT GDM, soils with sulfate content in excess of 5,000 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 to 160 ppm. Therefore, soil with sulfate content greater than 5,000 ppm was not encountered in any boring.

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.

## 5.2 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).

The extent/need for subgrade stabilization is entirely dependent on the subgrade conditions (i.e., moisture contents) encountered at the time of construction. If required, the method of stabilization employed is a function of the type of instability encountered the location (i.e., depth) of the instability and the resources available.

All proposed subgrade surfaces should be shaped to promote positive drainage, with a minimum slope of 2.0 percent or 0.25 inches per foot. Adequate drainage is necessary for maintaining the stability of the subgrade. Care should be taken during final grading so that no areas of potential ponding or standing water remain at the subgrade surface.

Materials utilized for engineered fill should conform to the latest ODOT CMS.

### *5.2.1 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 6. 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 |

## 5.3 Groundwater Considerations

Based on the groundwater observations made during drilling, little to no seepage of groundwater is anticipated to be encountered during construction at the site. Where/if groundwater is encountered, proper groundwater control measures should be implemented to prevent disturbance to excavation bottoms consisting of cohesive soil, and to prevent the possible development of a quick or “boiling” condition if soft/loose silts and/or fine sands are encountered. It is preferable that the groundwater level, if encountered, be maintained at least 24.0 inches below the deepest excavation. Any seepage or groundwater encountered at this site should be able to be controlled by pumping from temporary sumps. 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 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 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.

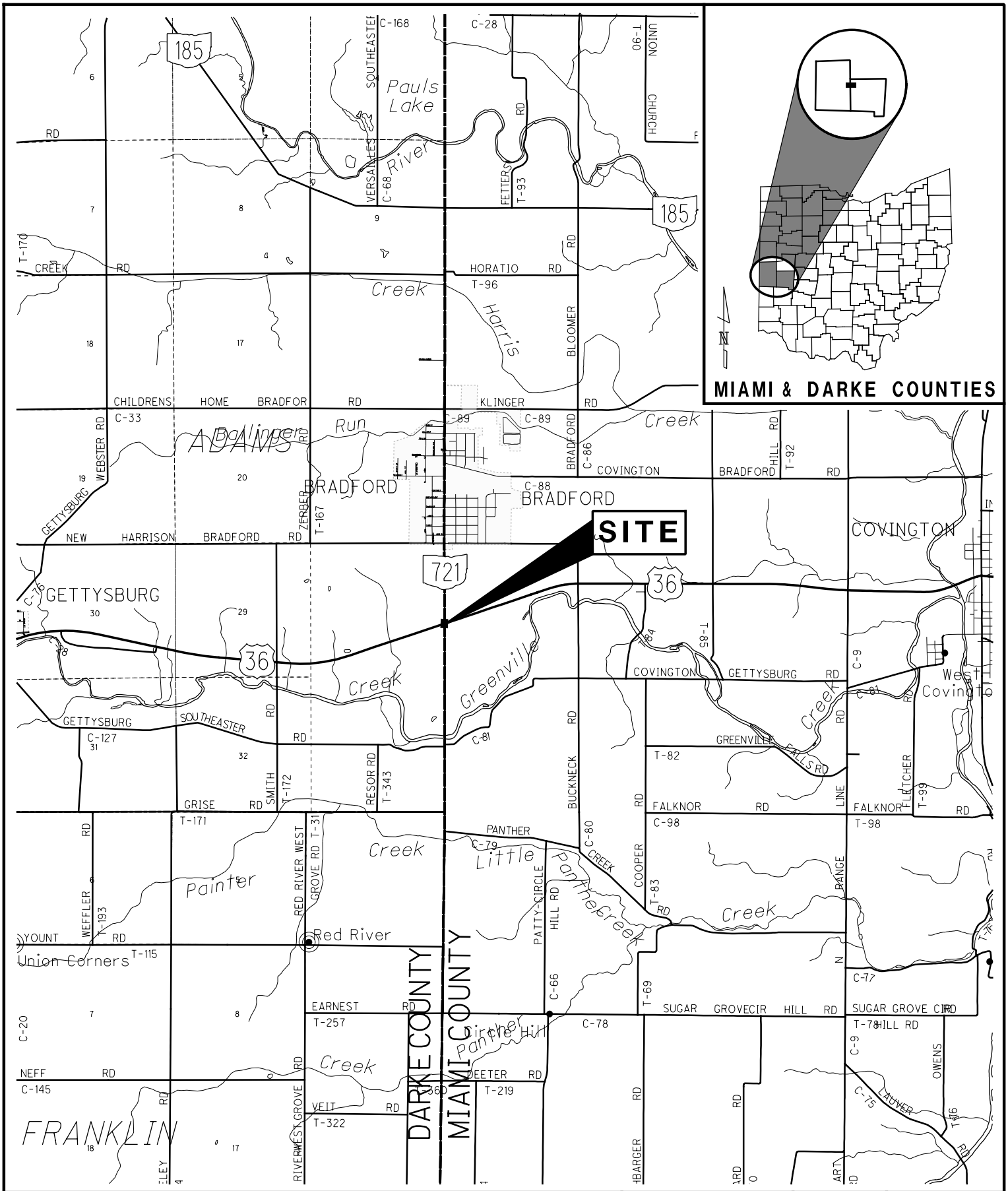
The conclusions and recommendations herein have been based upon the available soil and bedrock information and the design details furnished by a representative of the owner of the proposed project. Any revision in the plans for the proposed construction from those anticipated in this report should be 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 of 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

## MIA/DAR-36/721-22.56 INTERSECTION IMPROVEMENTS

## MIAMI AND DARKE COUNTIES, OHIO

RII PROJECT NO. W-23-176

SCALE: 1"=5000'

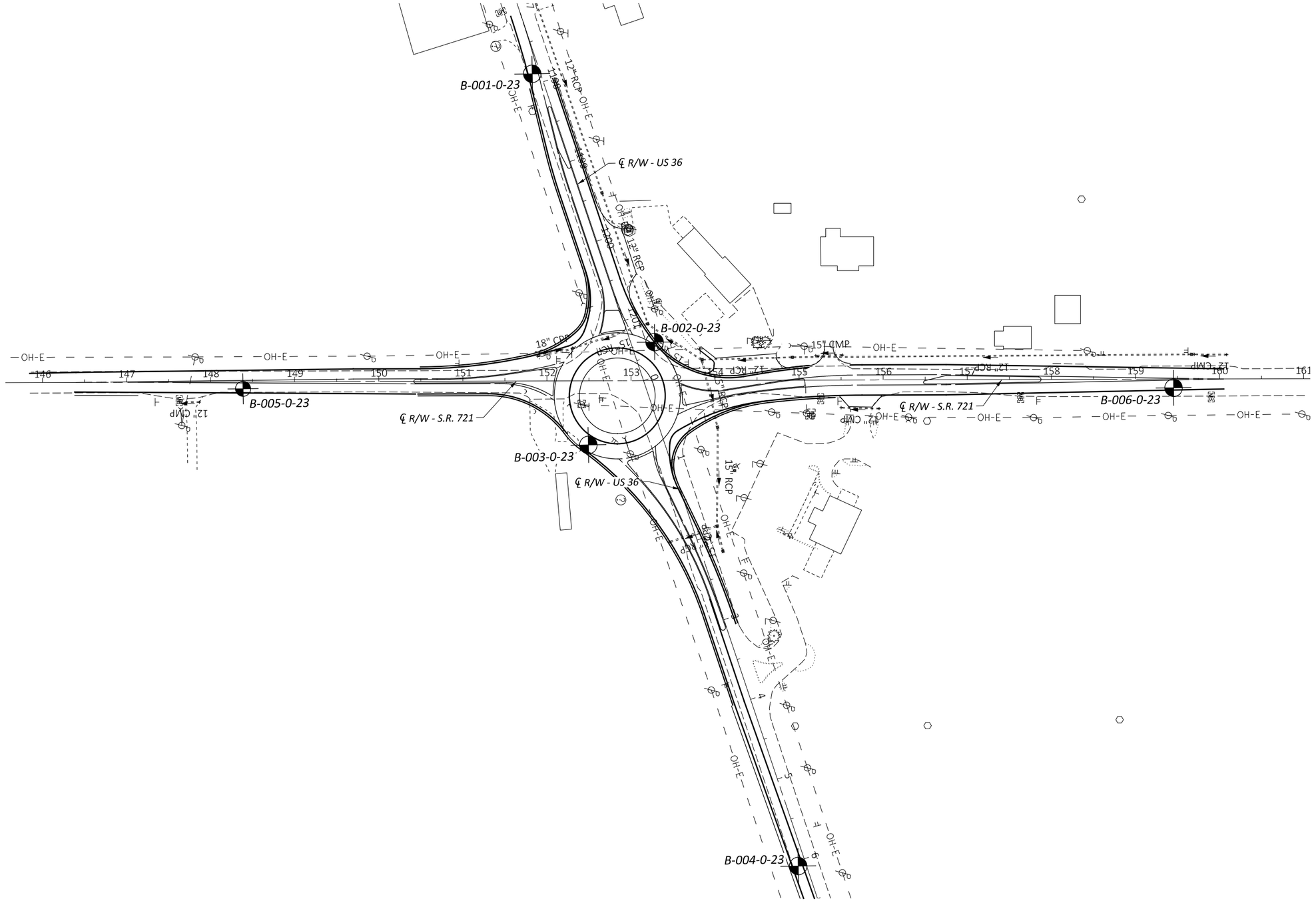
0 2500 5000

DRAWN JAS

REVIEWED JGR

DATE 1/30/2024

RESOURCE INTERNATIONAL Rii




# BORING PLAN

## MIA / DAR-36 / 721-22.56 INTERSECTION IMPROVEMENTS

## MIAMI AND DARKE COUNTIES, OHIO

| | |
|---|---|
| RII PROJECT NO. W-23-176 | DRAWN JAS |
| SCALE: 1"=120' (0 60 120) | REVIEWED JGR |
| | DATE 1/29/2024 |

J:\GEOTECH\PROJECTS\2023\W-23-176 MIA DAR-36 721-22.56 Intersection Improvements\DWG\118070_IP003.dgn

# APPENDIX II

## DESCRIPTION OF SOIL TERMS

# 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** – ODOT A-1, A-2, A-3, A-4 (non-plastic)
The relative compactness of granular soils is described as:

| 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** – ODOT A-4, A-5, A-6, A-7, A-8
The relative consistency of cohesive soils is described as:

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

**Modifiers of Components** - The following modifiers indicate the range of percentages of the minor soil components:

| 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 - ODOT |
|---|---|
| Dry | Well below Plastic Limit |
| Damp | Below Plastic Limit |
| Moist | Above PL to 3% below LL |
| Wet | 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. |

# APPENDIX III

**BORING LOGS:**

**B-001-0-23 through B-006-0-23**

# BORING LOGS

## Definitions of Abbreviations

AS = Auger sample

GI = Group index as determined from the Ohio Department of Transportation classification system

HP = Unconfined compressive strength as determined by a hand penetrometer (tons per square foot)

$LL_o$ = Oven-dried liquid limit as determined by ASTM D4318. Per ASTM D2487, if $LL_o/LL$ is less than 75 percent, soil is classified as "organic".

