Resource International, Inc.

HUR-4-8.02
INTERSECTION IMPROVEMENTS
HURON COUNTY, OHIO
PID No. 118005

ROADWAY EXPLORATION REPORT

Prepared For:
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Prepared By:
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Rii Project No. N-23-026

June 2026

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Planning

Engineering

Construction Management

Technology

June 2, 2026

Mr. Jake Barbour, P.E.
Project Manager
Crawford, Murphy & Tilly, Inc.
6060 Rockside Woods Blvd. N, Suite 321
Independence, Ohio 44131

Re: Roadway Exploration Report
HUR-4-8.02 Intersection Improvements
Huron County, Ohio
PID No. 118005
Rii Project No. N-23-026

Mr. Barbour:

Resource International, Inc. (Rii) is pleased to submit this 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 HUR-4-8.02 intersection improvements project in Huron County, Ohio.

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

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

Enclosure: Roadway Exploration Report

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APPENDICES

EXECUTIVE SUMMARY

Resource International, Inc. (Rii) has completed a geotechnical exploration for the proposed HUR-4-8.02 intersection improvements project in Huron County, Ohio. The project will extend from approximately 750 feet south to approximately 1,000 feet north of the intersection State Route (SR) 4 and SR 113 along SR 4, and approximately 280 feet west to 700 feet east along SR 113. It is understood that the proposed improvements will consist of replacing the existing intersection with a single lane roundabout to be located within the existing grass situated in the northeast quadrant of the existing intersection. It is also understood that the sections of SR 4 located south and north of the intersection are planned to be realigned along the east and west side of the existing SR 4, respectively. In addition, the proposed improvements include the construction of a cul-de-sac at the east end of Edmonds Road, closing the existing traffic exit from Edmonds Rd onto SR 4.

Exploration and Findings

On April 15, 2024, a total of eight (8) roadway borings, designated as B-001-0-24 through B-008-0-23, were advanced to depths ranging from 4.5 to 10.0 feet below the existing ground surface. Five (5) of the borings – designated as borings B-001-0-24 through B-005-0-24 - were performed along the proposed alignment of SR 4, and two (2) borings - designated as borings B-006-0-24 through B-007-0-24 – were performed along the proposed SR 113 alignment. Three (3) of these borings were performed within the grass area off the SR 4 pavement, within the footprint of the proposed SR 4 realignment (B-002-0-24 and B-004-0-24) and the proposed roundabout (B-003-0-24). The remaining boring – designated as B-008-0-24 - was performed within the footprint of the cul-de-sac proposed at the east terminus of Edmonds Road. It should be noted that boring B-008-0-24 as terminated at a depth of 4.5 below ground surface due to auger refusal. Consequently, an additional boring, designated as B-008-1-24, was conducted at an offset location and was sampled from 6.0 to 10.0 feet below ground surface without encountering auger refusal. Six (6) pavement cores where also collected, one at each of the tie in locations (at boring B-001-0-24, B-005-0-24 through B-007-0-24), one (X-003-0-24) within SR 113 near to boring B-003-0-24, and one (X-008-0-24) within Edmonds Road near to boring B-008-0-24. The boring and additional pavement core locations are illustrated on the boring plan presented in Appendix I.

The borings performed for the proposed intersection improvements encountered either full depth asphalt pavement section, or topsoil at the ground surface. Borings B-001-0-24 and B-005-0-24 through B-007-0-24, and pavement core X-003-0-24, encountered 9.0 to 16.5 inches of asphalt. Pavement core X-008-0-24, performed within Edmonds Road, encountered 6.5 inches of asphalt. Aggregate base materials ranging from 3.0 to 6.0 inches was encountered below the pavement section in the aforementioned borings and pavement cores. The remaining borings performed in a grass area off the pavement along SR 4 and Edmonds Road, encountered 4.0 to 4.5 inches of topsoil at the existing ground surface.

Below the surface materials in borings B-001-0-24, B-005-0-24, and B-007-0-24, material identified as existing fill was encountered extending to depths ranging from 2.3 to 2.9 feet below existing grade.

Beneath the surface and fill materials encountered in the borings, natural cohesive soils with some areas of granular soils were encountered to boring termination depths. The cohesive soils were described as brown to gray silt and clay, silty clay, and clay (ODOT A-4a, A-6a, A-6b, A-7-6); while the granular soils were generally described as gravel with sand and silt (ODOT A-2-4).

Bedrock was not encountered in any of the borings performed for this investigation. However, it is possible that shale may be encountered during construction if proposed grades are to change significantly from existing surface elevations.

