Resource International, Inc.

FUL-20-19.75
INTERSECTION IMPROVEMENTS
ODOT PID NO: 118185
FULTON COUNTY, OHIO

ROADWAY EXPLORATION REPORT

Prepared For:
Crawford, Murphy & Tilly
6060 Rockside Woods Blvd. N, Suite 321
Independence, Ohio 44131

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

Rii Project No. W-23-091

August 2025

RESOURCE INTERNATIONAL, INC.
6350 Presidential Gateway
Columbus, Ohio 43231
T: 614.823.4949

July 24, 2025 (Revised August 14, 2025)

Mr. Joshua Lockhart, P.E.
Project Manager
Crawford, Murphy & Tilly
8101 N High Street, Suite 150
Columbus, Ohio 43235

Re: Roadway Exploration Report
FUL-20-19.785
Intersection Improvements
PID No. 118185
Fulton County, Ohio
Rii Project No. W-23-091 (Rev. 1)

Mr. Lockhart:

Resource International, Inc. (Rii) is pleased to submit this revised 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 proposed improvements to the intersection of US 20 and SR 109 in Royalton Township, Fulton County, Ohio. This revised report supersedes our 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.

Daniel K. Hayes, E.I.
Staff Engineer

Daniel E. Karch, P.E.
Director – Geotechnical Services

Enclosure: Revised Roadway Exploration Report

TABLE OF CONTENTS

APPENDICES

EXECUTIVE SUMMARY

Resource International, Inc. (Rii) has completed a roadway exploration for the proposed improvements to the intersection of US 20 and SR 109 in Royalton Township, Fulton County, Ohio. It is understood that the project consists of a single lane roundabout at the intersection of US 20 and SR 109. It is understood the proposed improvements will consist of upgrading the intersection of the roadways to a single lane roundabout at the intersection of US 20 and SR 109 with 13-inches non-reinforced concrete pavement. Additionally, underdrains will be installed at regular intervals along both US 20 and SR 109 and at the proposed roundabout. Standard lighting will also be installed outside of the proposed roundabout.

Exploration and Findings

On September 5, 2023, a total of six (6) roadway borings, designated as B-001-0-23 through B-006-0-21, were drilled to completion depths ranging from 6.0 to 7.8 feet below the existing roadway and ground surface grades. The boring locations are summarized in Table 1 and area illustrated on the boring plan presented in Appendix I of this report.

All soil borings were performed in the area of the proposed improvement and encountered topsoil or existing asphalt overlying aggregate base material.

Beneath the pavement materials and topsoil in the borings, natural cohesive and granular soils were encountered to the boring termination depths. The cohesive soils were described as silt and clay, clay, silty clay, and sandy silt (ODOT A-6a, A-7-6, A-6b, A-4a). The granular soils were described as course and fine sand (ODOT A-3a).

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

Groundwater was encountered at completion of drilling in borings B-001-0-23 and B-00-004-23 at depths of 6.1 and 5.2 feet below the ground surface, respectively.

Analysis and Recommendations

Pavement Subgrade Recommendations

The subgrade soils along the alignment, are anticipated to consist of predominantly cohesive materials comprised of stiff to hard silt and clay, clay, silty clay, and sandy silt (ODOT A-6a, A-7-6, A-6b, 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 GDM. Based on the results of the subgrade analysis, the overall average site parameters based on all of the soil borings performed as part of this exploration are as follows:

Overall Average Site Parameters

Average N_{60L}	Average PI	Average Moisture	Average Optimum Moisture	Average Group Index	Design CBR
10	17	18	15	11	6

Based on the conditions encountered across the subject site, **it is recommended that pavement design be based on a CBR value of 6** with a corresponding resilient modulus, M_R, of 7,200 psi. Correlation charts indicate a modulus of subgrade reaction (K) of 150 pci and a soil support value (SSV) of 4.4.

Applying the averages in Table 5 and based on the results of the GB-1 analysis the following global stabilization options within the project limits:

Option 1. Chemically stabilize the entire subgrade with 14-inches of cement, as per ODOT Construction and Materials Specification (CMS) Item 206. For estimating purposes, utilize a cement content of 5.0 percent by weight of soil. Actual application rates shall be verified by the contractor under Item 206.06 Mixture Design for Chemically Stabilized Soils.

Option 2. Undercut 18-inch of subgrade and replace with Item 204 Granular Material Type B, Type C or Type D. It is recommended that Item 204 Geotextile be placed at the bottom of the undercut.

High Mast Lighting

It is understood that high mast lighting is proposed in the vicinity of the roundabout just beyond the proposed pavement limits. Based on the conditions encountered in borings B-002-0-23 and B-003-0-23, cohesive soils with undrained shear strengths greater than 2,000 psf were encountered, based on the hand penetrometer tests. These soils meet the requirements in standard construction drawing HL 20.11 dated July 12, 2023.

Please note that this executive summary does not contain all the information presented in the report. The unabridged Subgrade 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 improvements to the intersection of US 20 and SR 109 in Royalton Township, Fulton County, Ohio. It is understood the proposed improvements will consist of upgrading the intersection of the roadways to a single lane roundabout at the intersection of US 20 and SR 109. The proposed pavement buildup with consist of 13-inches non-reinforced concrete over 6-inches of aggregate base. Additionally, underdrains will be installed at regular intervals along both the improved sections of US 20 and SR 109 as well as at the proposed roundabout. Standard high mast lighting will also be installed in the vicinity of the proposed roundabout just beyond the proposed pavement limits.

This exploration was performed in accordance with the Ohio Department of Transportation (ODOT) Specification for Geotechnical Explorations (SGE) dated July 2023.

2.0 GEOLOGY AND OBSERVATIONS OF THE PROJECT

2.1 Site Geology

Physiographically, the project site falls within Maumee Sand Plains Region of the Huron-Erie Lake Plains. This low-relief region is generally dominated by lacustrine plains mantled by sand. Surficial features of this region include low dunes, inter-dunal pans, beach ridges, and sand sheets of glacial lakeshores.

Based on bedrock geology and topography maps of the area from the Ohio Department of Natural Resources (ODNR), the underlying bedrock beneath the site is Mississippian- to Devonian-aged Sunbury Shale, Berea Sandstone, and Bedford Shale, undivided. This group of formations is comprised of interbedded sandstone, siltstone, and shale. The Sunbury Shale is a dark brown to black, thinly bedded, carbonaceous shale. This unit ranges between 10 to 40 feet thick. The Berea Sandstone unit contains brown, planar to lenticular, thin to thickly bedded sandstone and minor shale. The Bedford Shale unit contains gray to brown, weathers reddish-brown, planar to lenticular, thin to medium bedded, silty to clayey shale and interbedded siltstone and sandstone. This unit ranges between 80 to 180 feet thick, but can be thin to absent where the Berea Sandstone is thick. The bedrock surface in the vicinity of the site is at an approximate elevation of 590 feet, which ranges between approximately 150 to 160 feet below the existing ground surface.