LOI = Percent organic content (by weight) as determined by ASTM D2974 (loss on ignition test)

PID = Photo-ionization detector reading (parts per million)

QR = Unconfined compressive strength of intact rock core sample as determined by ASTM D2938 (pounds per square inch)

QU = Unconfined compressive strength of soil sample as determined by ASTM D2166 (pounds per square foot)

RC = Rock core sample

REC = Ratio of total length of recovered soil or rock to the total sample length, expressed as a percentage

RQD = Rock quality designation – estimate of the degree of jointing or fracture in a rock mass, expressed as a percentage:

$$\frac{\sum \text{segments equal to or longer than 4.0 inches}}{\text{core run length}} \times 100$$

S = Sulfate content (parts per million)

SPT = Standard penetration test blow counts, per ASTM D1586. Driving resistance recorded in terms of blows per 6-inch interval while letting a 140-pound hammer free fall 30 inches to drive a 2-inch outer diameter (O.D.) split spoon sampler a total of 18 inches. The second and third intervals are added to obtain the number of blows per foot ($N_m$).

$N_{60}$ = Measured blow counts corrected to an equivalent (60 percent) energy ratio (ER) by the following equation: $N_{60} = N_m*(ER/60)$

SS = Split spoon sample

2S = For instances of no recovery from standard SS interval, a 2.5 inch O.D. split spoon is driven the full length of the standard SS interval plus an additional 6.0 inches to obtain a representative sample. Only the final 6.0 inches of sample is retained. Blow counts from 2S sampling are not correlated with $N_{60}$ values.

3S = Same as 2S, but using a 3.0 inch O.D. split spoon sampler.

TR = Top of rock

W = Initial water level measured during drilling

▼ = Water level measured at completion of drilling

Classification Test Data

Gradation (as defined on Description of Soil Terms):

GR = % Gravel
SA = % Sand
SI = % Silt
CL = % Clay

Atterberg Limits:

LL = Liquid limit
PL = Plastic limit
PI = Plasticity Index

WC = Water content (%)

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: MIA/DAR-36/721-22.56 IMP. | DRILLING FIRM / OPERATOR: RII / IS/SD | DRILL RIG: MOBILE B53 (62440) | STATION / OFFSET: 1197+87 / 9' RT | **EXPLORATION ID B-001-0-23** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / PF | HAMMER: AUTOMATIC | ALIGNMENT: CLX RW US 36 | | |
| PID: 118070 SFN: N/A | DRILLING METHOD: 4.5" CFA / NA | CALIBRATION DATE: 3/21/22 | ELEVATION: 999.4 (MSL) EOB: 7.5 ft. | | PAGE 1 OF 1 |
| START: 12/7/23 END: 12/7/23 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 79 | LAT / LONG: -84.431751, 40.114469 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 999.4 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.8' - ASPHALT ( 9.0") | 998.6 | | | | | | | | | | | | | | | | | | |
| 0.6' - CONCRETE ( 7.0") | 998.1 | | | | | | | | | | | | | | | | | | |
| 0.3'- AGGREGATE BASE ( 3.0") | 997.8 | | | | | | | | | | | | | | | | | | |
| STIFF TO VERY STIFF, BROWN **CLAY**, SOME TO "AND" SILT, TRACE TO LITTLE FINE GRAVEL AND COARSE TO FINE SAND, MOIST. | | 1<br>2<br>3 | 2<br>2<br>3 | 7 | 56 | SS-1 | 1.25 | 3 | 2 | 6 | 53 | 36 | 42 | 21 | 21 | 31 | A-7-6 (13) | <100 | |
| | | 4 | 2<br>4<br>5 | 12 | 89 | SS-2 | 2.50 | 12 | 4 | 14 | 26 | 44 | 47 | 17 | 30 | 24 | A-7-6 (16) | - | |
| | 994.9 | | | | | | | | | | | | | | | | | | |
| VERY STIFF TO HARD, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP. | | 5<br>6 | 4<br>6<br>8 | 18 | 100 | SS-3 | 4.5+ | - | - | - | - | - | - | - | - | 12 | A-4a (V) | - | |
| | | 7 | 6<br>7<br>8 | 20 | 100 | SS-4 | 3.50 | - | - | - | - | - | - | - | - | 13 | A-4a (V) | - | |
| | 991.9 | EOB | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR AT COMPLETION OF THE BORING

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

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: MIA/DAR-36/721-22.56 IMP. | DRILLING FIRM / OPERATOR: RII / IS/SD | DRILL RIG: MOBILE B53 (62440) | STATION / OFFSET: 1201+36 / 27' LT | **EXPLORATION ID B-002-0-23** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / PF | HAMMER: AUTOMATIC | ALIGNMENT: CLX RW US 36 | | |
| PID: 118070 SFN: N/A | DRILLING METHOD: 4.5" CFA / NA | CALIBRATION DATE: 3/21/22 | ELEVATION: 997.0 (MSL) EOB: 8.5 ft. | | PAGE 1 OF 1 |
| START: 12/7/23 END: 12/7/23 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 79 | LAT / LONG: -84.430555, 40.114903 | | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 997.0 | 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'- ASPAHLT ( 9.75") | 996.2 | | | | | | | | | | | | | | | | | | |
| MEDIUM STIFF, BROWN TO BROWNISH GRAY **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE TO LITTLE FINE GRAVEL, DAMP TO MOIST. | | 1 | 7 4 5 | 12 | 33 | SS-1 | 1.00 | 15 | 8 | 13 | 31 | 33 | 31 | 14 | 17 | 13 | A-6b (9) | 120 | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | 3 4 6 | 13 | 100 | SS-2 | 1.00 | 8 | 10 | 14 | 33 | 35 | 32 | 15 | 17 | 18 | A-6b (9) | - | |
| | 993.0 | 4 | | | | | | | | | | | | | | | | | |
| STIFF TO VERY STIFF, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | 5 | 6 6 6 | 16 | 100 | SS-3 | 2.50 | - | - | - | - | - | - | - | - | 14 | A-6b (V) | - | |
| -SAND SEAM @5.5' | | 6 | 3 5 7 | 16 | 100 | SS-4 | 1.25 | - | - | - | - | - | - | - | - | 16 | A-6b (V) | - | |
| | | 7 | 7 10 13 | 30 | 100 | SS-5 | 4.00 | - | - | - | - | - | - | - | - | 15 | A-6b (V) | - | |
| | 988.5 | 8 EOB | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR AT COMPLETION OF THE BORING

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

**RESOURCE INTERNATIONAL, INC.**

| | | | | |
|---|---|---|---|---|
| PROJECT: MIA/DAR-36/721-22.56 IMP. | DRILLING FIRM / OPERATOR: RII / IS/SD | DRILL RIG: MOBILE B53 (62440) | STATION / OFFSET: 152+49 / 76' RT | **EXPLORATION ID B-003-0-23** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / PF | HAMMER: AUTOMATIC | ALIGNMENT: CLX RW SR 721 | |
| PID: 118070 SFN: N/A | DRILLING METHOD: 4.5" CFA / NA | CALIBRATION DATE: 3/21/22 | ELEVATION: 993.1 (MSL) EOB: 7.0 ft. | PAGE 1 OF 1 |
| START: 12/7/23 END: 12/7/23 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 79 | LAT / LONG: -84.430147, 40.114702 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 993.1 | 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") | 992.6 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN **CLAY**, SOME SILT, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, SLIGHTLY ORGANIC, MOIST. -SS-1: LOI=3.3% | 990.6 | 1 | 4 5 6 | 14 | 50 | SS-1 | 3.50 | 13 | 4 | 9 | 34 | 40 | 45 | 17 | 28 | 23 | A-7-6 (16) | 160 | |
| HARD, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. | | 2 | 7 8 12 | 26 | 100 | SS-2 | 4.50 | 7 | 6 | 12 | 38 | 37 | 30 | 15 | 15 | 12 | A-6a (10) | - | |
| | | 3 | 10 14 16 | 40 | 100 | SS-3 | 4.50 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |
| | | 4 | 7 8 11 | 25 | 100 | SS-4 | 4.00 | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |
| | 986.1 | EOB 5 6 7 | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR AT COMPLETION OF THE BORING

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

**RESOURCE INTERNATIONAL, INC.**

| | | | | |
|---|---|---|---|---|
| PROJECT: MIA/DAR-36/721-22.56 IMP. | DRILLING FIRM / OPERATOR: RII / IS/SD | DRILL RIG: MOBILE B53 (62440) | STATION / OFFSET: 6+06 / 9' RT | **EXPLORATION ID B-004-0-23** |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / PF | HAMMER: AUTOMATIC | ALIGNMENT: CLX RW US 36 | |
| PID: 118070 SFN: N/A | DRILLING METHOD: 4.5" CFA / NA | CALIBRATION DATE: 3/21/22 | ELEVATION: 994.9 (MSL) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 12/7/23 END: 12/7/23 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 79 | LAT / LONG: -84.428391, 40.115382 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 994.9 | 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' - ASPHALT ( 9.5") | 994.1 | | | | | | | | | | | | | | | | | | |
| 0.6' - CONCRETE ( 7.0") | 993.5 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | 991.9 | | 2 3 4 | 9 | 78 | SS-1 | 3.50 | 6 | 8 | 13 | 36 | 37 | 30 | 15 | 15 | 18 | A-6a (10) | 160 | |
| VERY STIFF TO HARD, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | | | 3 6 9 | 20 | 100 | SS-2 | 3.50 | 7 | 8 | 13 | 37 | 35 | 30 | 10 | 20 | 15 | A-6b (11) | - | |
| | | | 6 10 9 | 25 | 100 | SS-3 | 4.50 | - | - | - | - | - | - | - | - | 13 | A-6b (V) | - | |
| | 987.4 | EOB | 6 8 10 | 24 | 100 | SS-4 | 3.00 | - | - | - | - | - | - | - | - | 14 | A-6b (V) | - | |