Groundwater was encountered in boring B-008-1-24 during drilling at a depth of 6.0 feet below the ground surface, and upon completion of the drilling operations at a depth of 3.8 feet below ground surface. Groundwater was not encountered during drilling or upon completion of drilling in any of the other borings performed during this investigation.

Analysis and Recommendations

Pavement Subgrade Recommendations

In the vicinity of borings B-003-0-24, and B-006-0-24, the soils at the anticipated subgrade elevation consist predominantly of natural cohesive soils described as stiff to very stiff silt and clay, and clay (ODOT A-6a, A-7-6). In the vicinity of boring B-002-0-24, B-004-0-24, and B-008-0-24, approximately 2.3 to 7.9 feet of new engineered fill will be required to bring the existing grade to the proposed subgrade elevation. In borings B-001-0-24, B-005-0-24, and B-007-0-24, existing fill consisting of a medium dense gravel with sand and silt as well as gravel with sand, silt and clay (ODOT A-2-4, A-2-6) is anticipated at the subgrade elevation.

Based on the soil conditions encountered during the drilling phase, it is estimated that approximately 75 percent of the subgrade soils within the upper portions of the anticipated subgrade area within the proposed roundabout and along SR 4 and SR 113alignments within the project limits will require some level of stabilization under ODOT GDM. It should be noted that due to the amount of new engineered fill required in the vicinity of borings B-002-0-24 and B-004-0-24 (along the proposed SR 4 realignment), and B-008-0-24 (within the proposed cul-de-sac at the terminus of Edmonds Road) to bring the area to subgrade elevation, stabilization is not anticipated to be required in the vicinity of these three borings locations.

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
13	21	22	16	11	6

After applying the averages in the above table and considering the conditions and type of soils encountered within the proposed roundabout and along the proposed SR 4 and SR 113 alignments, the following stabilization alternatives can be considered to globally stabilize the subgrade within the project limits:

Option 1: **Mechanically stabilize the entire subgrade via 12 inches of over excavation and replacement to proposed subgrade with ODOT Item 703.16C granular material, Type B, C or D installed over ODOT Item 712.09 Geotextile Fabric, Type D as detailed in accordance with ODOT Item 204.**

Option 2: **Chemically stabilize the entire subgrade with 12 inches of lime, per ODOT Construction and Materials Specification (CMS) Item 206. For estimating purposes, utilize a lime 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. Actual depth of chemical stabilization may vary based on the conditions encountered during construction.**

The aforementioned chemical stabilization depths, as well as the excavation and replacement depths, are to be measured from the proposed subgrade elevation, which is estimated to be approximately 1.5 feet below the proposed grade. In addition, the depths of stabilization provided above are estimated based on the soil conditions encountered in the borings performed during the field exploration. Actual 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 and/or compaction of new engineered fill materials, 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 12 with an average of 6. 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 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.

Please note that the recommended design CBR of 6 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 HUR-4-8.02 intersection improvements project in Huron County, Ohio. Based on the plan information provided by Crawford, Murphy & Tilly, Inc. (CMT), the project will extend from approximately 750 feet south to approximately 1,000 feet north of the intersection State Route (SR) 4 and SR 113 along SR 4, and approximately 280 feet west to 700 feet east of the intersection along SR 113. It is understood that the proposed improvements will consist of replacing the existing intersection with a single lane roundabout to be located within the existing grass area situated in the northeast quadrant of the existing intersection. It is also understood that the sections of SR 4 located south and north of the intersection are planned to be realigned along the east and west side of the existing SR 4, respectively. In addition, the proposed improvements include the construction of a cul-de-sac at the east end of Edmonds Road, closing the existing traffic exit from Edmonds Rd onto SR 4. 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 project area lies within the Huron-Erie Lake Plains of the Central Lowland. The Erie Lake Plain is characterized by edges of very low-relief (10') Ice-Age lake basin separated from modern Lake Erie by shoreline cliffs, major streams in deep gorges, and elevations ranging from 570 to 800 feet with Pleistocene-age lacustrine sand, silt, clay, and wave-planed till.

Based on the Bedrock Geologic Map of Ohio obtained from Ohio Department of Natural Resources (ODNR), the bedrock underlying the glacial deposits consists of the Devonian-aged Plum Brook Shale Member and Prout Limestone Member. The Plum Brook Shale formation contains gray fossiliferous shale and argillaceous limestone with a thickness of 20 to 40 feet on outcrop and 60 feet in subsurface. The Prout Limestone formation includes olive gray siliceous limestone, dolomitic in part with diagnostic features of pyrite and glauconite, with a thickness of 0 to 9 feet. Bedrock elevation within the project site ranges between approximate elevations of 737 to 762 feet, from the northeast to southwest of the project. This corresponds to approximate depths of 0 to 10 feet below existing ground surface in the vicinity of the intersection. It should be noted that bedrock was not encountered in any of the borings performed for this investigation. However, it is possible that shale may be encountered during construction if proposed grades are to change significantly from existing surface elevations.