2.2 Existing Site Conditions

The project site is located in the north-eastern part of Fulton County in Royalton Township, Ohio. The site is located at the intersection of US 20 and SR 109. Within the limits of the project, US 20 is situated in the east-west direction and SR 109 is situated in the

north-south direction. The roadways are two-lane asphalt surfaced and traverse predominantly agricultural land. At the interchange, a left turn lane is present along US-20 at both the west and east legs. Traffic is maintained along SR 109 by stop signs at north and south legs. Surface drainage appears to be directed to the ditches on either side of the roadways. Regionally, the site drains to the northwest toward Bear Creek and to the southeast toward Tenmile Creek. The existing pavement along each of the alignments appear to be in good condition with only isolated areas of distresses observed by alligator or transverse cracking.

3.0 EXPLORATION

On September 5, 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 6.0 to 7.8 feet below the existing roadway and ground surface grades. The boring locations are summarized in Table 1 and are illustrated on the boring plan presented in Appendix I of this report.

Table 1. Test Boring Summary

Boring	Reference Alignment	Latitude	Longitude	Ground Elevation (feet msl) [1]	Boring Depth (feet)
B-001-0-23	US 20	41.670814°	-84.037457°	756.3	7.8
B-002-0-23	SR 109	41.670592°	-84.036014°	754.1	6.0
B-003-0-23	SR 109	41.671081°	-84.035530°	754.7	6.0
B-004-0-23	US 20	41.670921°	-84.034287°	755.4	7.8
B-005-0-23	SR 109	41.669499°	-84.035813°	756.3	7.5
B-006-0-23	SR 109	41.672201°	-84.035963°	758.8	7.5

1. Ground surface elevations are estimated from Google Earth™.

The borings were drilled with a Mobile B-53 truck mounted rotary drilling machine, utilizing a 4.5-inch outside diameter, continuous flight augers to advance the holes. In general, standard penetration testing (SPT) and split spoon sampling at 1.5-foot intervals to the boring termination depth within each of the borings.

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. Rii utilized a calibrated automatic drop hammer to generate consistent energy transfer to the sampler. 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). Standard penetration blow counts aid in determining soil properties applicable in pavement and foundation system design. Measured blow count (N) values are corrected to an equivalent

(60%) energy ratio, N_{60}, by the following equation. Both values are represented on boring logs in Appendix III

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

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

The automatic hammer for the Mobile B-53 drill rig used for this project was calibrated on March 21, 2022 and has 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 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.

Upon completion of drilling, the borings were backfilled with either soil cuttings generated during the drilling process or a mixture of soil cuttings and bentonite chips. Where borings penetrated the existing subgrade, the pavement surface was patched with an equivalent thickness of cold patch asphalt.

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 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	26
Plastic and Liquid Limits	AASHTO T89, T90	10
Gradation – Sieve/Hydrometer	AASHTO T88	12
Sulfate Content – Colorimetric Method	ODOT S1122	6

The tests performed are necessary to classify existing soil according to the Ohio Department of Transportation (ODOT) classification system and to estimate engineering properties of importance for pavement 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

All soil borings were performed in the area of the proposed improvements and encountered topsoil or existing pavement materials. Borings B-002-0-23 and B-003-0-23 encountered 10.0 and 12.0 inches, respectively, of topsoil at the existing ground surface. The remaining borings encountered 10.5 to 18.5 inches of asphalt overlying 3.5 to 7.5 inches of aggregate base material. A summary of surface material thicknesses is summarized in Table 3. For further details please see the boring logs in Appendix III.

Table 3. Pavement Core Thickness Summary

Boring	Topsoil Thickness (in)	Asphalt Thickness (in)	Aggregate Base (in)
B-001-0-23	-	18.0	6.0
B-002-0-23	10.0	-	-
B-003-0-23	12.0	-	-
B-004-0-23	-	18.5	3.5
B-005-0-23	-	13.25	4.75
B-006-0-23	-	10.5	7.5

4.2 Subsurface Soils

Beneath the pavement materials and topsoil in the borings, natural cohesive and granular soils were encountered to the boring termination depths. The cohesive soils were described as sandy silt, silt and clay, silty clay, and clay (ODOT A-4a, A-6a, A-6b, A-7-6). The granular soils were described as coarse and fine sand (ODOT A-3a).

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 stiff ($1.0 < HP \leq 2.0$ tsf) to hard ($4.5 < HP$ tsf). The unconfined compressive strength

of the cohesive soil samples tested, obtained from the hand penetrometer, ranged from 1.25 tsf to over 4.5 tsf (limit of instrument).

Natural moisture contents of the soil samples tested ranged from 12 to 26 percent. The natural moisture contents of the cohesive soil samples tested for plasticity index ranged from 4 percent below to 7 percent above their corresponding plastic limits. In general, the soils exhibited natural moisture contents estimated to be slightly to significantly above their optimum moisture levels.

Sulfate testing was performed in accordance with the ODOT S1122 Colorimetric Method on the upper soils of the existing subgrade along the proposed alignments, as outlined in the current ODOT GDM. Based on the results of the testing, the sulfate contents of the subgrade soils range from less than 100 to 140 parts per million (ppm or mg/kg of material). A summary of surface material thicknesses is summarized Table 4. For further details please see the boring logs in Appendix III.

Table 4. Sulfate Content

Boring	Sulfate Content (ppm)
B-001-0-23	100
B-002-0-23	100
B-003-0-23	30
B-004-0-23	140
B-005-0-23	40
B-006-0-23	120

4.3 Bedrock

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

4.4 Groundwater

Groundwater was encountered upon completion of drilling in borings B-001-0-23 and B-004-0-23 at depths of 6.1 and 5.2 feet, respectively, below the ground surface.

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 boring logs in Appendix III.

5.0 ANALYSES AND RECOMMENDATIONS

Data obtained from the drilling and testing program have been used to determine pavement support capabilities for the soils encountered at the site. These parameters have been used to provide guidelines for the design of the pavement system, 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 subgrade soils along the alignment, are anticipated to consist of predominantly cohesive materials comprised of stiff to hard silt and clay, clay, silty clay, and sandy silt (ODOT A-6a, A-7-6, A-6b, 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. Proposed grading information was not available at the time of this draft report. It is understood that the proposed subgrade will generally match the existing subgrade within the existing roadways, and that minor amounts of earthwork cut or fill will be required outside the limits of the existing pavement to achieve the proposed subgrade elevations in the vicinity of the proposed roundabout.