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR AT COMPLETION OF THE BORING

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

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: MIA/DAR-36/721-22.56 IMP. | DRILLING FIRM / OPERATOR: RII / IS/SD | DRILL RIG: MOBILE B53 (62440) | STATION / OFFSET: 148+39 / 8' RT | **EXPLORATION ID B-005-0-23** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / PF | HAMMER: AUTOMATIC | ALIGNMENT: CLX RW SR 721 | | |
| PID: 118070 SFN: N/A | DRILLING METHOD: 4.5" CFA / NA | CALIBRATION DATE: 3/21/22 | ELEVATION: 989.1 (MSL) EOB: 8.5 ft. | | PAGE 1 OF 1 |
| START: 12/7/23 END: 12/7/23 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 79 | LAT / LONG: -84.430344, 40.113559 | | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 989.1 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.3' - ASPHALT ( 16.0") | 987.8 | | | | | | | | | | | | | | | | | | |
| 1.0' - AGGREGATE BASE ( 12.0") | 986.8 | | | | | | | | | | | | | | | | | | |
| STIFF TO VERY STIFF, BROWN **SILT AND CLAY**, LITTLE TO SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | 2 4 6 | 13 | 100 | SS-1 | 2.00 | 7 | 3 | 12 | 43 | 35 | 30 | 17 | 13 | 19 | A-6a (9) | <100 | |
| | | 4 | 4 6 4 | 13 | 100 | SS-2 | 1.25 | 5 | 8 | 17 | 40 | 30 | 30 | 16 | 14 | 18 | A-6a (9) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| | | 6 | 2 3 5 | 11 | 100 | SS-3 | 1.75 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |
| | 980.6 | 8 EOB | 5 5 5 | 13 | 100 | SS-4 | 4.00 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR AT COMPLETION OF THE BORING

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

**RESOURCE INTERNATIONAL, INC.**

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: MIA/DAR-36/721-22.56 IMP. | DRILLING FIRM / OPERATOR: RII / IS/SD | DRILL RIG: MOBILE B53 (62440) | STATION / OFFSET: 159+45 / 10' RT | **EXPLORATION ID B-006-0-23** | |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: RII / PF | HAMMER: AUTOMATIC | ALIGNMENT: CLX RW SR 721 | | |
| PID: 118070 SFN: N/A | DRILLING METHOD: 4.5" CFA / NA | CALIBRATION DATE: 3/21/22 | ELEVATION: 1011.7 (MSL) EOB: 7.5 ft. | | PAGE 1 OF 1 |
| START: 12/7/23 END: 12/7/23 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 79 | LAT / LONG: -84.430446, 40.116586 | | |

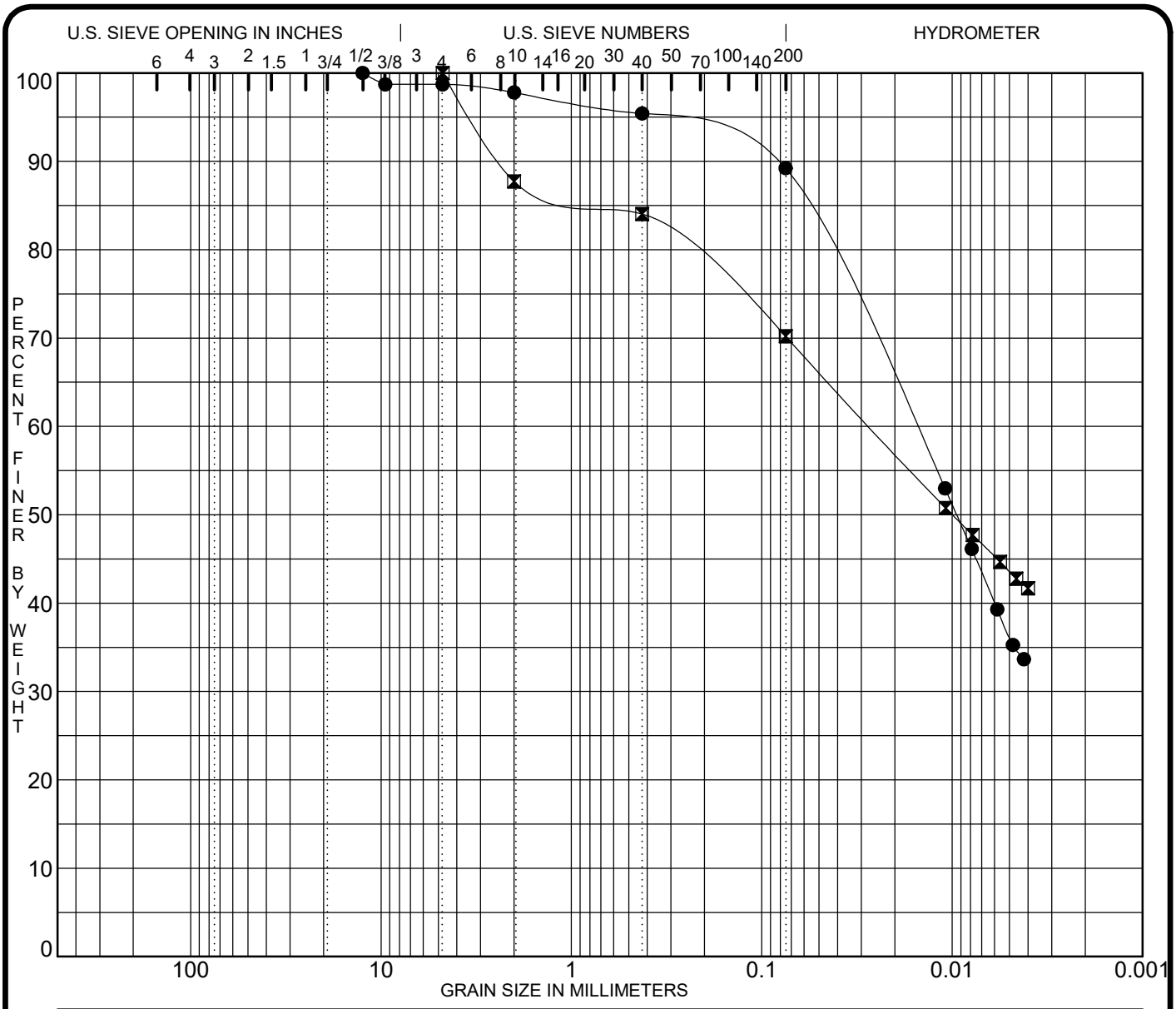
| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 1011.7 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6' - ASPHALT ( 7.75") | 1011.1 | | | | | | | | | | | | | | | | | | |
| 0.9' - AGGREGATE BASE ( 11.25") | 1010.2 | 1 | | | | | | | | | | | | | | | | | |
| STIFF, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. | 1008.7 | 2 | 2 4 4 | 11 | 67 | SS-1 | 2.00 | 10 | 8 | 13 | 30 | 39 | 38 | 15 | 23 | 21 | A-6b (12) | <100 | |
| STIFF, BROWN **CLAY**, SOME SILT, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. | 1007.2 | 3 4 | 3 5 7 | 16 | 100 | SS-2 | 2.00 | 13 | 6 | 14 | 30 | 37 | 41 | 16 | 25 | 19 | A-7-6 (13) | - | |
| VERY STIFF, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE GRAVEL, DAMP TO MOIST. | 1004.2 | 5 | 7 9 11 | 26 | 100 | SS-3 | 4.00 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |
| | | 6 | 7 10 11 | 28 | 100 | SS-4 | 3.50 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |
| | | 7 EOB | | | | | | | | | | | | | | | | | |

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR AT COMPLETION OF THE BORING

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

# APPENDIX IV

## Lab Test Results




| COBBLES | GRAVEL | | SAND | | SILT OR CLAY |
|---|---|---|---|---|---|
| | coarse | fine | coarse | fine | |