2.2 Existing Site Conditions

The project site is located in the northwest area of Huron County, about 4.1 miles south of I-90 (just about 0.76 miles south from the Norfolk Southern Bellevue Rail Yard), 1.3 miles north of SR 18, and about 2.0 miles northeast of Bellevue via SR 113. The existing SR 4 and SR 113 are each two-way, bidirectional, asphalt paved roadways with partial shoulders (1.0 to 2.0 feet wide) within the project limits. The existing Edmonds Road is a single lane, bidirectional, asphalt paved street with no shoulders. The project traverses predominantly through a rural residential and farm land area. The total length of the project along each of the alignments are approximately 1,750 feet, 980 feet, and 150 feet, along SR 4, SR 113, and Edmonds Road, respectively. The existing pavement at the intersection of SR 4 and SR 113 appears to be in fair condition with longitudinal cracking observed in some areas along the wheel path, with areas of patching, as well as edge crack observed in some shoulder sections. Regionally, the site drains east to Huron River, northwest to Sandusky River and north east to Lake Erie.

3.0 EXPLORATION

On April 15, 2024, a total of eight (8) roadway borings, designated as B-001-0-24 through B-008-0-23, were advanced to depths ranging from 4.5 to 10.0 feet below the existing ground surface. Five (5) of the borings – designated as borings B-001-0-24 through B-005-0-24 - were performed along the proposed alignment of SR 4, and two (2) borings - designated as borings B-006-0-24 through B-007-0-24 – were performed along the proposed SR 113 alignment. Three (3) of these borings were performed within the grass area off the SR 4 pavement, within the footprint of the proposed SR 4 realignment (B-002-0-24 and B-004-0-24) and the proposed roundabout (B-003-0-24). The remaining boring – designated as B-008-0-24 - was performed within the footprint of the cul-de-sac proposed at the east terminus of Edmonds Road. It should be noted that boring B-008-0-24 as terminated at a depth of 4.5 below ground surface due to auger refusal. Consequently, an additional boring, designated as B-008-1-24, was conducted at an offset location and was sampled from 6.0 to 10.0 feet below ground surface without encountering auger refusal. Six (6) pavement cores where also collected, one at each of the tie in locations (at boring B-001-0-24, B-005-0-24 through B-007-0-24), one (X-003-0-24) within SR 113 near to boring B-003-0-24, and one (X-008-0-24) within Edmonds Road near to boring B-008-0-24. 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	Longitude	Ground Elevation (feet)[1]	Boring Depth (feet) [1]
B-001-0-24	R/W SR 4	417+10	9.1' L	41.282142	-82.787008	766.1	6.3
B-002-0-24	R/W SR 4	420+90	85.5' R	41.283031	-82.786238	765.1	8.5
B-003-0-24	R/W SR 4	424+96	60.0' R	41.284105	-82.785839	763.3	9.4
B-004-0-24	R/W SR 4	428+49	47.7' L	41.285116	-82.785779	743.6	10.0
B-005-0-24	R/W SR 4	432+42	6.4' R	41.286083	-82.785114	744.1	6.8
B-006-0-24	SR 113	159+32	8.9' R	41.283451	-82.786941	764.9	7.2
B-007-0-24	SR 113	167+76	13.7' L	41.284678	-82.784332	755.3	7.4
B-008-0-24	Edmonds Road	698+81	38.6' L	41.284183	-82.786506	761.8	4.5
B-008-1-24	Edmonds Road	698+90	44.6' L	41.284203	-82.786479	760.5	10.0
X-003-0-24 [2]	SR 113	162+97	16.2' L	41.2840167	-82.785839	765.2	N/A
X-008-0-24 [2]	Edmonds Road	698+81	7.5' L	41.284099	-82.786484	766.9	N/A

1. *Ground surface elevations were interpolated using topographic mapping information provided by CMT.*
2. *Pavement core collected. No boring performed at this location.*

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 CMT.

The borings were drilled with a Diedrich D-50 rotary drilling machine, utilizing a 4.5-inch outside diameter continuous flight auger to advance the holes. In general, standard penetration testing (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 Diedrich D-50 drill rig used for this project was calibrated on March 25, 2024 and have a drill rod energy ratio of 91.1 percent. However, per the Section 404.3 of the ODOT SGE, an energy ratio of 90 percent was utilized.