5.1.1 Subgrade Stabilization

Based on the ODOT GDM 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 85 percent of the subgrade area is anticipated to require stabilization based on the soil borings performed. Per ODOT subgrade analysis, global stabilization recommendations are based upon the overall average site parameters, as noted in Table 5.

Table 5. Average Site Parameters

Average N_{60L}	Average PI	Average Moisture	Average Optimum Moisture	Average Group Index	Average CBR
10	17	18	15	11	6

Applying the averages in Table 5 and based on the results of the subgrade analysis the following global stabilization options within the project limits:

Option 1. Chemically stabilize the entire subgrade with 14-inches of lime or cement, as per ODOT Construction and Materials Specification (CMS) Item 206. For estimating purposes, utilize a cement content of 5.0 percent by weight of soil. Actual application rates shall be verified by the contractor under Item 206.06 Mixture Design for Chemically Stabilized Soils.

Option 2. Undercut 18-inch of subgrade and replace with Item 204 Granular Material Type B, Type C or Type D. It is recommended that Item 204 Geotextile be placed at the bottom of the undercut.

Per ODOT GDM requirements, the entire subgrade should be stabilized using one of the global stabilization options provided above. Upon completion of the stabilization, the entire subgrade should be proof rolled to verify that stability has been achieved.

5.1.2 Subgrade Design Considerations

Based on the conditions encountered across the subject site, **it is recommended that pavement design be based on a CBR value of 6** with a corresponding resilient modulus, M_R, of 7,200 psi. Correlation charts indicate a modulus of subgrade reaction (K) of 150 pci and a soil support value (SSV) of 4.4.

Boring B-006 encountered very loose coarse and fine sand (ODOT A-3a) at a depth of 4.5 feet below the existing ground surface, which is within the proposed subgrade. Where global stabilization and a subsequent proof roll are performed to verify performance, no further remediation of these soils is considered necessary.

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 140 ppm. Therefore, soil with sulfate content greater than 5,000 ppm was not encountered in any boring.

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 of 6.

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. Based on the elevated natural moisture contents compared to the optimum values, as shown in the boring logs and subgrade analysis, it is recommended that underdrains be considered for the proposed improvements. Under

drains should be installed in accordance with the specifications in Item 204 of the ODOT CMS.

5.1.3 High Mast Lighting Foundations

It is understood that high mast lighting is proposed in the vicinity of the roundabout just beyond the proposed pavement limits. Based on the conditions encountered in borings B-002-0-23 and B-003-0-23, cohesive soils with undrained shear strengths greater than 2,000 psf were encountered, based on the hand penetrometer tests. These soils meet the requirements in standard construction drawing HL 20.11 dated July 12, 2023.

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).

5.3 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 or trench boxes may be required. Based on the conditions encountered in the soil borings, maximum back slopes of 1.5H:1V (Horizontal:Vertical) are anticipated at this site. However, ground conditions may vary between the boring locations. Actual excavation back slopes must be field verified by qualified personnel at the time of excavation in strict accordance with OSHA guidelines.

5.4 Groundwater Considerations

Groundwater was encountered upon completion of drilling in borings B-001-0-23 and B-004-0-23 at depths of 6.1 and 5.2 feet, respectively, below the ground surface. Based on available plans, excavations are not anticipated to extend to the depths at which groundwater was encountered in the borings.

Based on the groundwater observations made during drilling, little to no groundwater seepage is anticipated to be encountered during construction at the site. Wherever 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 pavement system and are part of these 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 for the current investigation. Resource International is not responsible for the data, conclusions, opinions or recommendations made by others during previous investigations at this 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.

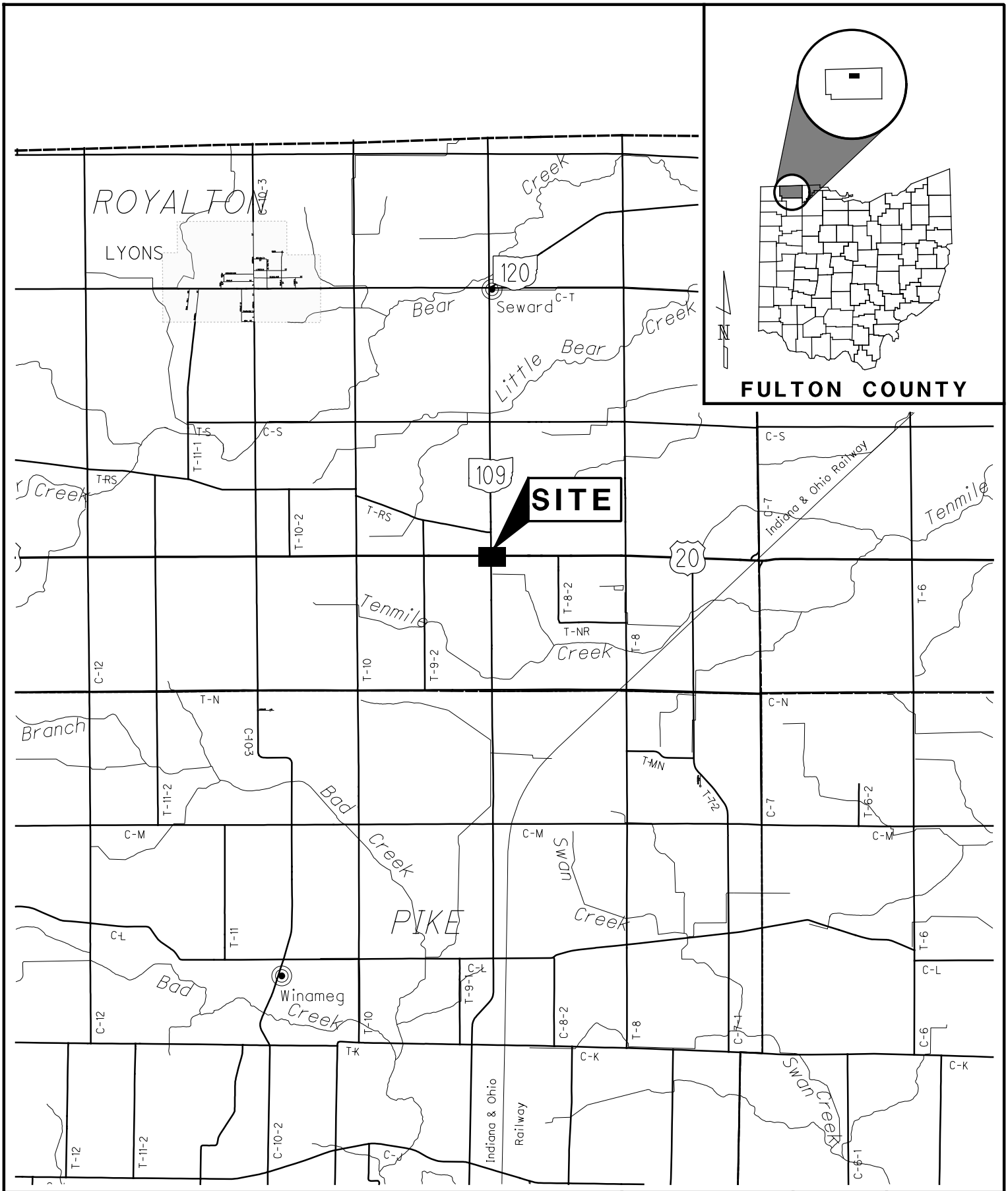
The conclusions and recommendations herein have been based upon the available soil and bedrock information and the design details furnished by a representative of the owner of the proposed project. Any revision in the plans for the proposed construction from those anticipated in this report should be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