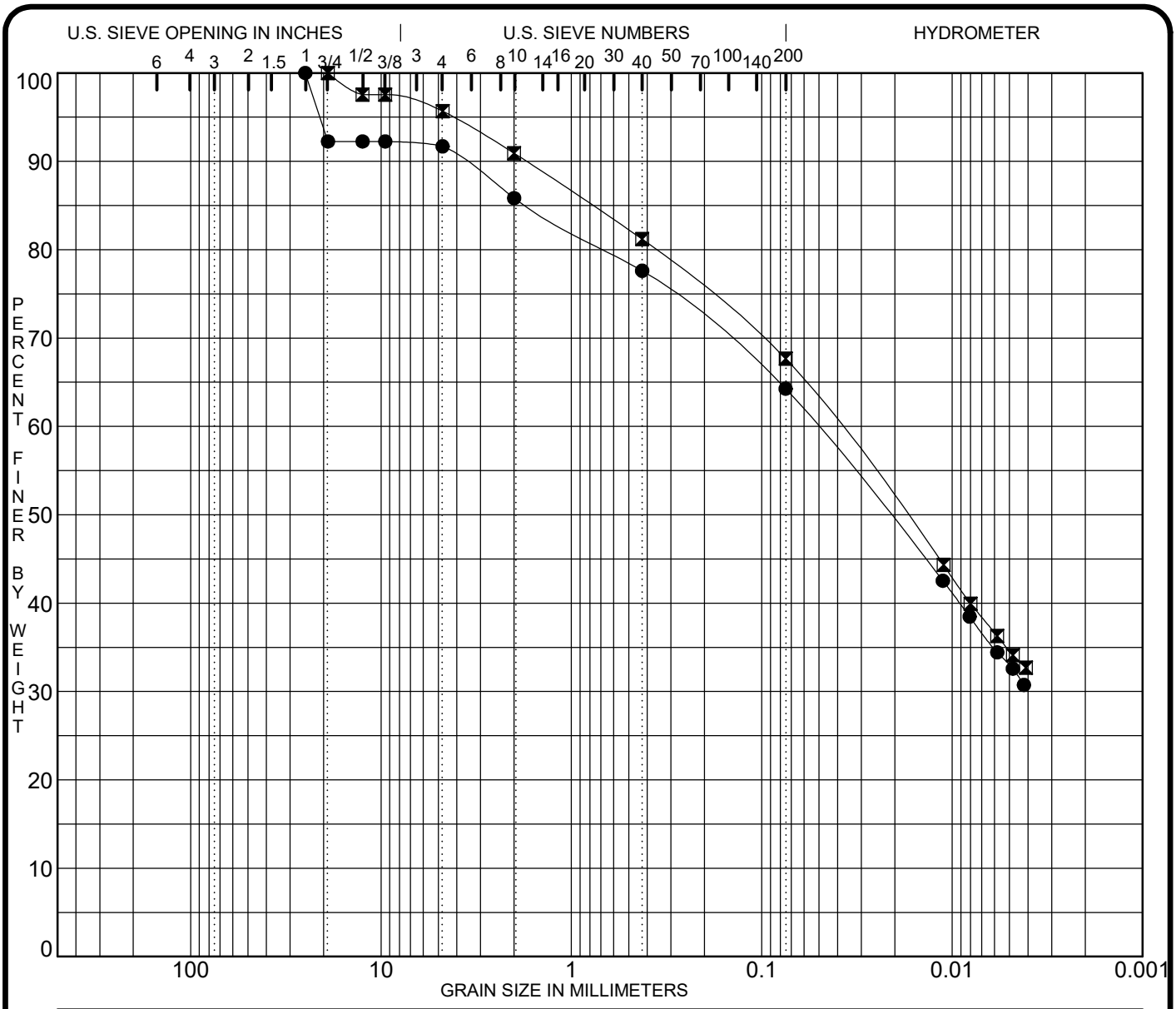
| | Specimen Identification | Depth | Classification | MC% | LL | PL | PI | Cz | Cu |
|---|---|---|---|---|---|---|---|---|---|
| ● | **B-001-0-23** | **1.5** | **A-7-6** | **31** | **42** | **21** | **21** | | |
| ⊠ | **B-001-0-23** | **3.0** | **A-7-6** | **24** | **47** | **17** | **30** | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| | Specimen Identification | D60 | D50 | D30 | D10 | %Gravel coarse | %Gravel fine | %Sand coarse | %Sand fine | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B-001-0-23** | **0.060** | **0.009** | | | **0.0** | **2.2** | **2.4** | **6.2** | **53.1** | **36.1** |
| ⊠ | **B-001-0-23** | **0.636** | **0.010** | | | **0.0** | **12.3** | **3.7** | **13.8** | **26.6** | **43.6** |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

PROJECT **MIA/DAR-36/721-22.56 IMP.** PROJECT NO. **W-23-176**

# GRADATION CURVES

**Resource International, Inc.**




| COBBLES | GRAVEL | | SAND | | SILT OR CLAY |
|---|---|---|---|---|---|
| | coarse | fine | coarse | fine | |

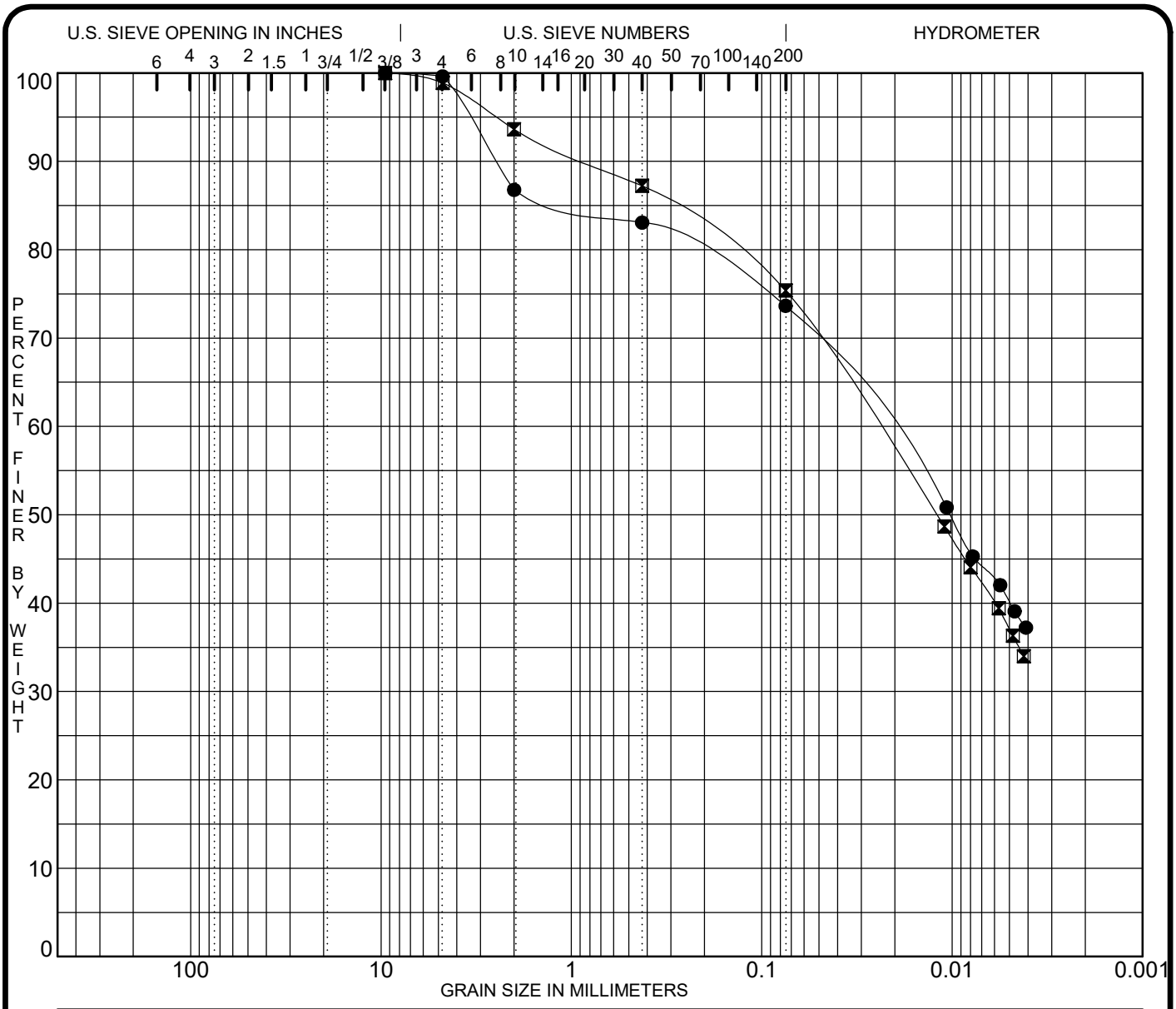
| | Specimen Identification | Depth | Classification | MC% | LL | PL | PI | Cz | Cu |
|---|---|---|---|---|---|---|---|---|---|
| ● | **B-002-0-23** | **1.0** | **A-6b** | **13** | **31** | **14** | **17** | | |
| ⊠ | **B-002-0-23** | **2.5** | **A-6b** | **18** | **32** | **15** | **17** | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| | Specimen Identification | D60 | D50 | D30 | D10 | %Gravel coarse | %Gravel fine | %Sand coarse | %Sand fine | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B-002-0-23** | **1.708** | **0.022** | | | **7.7** | **6.4** | **8.2** | **13.3** | **31.3** | **33.0** |
| ⊠ | **B-002-0-23** | **0.779** | **0.018** | | | **0.0** | **9.1** | **9.7** | **13.5** | **33.1** | **34.6** |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

PROJECT **MIA/DAR-36/721-22.56 IMP.** PROJECT NO. **W-23-176**

# GRADATION CURVES

**Resource International, Inc.**




| COBBLES | GRAVEL | | SAND | | SILT OR CLAY |
|---|---|---|---|---|---|
| | coarse | fine | coarse | fine | |

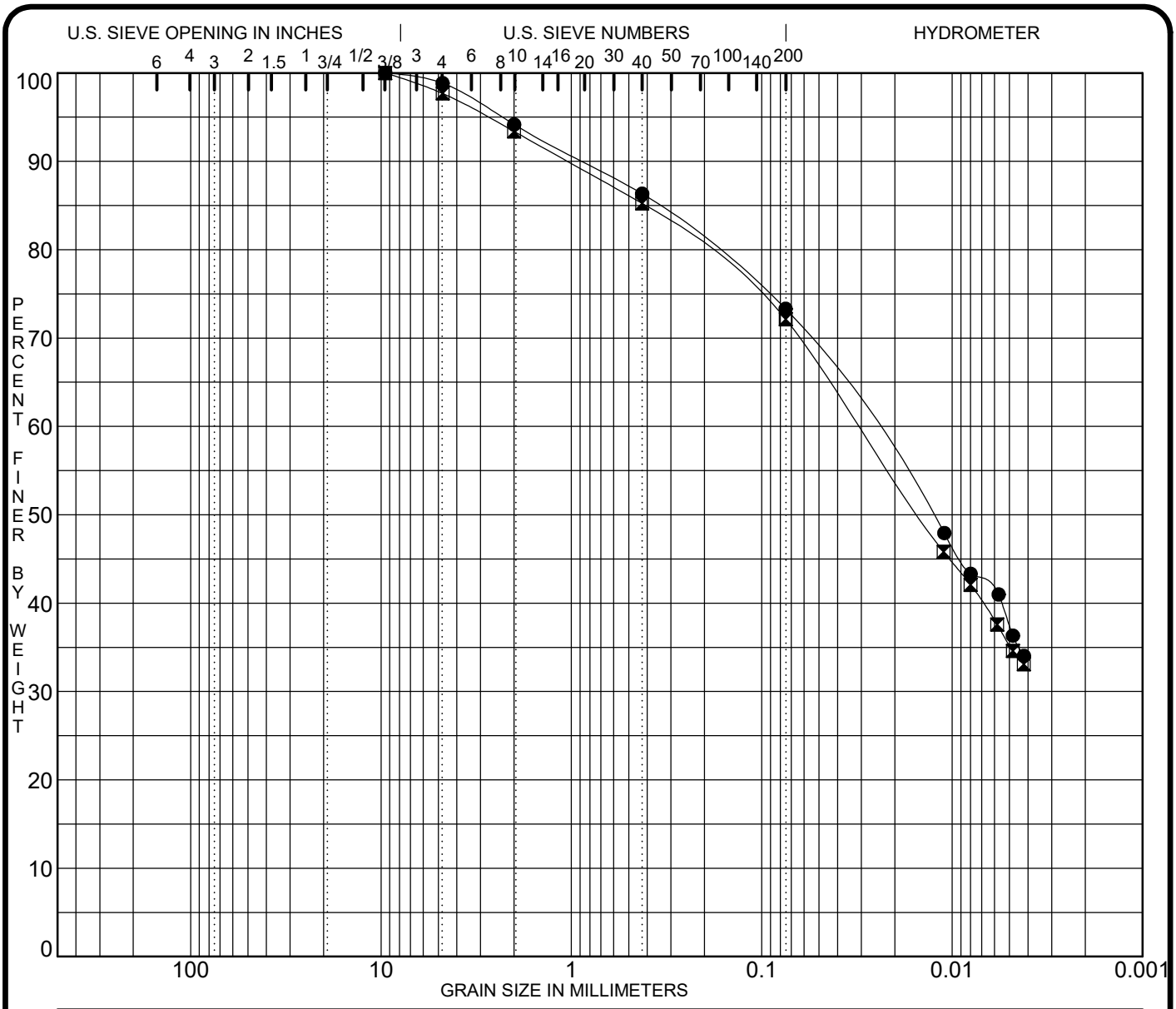
| | Specimen Identification | Depth | Classification | MC% | LL | PL | PI | Cz | Cu |
|---|---|---|---|---|---|---|---|---|---|
| ● | **B-003-0-23** | **1.0** | **A-7-6** | **23** | **45** | **17** | **28** | | |
| ⊠ | **B-003-0-23** | **2.5** | **A-6a** | **12** | **30** | **15** | **15** | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| | Specimen Identification | D60 | D50 | D30 | D10 | %Gravel coarse | %Gravel fine | %Sand coarse | %Sand fine | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B-003-0-23** | **0.954** | **0.010** | | | **0.0** | **13.2** | **3.7** | **9.4** | **33.5** | **40.1** |
| ⊠ | **B-003-0-23** | **0.307** | **0.012** | | | **0.0** | **6.4** | **6.4** | **11.8** | **38.3** | **37.0** |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

PROJECT **MIA/DAR-36/721-22.56 IMP.** PROJECT NO. **W-23-176**

# GRADATION CURVES

**Resource International, Inc.**




| COBBLES | GRAVEL | | SAND | | SILT OR CLAY |
|---|---|---|---|---|---|
| | coarse | fine | coarse | fine | |

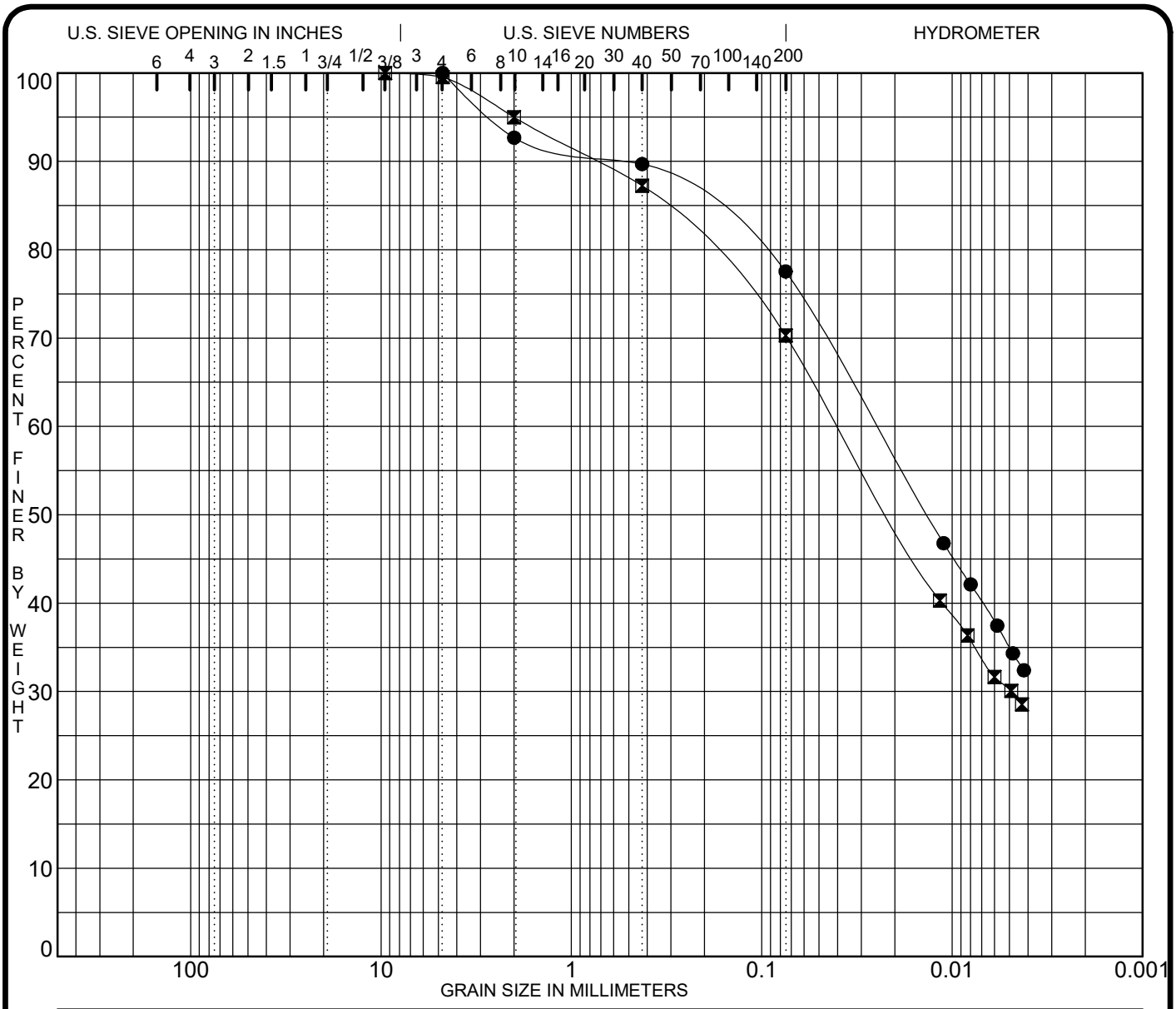
| | Specimen Identification | Depth | Classification | MC% | LL | PL | PI | Cz | Cu |
|---|---|---|---|---|---|---|---|---|---|
| ● | **B-004-0-23** | **1.5** | **A-6a** | **18** | **30** | **15** | **15** | | |
| ⊠ | **B-004-0-23** | **3.0** | **A-6b** | **15** | **30** | **10** | **20** | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| | Specimen Identification | D60 | D50 | D30 | D10 | %Gravel coarse | %Gravel fine | %Sand coarse | %Sand fine | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B-004-0-23** | **0.356** | **0.013** | | | **0.0** | **5.8** | **7.8** | **13.0** | **35.9** | **37.4** |
| ⊠ | **B-004-0-23** | **0.411** | **0.015** | | | **0.0** | **6.6** | **8.1** | **13.1** | **36.9** | **35.2** |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

PROJECT **MIA/DAR-36/721-22.56 IMP.** PROJECT NO. **W-23-176**

# GRADATION CURVES

**Resource International, Inc.**




| COBBLES | GRAVEL | | SAND | | SILT OR CLAY |
|---|---|---|---|---|---|
| | coarse | fine | coarse | fine | |

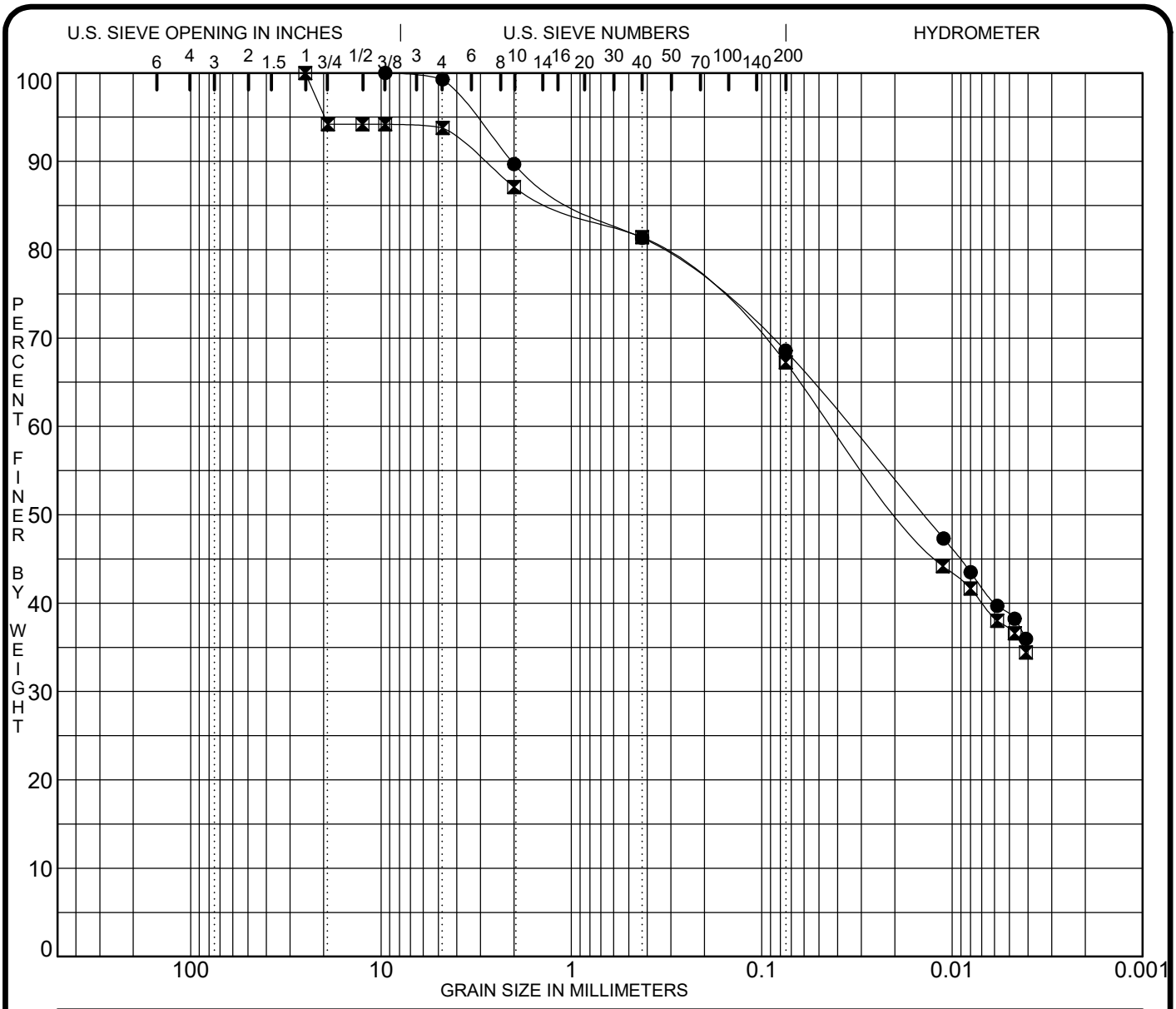
| | Specimen Identification | Depth | Classification | MC% | LL | PL | PI | Cz | Cu |
|---|---|---|---|---|---|---|---|---|---|
| ● | **B-005-0-23** | **2.5** | **A-6a** | **19** | **30** | **17** | **13** | | |
| ⊠ | **B-005-0-23** | **4.0** | **A-6a** | **18** | **30** | **16** | **14** | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| | Specimen Identification | D60 | D50 | D30 | D10 | %Gravel coarse | %Gravel fine | %Sand coarse | %Sand fine | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B-005-0-23** | **0.218** | **0.014** | | | **0.0** | **7.3** | **3.0** | **12.1** | **42.5** | **35.0** |
| ⊠ | **B-005-0-23** | **0.338** | **0.021** | **0.005** | | **0.0** | **5.0** | **7.8** | **17.0** | **40.1** | **30.2** |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