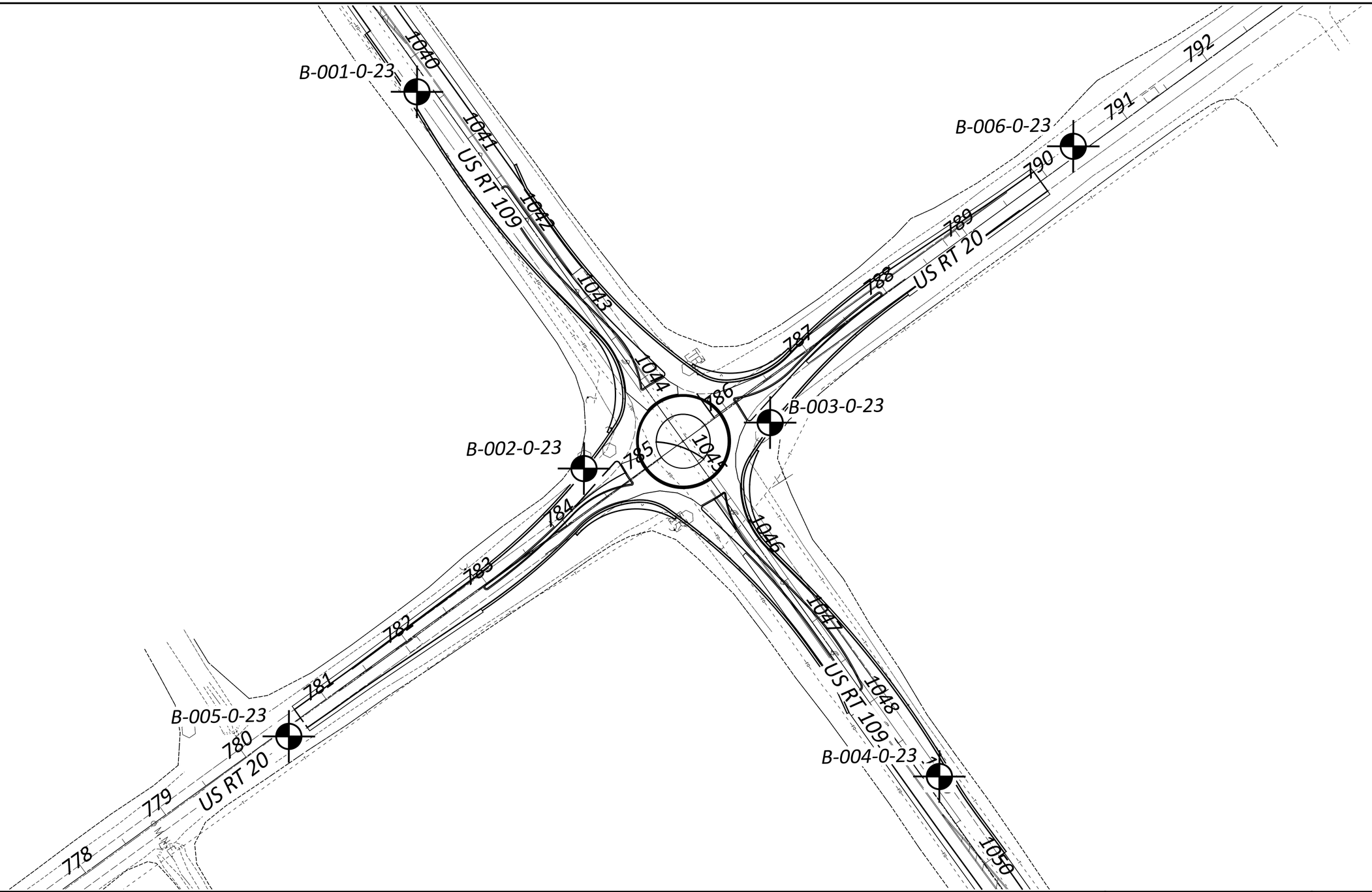
VICINITY MAP

ODOT FUL-20-19.75 PID 118185

FULTON COUNTY, OHIO

RII PROJECT NO. W-23-091	DRAWN JAS
SCALE: 1"=5000' (0, 2500, 5000)	REVIEWED DKH
	DATE 11/17/2023

RESOURCE INTERNATIONAL Rii



BORING PLAN
FUL-20-19.75 PID 118185
FULTON COUNTY, OHIO

RII PROJECT NO. W-23-091		DRAWN ALF
SCALE: 1"=100' 0 50 100	N	REVIEWED DH
		DATE 11/7/2023

RESOURCE INTERNATIONAL Rii

APPENDIX II

DESCRIPTION OF SOIL TERMS

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.

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.