PROJECT **MIA/DAR-36/721-22.56 IMP.** PROJECT NO. **W-23-176**

# GRADATION CURVES

**Resource International, Inc.**




| COBBLES | GRAVEL | | SAND | | SILT OR CLAY |
|---|---|---|---|---|---|
| | coarse | fine | coarse | fine | |

| | Specimen Identification | Depth | Classification | MC% | LL | PL | PI | Cz | Cu |
|---|---|---|---|---|---|---|---|---|---|
| ● | **B-006-0-23** | **1.5** | **A-6b** | **21** | **38** | **15** | **23** | | |
| ⊠ | **B-006-0-23** | **3.0** | **A-7-6** | **19** | **41** | **16** | **25** | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| | Specimen Identification | D60 | D50 | D30 | D10 | %Gravel coarse | %Gravel fine | %Sand coarse | %Sand fine | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B-006-0-23** | **0.838** | **0.014** | | | **0.0** | **10.3** | **8.3** | **12.8** | **29.9** | **38.7** |
| ⊠ | **B-006-0-23** | **1.131** | **0.018** | | | **5.8** | **7.1** | **5.7** | **14.2** | **30.2** | **37.0** |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

PROJECT **MIA/DAR-36/721-22.56 IMP.** PROJECT NO. **W-23-176**

# GRADATION CURVES

**Resource International, Inc.**

# APPENDIX V

## Pavement Core Data Sheet

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

# Pavement Core Data Summary

| | |
|---|---|
| PROJECT | MIA/DAR-36/721-22.56 Intersection Improvemnnt |
| LOCATION | Miami & Darke Counties, Ohio |
| JOB No. | W-23-176 |
| BORING/CORE No. | B-001-0-23 |
| DATE CORE OBTAINED | 12/7/2023 |
| CORE OBTAINED BY | IS, SD & PF |

## Core Composition

| Core Number | Layer Thickness (in.) | Pavement Layer Number | Asphalt: Surface Binder | Asphalt: Intermediate Binder | Asphalt: Base Binder | Concrete | Aggregate/Granular Base | Other | Other | Other |
|---|---|---|---|---|---|---|---|---|---|---|
| B-001-0-23 | 3.50 | 5 | ✓ | | | | | | | |
| | 2.00 | 4 | ✓ | | | | | | | |
| | 1.00 | 3 | ✓ | | | | | | | |
| | 2.50 | 2 | ✓ | | | | | | | |
| | 7.00 | 1 | | | | ✓ | | | | |
| | 3.00 | | | | | | ✓ | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

## Comments/Remarks

- The core is highly deteriorated. It is hard to discern between some layers.
- The core is separated between all the layers.
- Layer 1 is broken into pieces.
- Layers 3 & 4 are deteriorating.
- Aggregate Base: Sand with gravel (visual)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 16.00 | in. | Total Asphalt Thickness = | 9.00 | in. | Total Concrete Thickness = | 7.00 | in. | Total Base Thickness = | 3.00 | in. |

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

# Pavement Core Data Summary

| | |
|---|---|
| PROJECT | MIA/DAR-36/721-22.56 Intersection Improvemnnt |
| LOCATION | Miami & Darke Counties, Ohio |
| JOB No. | W-23-176 |
| BORING/CORE No. | B-004-0-23 |
| DATE CORE OBTAINED | 12/7/2023 |
| CORE OBTAINED BY | IS, SD & PF |

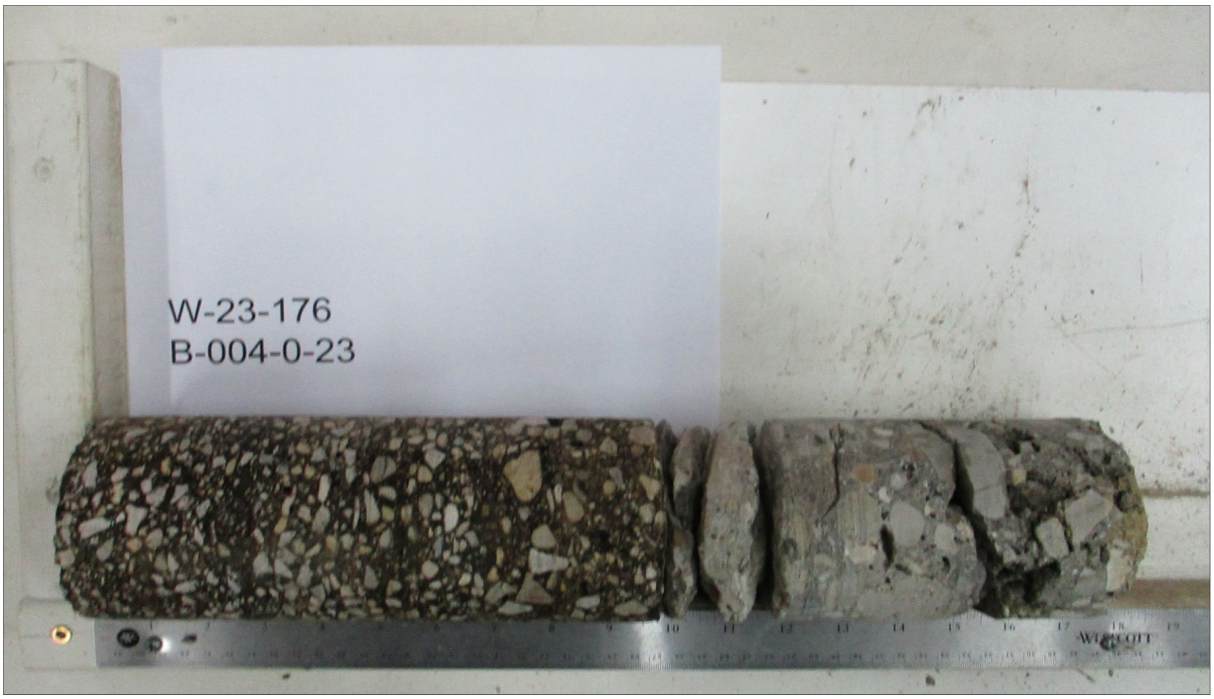
## Core Composition

| Core Number | Layer Thickness (in.) | Pavement Layer Number | Asphalt: Surface Binder | Asphalt: Intermediate Binder | Asphalt: Base Binder | Concrete | Aggregate/Granular Base | Other | | |
|---|---|---|---|---|---|---|---|---|---|---|
| B-004-0-23 | 1.75 | 4 | ✓ | | | | | | | |
| | 5.00 | 3 | ✓ | | | | | | | |
| | 2.75 | 2 | | ✓ | | | | | | |
| | 7.00 | 1 | | | | ✓ | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

## Comments/Remarks

- Core is separated between layers 1 and 2.
- Layer 1 is highly deteriorated and broken in several pieces.

| Total Pavement Thickness = | 16.50 in. | Total Asphalt Thickness = | 9.50 in. | Total Concrete Thickness = | 7.00 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 | MIA/DAR-36/721-22.56 Intersection Improvemnnt |
| LOCATION | Miami & Darke Counties, Ohio |
| JOB No. | W-23-176 |
| BORING/CORE No. | B-005-0-23 |
| DATE CORE OBTAINED | 12/7/2023 |
| CORE OBTAINED BY | IS, SD & PF |

## Core Composition

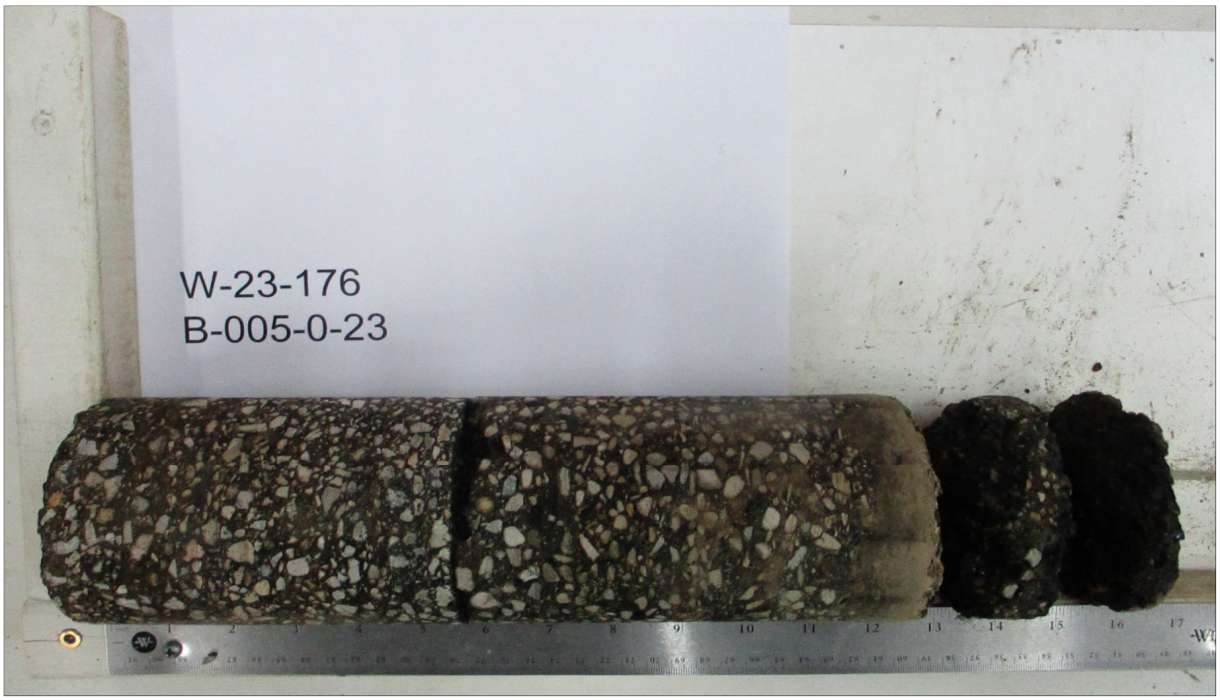
| Core Number | Layer Thickness (in.) | Pavement Layer Number | Asphalt: Surface Binder | Asphalt: Intermediate Binder | Asphalt: Base Binder | Concrete | Aggregate/Granular Base | Other | | |
|---|---|---|---|---|---|---|---|---|---|---|
| B-005-0-23 | 2.25 | 5 | ✓ | | | | | | | |
| | 3.50 | 4 | ✓ | | | | | | | |
| | 3.25 | 3 | ✓ | | | | | | | |
| | 3.50 | 2 | ✓ | | | | | | | |
| | 3.50 | 1 | ✓ | | | | | | | |
| | 12.00 | | | | | | ✓ | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

## Comments/Remarks

- The core separated between layers 1 & 2, and 3 & 4.
- Layer 1 is broken @ 14.5" and highly deteriorated.
- Total of 12.0" aggregate base (No possible to discern different thicknesses)
- Aggregate Base (upper): Gravel with sand (visual) (Asphlat Smell in sample)

Aggregate Base (lower): Sand with gravel (visual)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 16.00 | in. | Total Asphalt Thickness = | 16.00 | in. | Total Concrete Thickness = | 0.00 | in. | Total Base Thickness = | 12.00 | in. |



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

## Pavement Core Data Summary

| | |
|---|---|
| PROJECT | MIA/DAR-36/721-22.56 Intersection Improvemnnt |
| LOCATION | Miami & Darke Counties, Ohio |
| JOB No. | W-23-176 |
| BORING/CORE No. | B-006-0-23 |
| DATE CORE OBTAINED | 12/7/2023 |
| CORE OBTAINED BY | IS, SD & PF |

### Core Composition

| Core Number | Layer Thickness (in.) | Pavement Layer Number | Asphalt: Surface Binder | Asphalt: Intermediate Binder | Asphalt: Base Binder | Concrete | Aggregate/Granular Base | Other | | |
|---|---|---|---|---|---|---|---|---|---|---|
| B-006-0-23 | 1.75 | 4 | ✓ | | | | | | | |
| | 2.00 | 3 | ✓ | | | | | | | |
| | 2.00 | 2 | ✓ | | | | | | | |
| | 2.00 | 1 | ✓ | | | | | | | |
| | 5.25 | B2 | | | | | ✓ | | | |
| | 6.00 | B1 | | | | | ✓ | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

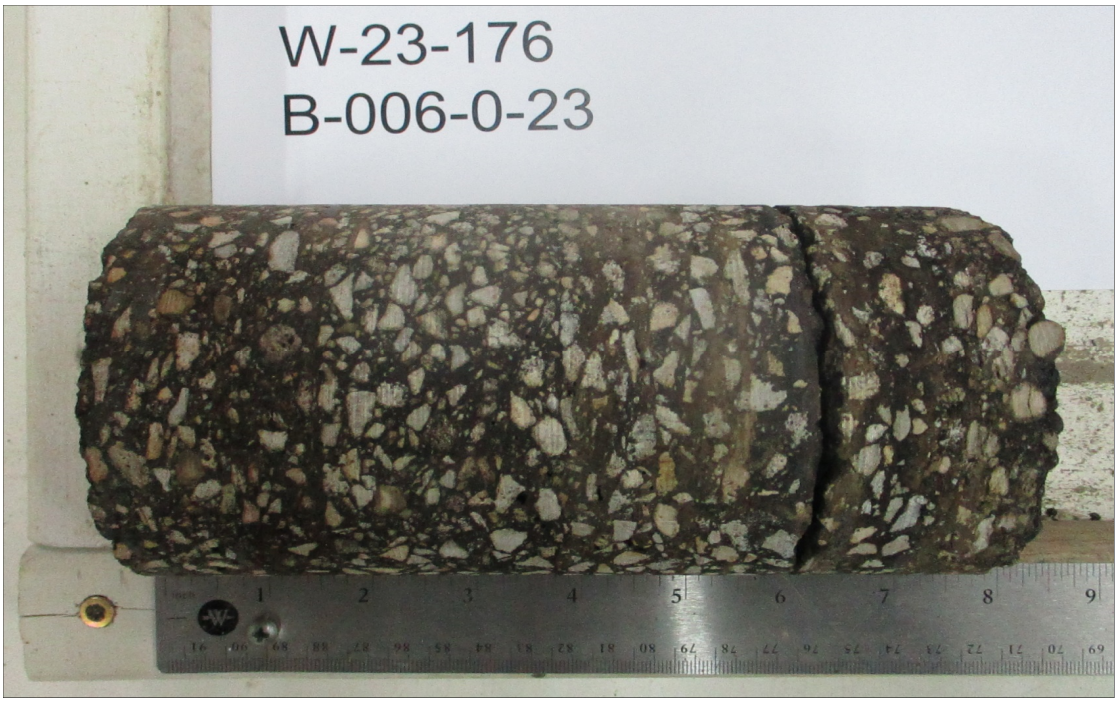
### Comments/Remarks

- The core separated between layers 1 & 2.

- Aggregate Base (B2): Gravel with sand (visual) (Asphlat smell in sample)

Aggregate Base (B1): Crushed Limestone (visual)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Pavement Thickness = | 7.75 | in. | Total Asphalt Thickness = | 7.75 | in. | Total Concrete Thickness = | 0.00 | in. | Total Base Thickness = | 11.25 | in. |



# Appendix VI

## ODOT Subgrade Stabilization Summary

# OHIO DEPARTMENT OF TRANSPORTATION

## OFFICE OF GEOTECHNICAL ENGINEERING

## PLAN SUBGRADES
## Geotechnical Design Manual Section 600

**MIA/DAR-36/721-22.56**
**118070**

## MIA/DAR-36/721-22.56 Intersection Improvement

**Resource International, Inc.**

**Prepared By:** Johnnatan Garcia-Ruiz, Ph.D.
**Date prepared:** Friday, April 19, 2024

Resource International, Inc.
Jon Sterenberg, P.E.
6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
jonathans@resourceinternational.com

**NO. OF BORINGS:** 6

| # | Boring ID | Alignment | Station | Offset | Dir | Drill Rig | ER | Boring EL. | Proposed Subgrade EL | Cut Fill |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B-001-0-23 | CLX RW US 36 | 1197+86 | 9.5 | RT | Mobile B53 | 79.0 | 999.4 | 997.9 | 1.5 C |
| 2 | B-002-0-23 | CLX RW US 36 | 1201+35 | 27 | LT | Mobile B53 | 79.0 | 997.0 | 996.7 | 0.3 C |
| 3 | B-003-0-23 | CLX RW SR 721 | 152+49 | 76.3 | RT | Mobile B53 | 79.0 | 993.1 | 997.9 | 4.8 F |
| 4 | B-004-0-23 | CLX RW US 36 | 6+05 | 9.4 | RT | Mobile B53 | 79.0 | 994.9 | 993.3 | 1.6 C |
| 5 | B-005-0-23 | CLX RW SR 721 | 148+38 | 8.1 | RT | Mobile B53 | 79.0 | 989.1 | 987.5 | 1.6 C |
| 6 | B-006-0-23 | CLX RW SR 721 | 159+45 | 10.4 | RT | Mobile B53 | 79.0 | 1011.7 | 1010.1 | 1.6 C |