APPENDIX III

BORING LOGS:

B-001-0-21 through B-006-0-21

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: FUL-20-19.78 INTERS. IMPROV.	DRILLING FIRM / OPERATOR: RII / BG	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 1040+31.42 / 14.4' RT	**EXPLORATION ID B-001-0-23**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / TK	HAMMER: AUTOMATIC	ALIGNMENT: US 20		
PID: 118185 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 756.3 (MSL) EOB: 7.8 ft.		PAGE 1 OF 1
START: 9/5/23 END: 9/5/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79	LAT / LONG: 41.670814, -84.037457		

MATERIAL DESCRIPTION AND NOTES	ELEV. 756.3	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
1.5' - ASPHALT (18.0")	754.8																		
0.5' - AGGREGATE BASE (6.0")	754.3					2S-1A	-	-	-	-	-	-	-	-	-	-		-	
STIFF, DARK BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.	753.0		4 3 3	8	50	SS-1B	2.00	16	10	14	30	30	30	17	13	21	A-6a (6)	100	
STIFF TO VERY STIFF, BROWNISH GRAY TO BROWN **CLAY**, SOME SILT, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.			3 2 3	7	50	SS-2	2.00	2	5	19	24	50	43	18	25	23	A-7-6 (14)	-	
			0 1 2	4	56	SS-3	2.00	-	-	-	-	-	-	-	-	19	A-7-6 (V)	-	
	748.5	EOB	3 4 8	16	69	SS-4	4.00	-	-	-	-	-	-	-	-	18	A-7-6 (V)	-	

NOTES: GROUNDWATER ENCOUNTERED AT COMPLETION @ 6.1'; CAVE-IN DEPTH @ 7.1'

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

RESOURCE INTERNATIONAL, INC.

PROJECT: FUL-20-19.78 INTERS. IMPROV.	DRILLING FIRM / OPERATOR: RII / BG	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 786+27.46 / 36.45' RT	**EXPLORATION ID B-002-0-23**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / TK	HAMMER: AUTOMATIC	ALIGNMENT: SR 109		
PID: 118185 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 754.1 (MSL) EOB: 6.0 ft.		PAGE 1 OF 1
START: 9/5/23 END: 9/5/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79	LAT / LONG: 41.670592, -84.036014		

MATERIAL DESCRIPTION AND NOTES	ELEV. 754.1	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
0.8' - TOPSOIL (10.0")	753.3																		
VERY STIFF, DARK BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. -ROOT FIBERS IN SS-1	752.6	1	3 2 3	7	67	SS-1A	-	-	-	-	-	-	-	-	-	-		-	
						SS-1B	3.50	5	6	24	31	34	31	17	14	16	A-6a (8)	100	
		2	3 3 3	8	81	SS-2	3.00	1	3	22	22	52	40	18	22	21	A-6b (13)	-	
VERY STIFF, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. -ROOT FIBERS IN SS-2		3	3 3 4	9	58	SS-3	3.00	-	-	-	-	-	-	-	-	18	A-6b (V)	-	
		4	4 3 4	9	61	SS-4	3.00	-	-	-	-	-	-	-	-	17	A-6b (V)	-	
	748.1	EOB 5 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: FUL-20-19.78 INTERS. IMPROV.	DRILLING FIRM / OPERATOR: RII / BG	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 784+47.75 / 36.31' LT	**EXPLORATION ID B-003-0-23**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / TK	HAMMER: AUTOMATIC	ALIGNMENT: SR 109	
PID: 118185 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 754.7 (MSL) EOB: 6.0 ft.	PAGE 1 OF 1
START: 9/5/23 END: 9/5/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79	LAT / LONG: 41.671081, -84.035530	

MATERIAL DESCRIPTION AND NOTES	ELEV. 754.7	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
1.0' - TOPSOIL (12.0")	753.7		3 4 5	12	72	SS-1A	-	-	-	-	-	-	-	-	-	-		-	
STIFF, DARK BROWN **SILT AND CLAY**, "AND" COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. -ROOT FIBERS IN SS-1	753.2	1				SS-1B	1.25	2	8	30	32	28	31	19	12	15	A-6a (6)	<100	
		2	2 3 5	11	56	SS-2	4.5+	3	10	24	16	47	39	17	22	17	A-6b (10)	-	
HARD, BROWNISH GRAY TO BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST. -ROOT FIBERS IN SS-2		3	4 3 5	11	83	SS-3	4.00	-	-	-	-	-	-	-	-	18	A-6b (V)	-	
		4	4 5 6	14	97	SS-4	4.5+	-	-	-	-	-	-	-	-	15	A-6b (V)	-	
	748.7	EOB 5 6																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 5.6'

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

RESOURCE INTERNATIONAL, INC.

PROJECT: FUL-20-19.78 INTERS. IMPROV.	DRILLING FIRM / OPERATOR: RII / BG	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 1049+1.63 / 14.13' LT	**EXPLORATION ID B-004-0-23**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / TK	HAMMER: AUTOMATIC	ALIGNMENT: US 20		
PID: 118185 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 755.4 (MSL) EOB: 7.8 ft.		PAGE 1 OF 1
START: 9/5/23 END: 9/5/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79	LAT / LONG: 41.670921, -84.034287		

MATERIAL DESCRIPTION AND NOTES	ELEV. 755.4	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
1.5' - ASPHALT (18.5")	753.9																		
0.3' - AGGREGATE BASE (3.5")	753.6																		
VERY STIFF, GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST.	752.6		2 3 3	8	81	SS-1A	4.00	2	13	29	28	28	28	18	10	21	A-4a (4)	140	
						SS-1B	2.00	1	4	36	10	49	32	15	17	20	A-6b (8)	-	
VERY STIFF, BROWNISH GRAY **SILTY CLAY**, "AND" COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	750.1	▽ 750.2	1 1 3	5	58	SS-2	2.00	-	-	-	-	-	-	-	-	20	A-6b (V)	-	
			0 3 5	11	89	SS-3A	1.25	-	-	-	-	-	-	-	-	22	A-6b (V)	-	
						SS-3B	4.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
HARD, BROWNISH GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.	747.6	EOB	5 6 8	18	89	SS-4	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	-	

NOTES: GROUNDWATER ENCOUNTERED AT COMPLETION @ 5.2'; CAVE-IN DEPTH @ 6.6'

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

RESOURCE INTERNATIONAL, INC.

PROJECT: FUL-20-19.78 INTERS. IMPROV.	DRILLING FIRM / OPERATOR: RII / BG	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 780+47.36 / 8.53' RT	**EXPLORATION ID B-005-0-23**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / TK	HAMMER: AUTOMATIC	ALIGNMENT: SR 109		
PID: 118185 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 756.3 (MSL) EOB: 7.5 ft.		PAGE 1 OF 1
START: 9/5/23 END: 9/5/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79	LAT / LONG: 41.669499, -84.038130		

MATERIAL DESCRIPTION AND NOTES	ELEV. 756.3	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
1.1' - ASPHALT (13.25")	755.2																		
0.4' - AGGREGATE BASE (4.75")	754.8																		
VERY STIFF, DARK BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	753.3		2 3 4	9	78	SS-1	2.00	1	15	18	34	32	34	19	15	26	A-6a (8)	<100	
VERY STIFF TO HARD, GRAY TO BROWNISH GRAY **CLAY**, SOME SILT, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.			1 2 3	7	58	SS-2	2.50	2	3	21	20	54	41	17	24	22	A-7-6 (14)	-	
			1 2 3	7	78	SS-3	2.00	-	-	-	-	-	-	-	-	18	A-7-6 (V)	-	
	748.8	EOB	4 5 7	16	100	SS-4	4.50	-	-	-	-	-	-	-	-	15	A-7-6 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

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

RESOURCE INTERNATIONAL, INC.

PROJECT: FUL-20-19.78 INTERS. IMPROV.	DRILLING FIRM / OPERATOR: RII / BG	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 790+39.53 / 9.21' LT	**EXPLORATION ID B-006-0-23**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / TK	HAMMER: AUTOMATIC	ALIGNMENT: SR 109		
PID: 118185 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 758.8 (MSL) EOB: 7.5 ft.		PAGE 1 OF 1
START: 9/5/23 END: 9/5/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79	LAT / LONG: 41.672201, -84.035963		

MATERIAL DESCRIPTION AND NOTES	ELEV. 758.8	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
0.8' - ASPHALT (10.5")	758.0																		
0.7' - AGGREGATE BASE (7.5")	757.3																		
VERY LOOSE TO MEDIUM DENSE, DARK BROWN **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, MOIST.	754.3	1 2 3 4	5 5 3	11	67	SS-1	-	0	9	68	16	7	NP	NP	NP	12	A-3a (0)	120	
			2 1 2	4	89	SS-2	-	1	4	67	9	19	NP	NP	NP	18	A-3a (0)	-	
STIFF TO VERY STIFF, BROWNISH GRAY TO BROWN **SILTY CLAY**, SOME SILT, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	751.3	5 6 7	1 1 3	5	61	SS-3	3.25	-	-	-	-	-	-	-	-	17	A-6b (V)	-	
EOB			3 4 5	12	92	SS-4	4.00	-	-	-	-	-	-	-	-	17	A-6b (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 6.8'

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

APPENDIX IV

PAVEMENT CORE DATA SHEETS

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

Pavement Core Data Summary

PROJECT	FUL-20-19.78 Intersection Improvements
LOCATION	US 20 and SR109, Royalton Township, Fulton Coun
JOB No.	W-23-091
BORING/CORE No.	B-001-0-23
DATE CORE OBTAINED	9/5/2023
CORE OBTAINED BY	BG, JK

Core Composition

Core Number	Layer Thickness (in.)	Pavement Layer Number	Asphalt: Surface Binder	Asphalt: Intermediate Binder	Asphalt: Base Binder	Concrete	Other: Aggregate/Granular Base	Other	Other	Other
B-001-0-23	1.25	7	✓							
	1.50	6		✓						
	3.50	5		✓						
	2.50	4		✓						
	2.50	3		✓						
	6.75	2		✓						
	6.00	1					✓			

Comments/Remarks

- Core is separated between layers 1 and 2, and layers 2 and 3
  Layer 1 is entirely deteriorated

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

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

Pavement Core Data Summary

PROJECT	FUL-20-19.78 Intersection Improvements
LOCATION	US 20 and SR109, Royalton Township, Fulton Coun
JOB No.	W-23-091
BORING/CORE No.	B-004-0-23
DATE CORE OBTAINED	9/5/2023
CORE OBTAINED BY	BG, JK

Core Composition

Core Number	Layer Thickness (in.)	Pavement Layer Number	Asphalt: Surface Binder	Asphalt: Intermediate Binder	Asphalt: Base Binder	Concrete	Other: Aggregate/Granular Base	Other	Other	Other
B-004-0-23	1.75	5	✓							
	2.75	4		✓						
	3.50	3		✓						
	10.00	2		✓						
	3.50	1					✓			

Comments/Remarks

- Core is separated between layers 1 and 2
  Layer 1 is entirely deteriorated
  Layer 2 has some voids

Total Pavement Thickness =	18.00	in.	Total Asphalt Thickness =	18.00	in.	Total Concrete Thickness =	0.00	in.	Total Base Thickness =	3.50	in.

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

Pavement Core Data Summary

PROJECT	FUL-20-19.78 Intersection Improvements
LOCATION	US 20 and SR109, Royalton Township, Fulton Coun
JOB No.	W-23-091
BORING/CORE No.	B-005-0-23
DATE CORE OBTAINED	9/5/2023
CORE OBTAINED BY	BG, JK