OHIO DEPARTMENT OF TRANSPORTATION

# Subgrade Analysis

V. 14.6 2/11/2022

| # | 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 | 1.5 | 3.0 | 0.0 | 1.5 | 7 | | 1.25 | 42 | 21 | 21 | 53 | 36 | 89 | 31 | 18 | A-7-6 | 13 | 100 | | HP & Mc | | | 15" | 204 Geotextile |
| | 001-0 | SS-2 | 3.0 | 4.5 | 1.5 | 3.0 | 12 | | 2.5 | 47 | 17 | 30 | 26 | 44 | 70 | 24 | 18 | A-7-6 | 16 | | | $N_{60}$ & Mc | | | | |
| | 23 | SS-3 | 4.5 | 6.0 | 3.0 | 4.5 | 18 | | 4.5 | | | | | | | 12 | 10 | A-4a | 8 | | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 4.5 | 6.0 | 20 | 7 | 3.5 | | | | | | | 13 | 10 | A-4a | 8 | | | | | | | |
| 2 | B | SS-1 | 1.0 | 2.5 | 0.7 | 2.2 | 12 | | 1 | 31 | 14 | 17 | 31 | 33 | 64 | 13 | 16 | A-6b | 9 | 120 | | HP | | | 12" | 204 Geotextile |
| | 002-0 | SS-2 | 2.5 | 4.0 | 2.2 | 3.7 | 13 | | 1 | 32 | 15 | 17 | 33 | 35 | 68 | 18 | 16 | A-6b | 9 | | | | | | | |
| | 23 | SS-3 | 4.0 | 5.5 | 3.7 | 5.2 | 16 | | 2.5 | | | | | | | 14 | 16 | A-6b | 16 | | | | | | | |
| | | SS-4 | 5.5 | 7.0 | 5.2 | 6.7 | 16 | 12 | 1.25 | | | | | | | 16 | 16 | A-6b | | | | | | | | |
| 3 | B | SS-1 | 1.0 | 2.5 | 5.8 | 7.3 | 14 | | 3.5 | 45 | 17 | 28 | 34 | 40 | 74 | 23 | 18 | A-7-6 | | 160 | | | | | | |
| | 003-0 | SS-2 | 2.5 | 4.0 | 7.3 | 8.8 | 26 | | 4.5 | 30 | 15 | 15 | 38 | 37 | 75 | 12 | 14 | A-6a | | | | | | | | |
| | 23 | SS-3 | 4.0 | 5.5 | 8.8 | 10.3 | 40 | | 4.5 | | | | | | | 12 | 14 | A-6a | | | | | | | | |
| | | SS-4 | 5.5 | 7.0 | 10.3 | 11.8 | 25 | 14 | 4.5 | | | | | | | 13 | 14 | A-6a | | | | | | | | |
| 4 | B | SS-1 | 1.5 | 3.0 | -0.1 | 1.4 | 9 | | 3.5 | 30 | 15 | 15 | 36 | 37 | 73 | 18 | 14 | A-6a | 10 | 160 | | $N_{60}$ & Mc | | | 12" | 204 Geotextile |
| | 004-0 | SS-2 | 3.0 | 4.5 | 1.4 | 2.9 | 20 | | 3.5 | 30 | 10 | 20 | 37 | 35 | 72 | 15 | 16 | A-6b | 11 | | | | | | | |
| | 23 | SS-3 | 4.5 | 6.0 | 2.9 | 4.4 | 25 | | 4.5 | | | | | | | 13 | 16 | A-6b | 16 | | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 4.4 | 5.9 | 24 | 9 | 3 | | | | | | | 14 | 16 | A-6b | 16 | | | | | | | |
| 5 | B | SS-1 | 2.5 | 4.0 | 0.9 | 2.4 | 13 | | 2 | 30 | 17 | 13 | 43 | 35 | 78 | 19 | 14 | A-6a | 9 | 100 | | $N_{60}$ & Mc | | | 12" | 204 Geotextile |
| | 005-0 | SS-2 | 4.0 | 5.5 | 2.4 | 3.9 | 13 | | 1.25 | 30 | 16 | 14 | 40 | 30 | 70 | 18 | 14 | A-6a | 9 | | | | | | | |
| | 23 | SS-3 | 5.5 | 7.0 | 3.9 | 5.4 | 11 | | 1.75 | | | | | | | 14 | 14 | A-6a | 10 | | | | | | | |
| | | SS-4 | 7.0 | 8.5 | 5.4 | 6.9 | 13 | 11 | 4 | | | | | | | 14 | 14 | A-6a | | | | | | | | |
| 6 | B | SS-1 | 1.5 | 3.0 | -0.1 | 1.4 | 11 | | 2 | 38 | 15 | 23 | 30 | 39 | 69 | 21 | 16 | A-6b | 12 | 100 | | $N_{60}$ & Mc | | | 12" | 204 Geotextile |
| | 006-0 | SS-2 | 3.0 | 4.5 | 1.4 | 2.9 | 16 | | 2 | 41 | 16 | 25 | 30 | 37 | 67 | 19 | 18 | A-7-6 | 13 | | | | | | | |
| | 23 | SS-3 | 4.5 | 6.0 | 2.9 | 4.4 | 26 | | 4 | | | | | | | 12 | 18 | A-7-6 | 16 | | | | | | | |
| | | SS-4 | 6.0 | 7.5 | 4.4 | 5.9 | 28 | 11 | 3.5 | | | | | | | 14 | 18 | A-7-6 | 16 | | | | | | | |

**PID:** 118070

**County-Route-Section:** MIA/DAR-36/721-22.56

**No. of Borings:** 6

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

**Prepared By:** Johnnatan Garcia-Ruiz, Ph.D.

**Date prepared:** 4/19/2024

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

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

| Design CBR | 5 |
|---|---|

| % Samples within 6 feet of subgrade | | | |
|---|---|---|---|
| $N_{60} \leq 5$ | 0% | HP ≤ 0.5 | 0% |
| $N_{60} < 12$ | 19% | 0.5 < HP ≤ 1 | 10% |
| $12 \leq N_{60} < 15$ | 33% | 1 < HP ≤ 2 | 33% |
| $N_{60} \geq 20$ | 29% | HP > 2 | 57% |
| M+ | 24% | | |
| Rock | 0% | | |
| Unsuitable | 0% | | |

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

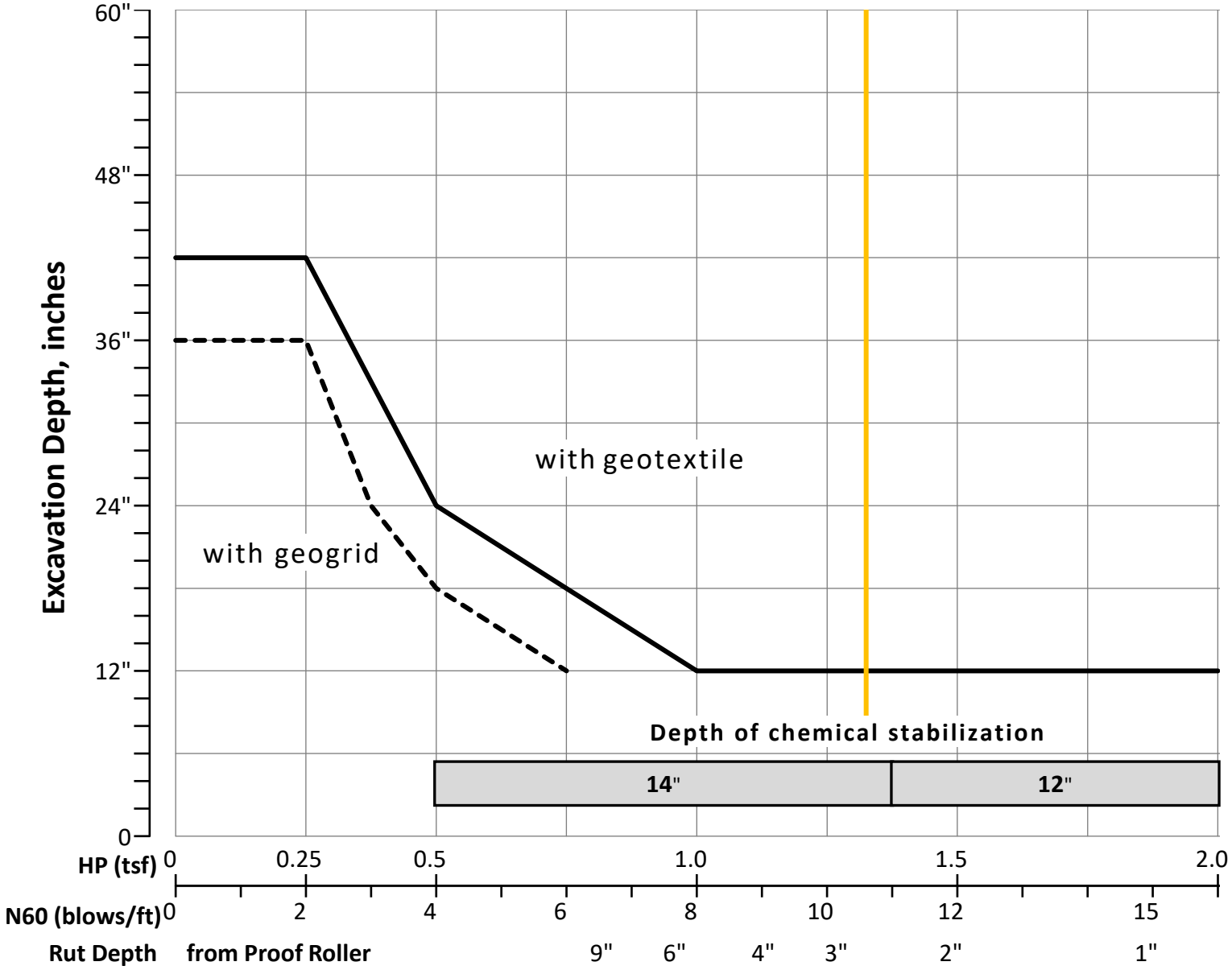
| % Proposed Subgrade Surface | |
|---|---|
| Unstable & Unsuitable | 60% |
| Unstable | 60% |
| Unsuitable | 0% |

| | $N_{60}$ | $N_{60L}$ | HP | LL | PL | PI | Silt | Clay | P 200 | $M_C$ | $M_{OPT}$ | GI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 18 | 11 | 2.90 | 36 | 16 | 20 | 36 | 37 | 72 | 16 | 15 | 12 |
| Maximum | 40 | 14 | 4.50 | 47 | 21 | 30 | 53 | 44 | 89 | 31 | 18 | 16 |
| Minimum | 7 | 7 | 1.00 | 30 | 10 | 13 | 26 | 30 | 64 | 12 | 10 | 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 8 | 8 | 0 | 6 | 0 | 0 | 24 |
| Percent | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 8% | 0% | 0% | 33% | 33% | 0% | 25% | 0% | 0% | 100% |
| % Rock\|Granular\|Cohesive | 0% | 8% | | | | | | | | | 92% | | | | | | | | 100% |
| Surface Class Count | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 | 0 | 3 | 0 | 0 | 10 |
| Surface Class Percent | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 30% | 40% | 0% | 30% | 0% | 0% | 100% |

**Fig. 600-1 – Subgrade Stabilization**




OVERRIDE TABLE

| Calculated Average | New Values | Check to Override |
|---|---|---|
| 2.90 | | ☐ HP |
| 10.67 | | ☐ N60L |

Average HP
Average $N_{60L}$