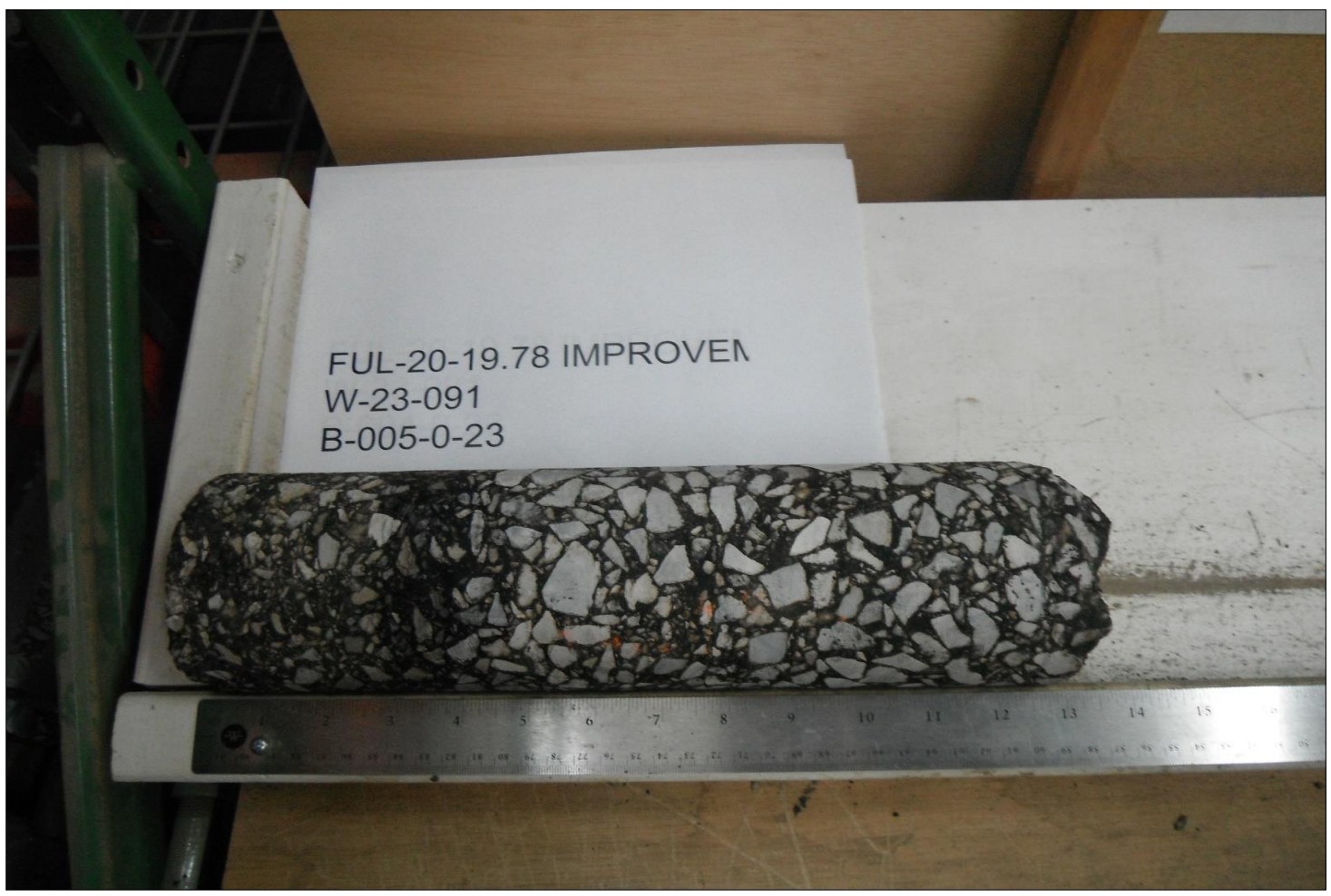
Core Composition

Core Number	Layer Thickness (in.)	Pavement Layer Number	Asphalt: Surface Binder	Asphalt: Intermediate Binder	Asphalt: Base Binder	Concrete	Other: Aggregate/Granular Base	Other	Other	Other
B-005-0-23	1.25	6	✓							
	2.00	5		✓						
	0.75	4		✓						
	3.75	3		✓						
	5.50	2		✓						
	4.75	1					✓			

Comments/Remarks

- Core is intact

Total Pavement Thickness =	13.25	in.	Total Asphalt Thickness =	13.25	in.	Total Concrete Thickness =	0.00 in.	Total Base Thickness =	4.75 in.



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

Pavement Core Data Summary

PROJECT	FUL-20-19.78 Intersection Improvements
LOCATION	US 20 and SR109, Royalton Township, Fulton Coun
JOB No.	W-23-091
BORING/CORE No.	B-006-0-23
DATE CORE OBTAINED	9/5/2023
CORE OBTAINED BY	BG, JK

Core Composition

Core Number	Layer Thickness (in.)	Pavement Layer Number	Asphalt: Surface Binder	Asphalt: Intermediate Binder	Asphalt: Base Binder	Concrete	Other: Aggregate/Granular Base	Other	Other	Other
B-006-0-23	1.25	7	✓							
	2.00	6		✓						
	1.50	5		✓						
	1.50	4		✓						
	2.50	3		✓						
	1.75	2		✓						
	7.50	1					✓			

Comments/Remarks

- Core is separated between layers 2 and 3
  Layer 3 has trace voids

Total Pavement Thickness =	10.50	in.	Total Asphalt Thickness =	10.50	in.	Total Concrete Thickness =	0.00 in.	Total Base Thickness =	7.50 in.

APPENDIX V

SUBGRADE STABILIZATION SUMMARY

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Design Manual Section 600

Instructions: Enter data in the shaded cells only.
(Enter state route number, project description,county, consultant's name, prepared by name, and date prepared. This information will be transferred to all other sheets. The date prepared must be entered in the appropriate cell on this sheet to remove these instructions prior to printing.)

FUL-20-19.78
118185
Improvements to the intersection of US Route 20 and SR 109 in Fulton County, Ohio.

Resource International, Inc.

Prepared By: Daniel Karch, P.E.
Date prepared: Thursday, December 7, 2023

Daniel Karch
6350 Presidential Gateway
Columbus, Ohio 43212

614.823.4949
danielk@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	CL OF US 20	1040+31	14	RT	MOBILE B53	79	756.0	755.0	1.0 C
2	B-002-0-23	CL OF SR 109	786+27	36	RT	MOBILE B53	79	755.0	754.0	1.0 C
3	B-003-0-23	CL OF SR 109	784+48	36	LT	MOBILE B53	79	755.0	754.0	1.0 C
4	B-004-0-23	CL OF US 20	1049+02	14	LT	MOBILE B53	79	755.0	754.0	1.0 C
5	B-005-0-23	CL OF SR 109	780+47	9	RT	MOBILE B53	79	757.0	756.0	1.0 C
6	B-006-0-23	CL OF SR 109	790+40	9	LT	MOBILE B53	79	758.0	757.0	1.0 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 001-0 23	1	1.8	3.3	0.8	2.3	8		2	30	17	13	30	30	60	21	14	A-6a	6	100		N_{60} & Mc		12"	206 Cement or 204 Geotextile
		2	3.3	4.8	2.3	3.8	7		2	43	18	25	24	50	74	23	18	A-7-6	14						
		3	4.8	6.3	3.8	5.3	4		2							19	18	A-7-6	16						
		4	6.3	7.8	5.3	6.8	16	4	4							18	18	A-7-6							
2	B 002-0 23	1	0.0	1.5	-1.0	0.5	7		3.5	31	17	14	31	34	65	16	14	A-6a	8	100		N_{60}		15"	206 Cement or 204 Geotextile
		2	1.5	3.0	0.5	2.0	8		3	40	18	22	22	52	74	21	16	A-6b	13			N_{60} & Mc		12"	
		3	3.0	4.5	2.0	3.5	9		3							18	14	A-6a	10			N_{60} & Mc			
		4	4.5	6.0	3.5	5.0	9	7	3							17	16	A-6b	16						
3	B 003-0 23	1	0.0	1.5	-1.0	0.5	12		1.25	31	19	12	32	28	60	15	14	A-6a	6	100		HP		12"	206 Cement or 204 Geotextile
		2	1.5	3.0	0.5	2.0	11		4.5	39	17	22	16	47	63	17	16	A-6b	10			N_{60}		12"	
		3	3.0	4.5	2.0	3.5	11		4							18	16	A-6b	16			N_{60}			
		4	4.5	6.0	3.5	5.0	14	11	4.5							15	16	A-6b	16						
4	B 004-0 23	1	1.8	3.3	0.8	2.3	8		4	28	18	10	28	28	56	21	13	A-4a	4	140		N_{60} & Mc		12"	206 Cement or 204 Geotextile
		2	3.3	4.8	2.3	3.8	5		2	32	15	17	10	49	59	20	16	A-6b	8						
		3	4.8	6.3	3.8	5.3	11		1.25							22	16	A-6b	16						
		4	6.3	7.8	5.3	6.8	18	5	4.5							15	14	A-6a							
5	B 005-0 23	1	1.5	3.0	0.5	2.0	9		2	34	19	15	34	32	66	26	14	A-6a	8	100		N_{60} & Mc		12"	206 Cement or 204 Geotextile
		2	3.0	4.5	2.0	3.5	7		2.5	41	17	24	20	54	74	22	18	A-7-6	14			N_{60} & Mc			
		3	4.5	6.0	3.5	5.0	7		2							18	18	A-7-6	16						
		4	6.0	7.5	5.0	6.5	16	7	4.5							15	18	A-7-6	16						
6	B 006-0 23	1	1.5	3.0	0.5	2.0	11			NP	NP	NP	16	7	23	12	8	A-3a	0	120					
		2	3.0	4.5	2.0	3.5	4			NP	NP	NP	9	19	28	18	8	A-3a	0						
		3	4.5	6.0	3.5	5.0	5		3.25							17	16	A-6b	16						
		4	6.0	7.5	5.0	6.5	12	4	4							17	16	A-6b	16						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

PID: 118185

County-Route-Section: FUL-20-19.78
No. of Borings: 6

Geotechnical Consultant: Resource International, Inc.
Prepared By: Daniel Karch, P.E.
Date prepared: 12/7/2023

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):	18''
Average(HP):	0''
Global Geogrid Average(N60L):	12''
Average(HP):	0''

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	17%	HP ≤ 0.5	0%
$N_{60} < 12$	75%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	13%	1 < HP ≤ 2	33%
$N_{60} \geq 20$	0%	HP > 2	58%
M+	25%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0''
Maximum	0''
Minimum	0''

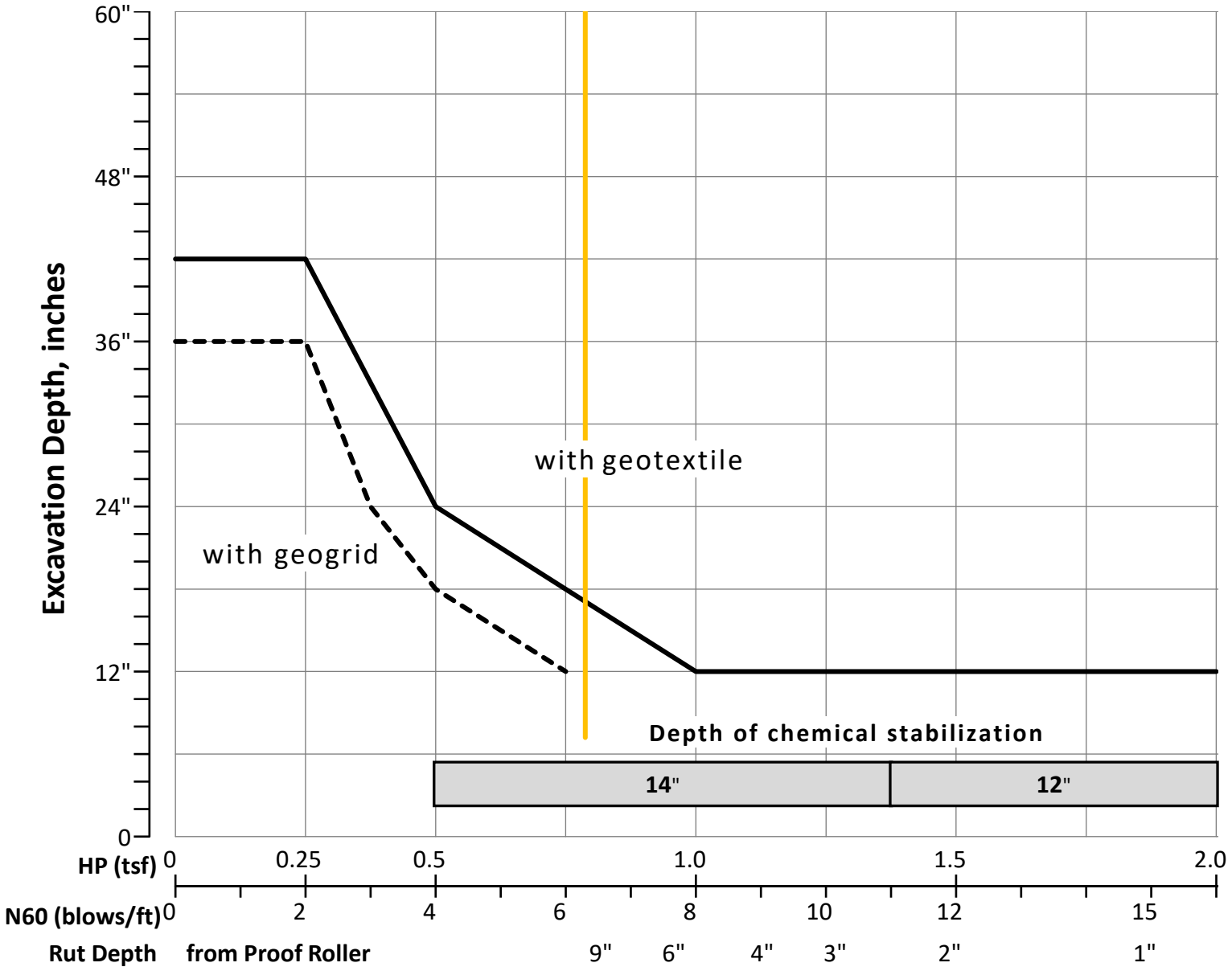
% Proposed Subgrade Surface	
Unstable & Unsuitable	71%
Unstable	71%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	10	6	3.03	35	18	17	23	36	59	18	15	11
Maximum	18	11	4.50	43	19	25	34	54	74	26	18	16
Minimum	4	4	1.25	28	15	10	9	7	23	12	8	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	0	0	0	0	0	2	1	0	0	6	9	0	6	0	0	24
Percent	0%	0%	0%	0%	0%	0%	0%	0%	8%	4%	0%	0%	25%	38%	0%	25%	0%	0%	100%
% Rock|Granular|Cohesive	0%	13%									88%								100%
Surface Class Count	0	0	0	0	0	0	0	0	2	1	0	0	5	4	0	2	0	0	14
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	14%	7%	0%	0%	36%	29%	0%	14%	0%	0%	100%

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.03	0.50	☐ HP
6.33	6.00	☐ N60L

Average HP
Average N_{60L}