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	31
Plastic and Liquid Limits	AASHTO T89, T90	15
Gradation – Sieve/Hydrometer	AASHTO T88	16
Loss on Ignition	ASTM D2974	2
Sulfate Content - Colorimetric Method	ODOT S1122	8

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 full depth asphalt pavement section or topsoil at the existing ground surface. Borings B-001-0-24 and B-005-0-24, performed within the driving lanes along SR 4, encountered 12.5 and 9.0 inches of asphalt, respectively. Borings B-006-0-24, B-007-0-24, and pavement core X-003-0-24, performed within the driving lanes along SR 113, encountered 15.25 to 16.5 inches of asphalt. Pavement core X-008-0-24, performed within Edmonds Road, encountered 6.5 inches of asphalt. Aggregate base materials ranging from 3.0 to 6.0 inches were encountered below the pavement section in the aforementioned borings and pavement cores. The remaining borings performed in a grass area off the pavement along SR 4 and Edmonds Road, encountered 4.0 to 4.5 inches of topsoil at the existing surface. Surface material found at each boring and pavement core location are summarized in Table 3.

Table 3. Surface Material Thickness Summary

Boring ID	Topsoil (in)	Asphalt (in)	Aggregate Base (in)
B-001-0-24	-	12.5	3.5
B-002-0-24	4.5	-	-
B-003-0-24	4.5	-	-
B-004-0-24	-	-	-
B-005-0-24	-	9.0	6.0
B-006-0-24	-	15.5	6.0
B-007-0-24	-	16.5	3.0
B-008-0-24	4.0	-	-
B-008-1-24	4.0	-	-
X-003-0-24 1	-	15.25	4.0
X-008-0-24 2	-	6.5	5.3

1. *Pavement cores obtained within SR 113 pavement adjacent to boring B-003-0-24.*
2. *Pavement cores obtained within Edmonds Road pavement adjacent to boring B-008-0-24.*

It should be noted that the in general the pavement cores collected exhibited cracks propagated through some of the layers and considerably deterioration of the bottom asphalt layers.

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

4.2 Subsurface Soils

Below the surface materials in borings B-001-0-24, B-005-0-24, and B-007-0-24, material identified as existing fill was encountered extending to depths ranging from 2.3 to 2.9 feet below existing grade. In general, the fill material was described as gravel with sand and silt, gravel with sand, silt and clay (ODOT A-2-4 and A-2-6), and sandy silt (ODOT A-4a). Asphalt fragments was observed within the fill material in boring B-005-0-24.

Beneath the surface and fill materials encountered in the borings, natural cohesive soils with some areas of granular soils were encountered to boring termination depths. The cohesive soils were described as brown to gray silt and clay, silty clay, and clay (ODOT A-4a, A-6a, A-6b, A-7-6), while the granular soils were generally described as gravel with sand and silt (ODOT A-2-4).

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 ($HP > 4.5$ 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). The N_{60} values obtained within the granular soils were higher than 50 blows per foot (bpf), corresponding to very dense relative densities. The overall blow counts recorded from the SPT blow count (N_{60}) sampling ranged from 4 bpf to 56 bpf.

Natural moisture contents of the soil samples tested ranged from 5 to 46 percent. The natural moisture contents of the cohesive soil samples tested for plasticity index ranged from 1 percent below to 17 percent above their corresponding plastic limits. In general, the soils exhibited natural moisture contents estimated to be moderately 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 180 to 460 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 borings B-001-0-24 and B-003-0-24, were tested by loss on ignition (LOI) with results of 7.0 and 5.0 percent, respectively.

4.3 Bedrock

Bedrock was not encountered in any of the borings performed for this investigation. However, it is possible that shale may be encountered during construction if proposed grades are to change significantly from existing surface elevations.

4.4 Groundwater

Groundwater was encountered in boring B-008-1-24 during drilling at a depth of 6.0 feet below the ground surface, and upon completion of the drilling operations at a depth of 3.8 feet below the ground surface. Groundwater was not encountered during or upon completion of drilling in any of the other 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

In the vicinity of borings B-003-0-24 and B-006-0-24, the soils at the anticipated subgrade elevation consist predominantly of natural cohesive soils described as stiff to very stiff silt and clay and clay (ODOT A-6a, A-7-6). In the vicinity of borings B-002-0-24, B-004-0-24, and B-008-0-24, new engineered fill will be required to bring the existing grade to the proposed subgrade elevation. In borings B-001-0-24, B-005-0-24, and B-007-0-24, existing fill consisting of a medium dense gravel with sand and silt as well as gravel with sand, silt and clay (ODOT A-2-4, A-2-6) are anticipated at the subgrade elevation.

The ODOT subgrade analysis was performed based on the consideration that the thickness of the existing and proposed pavement buildup along SR 4 and SR 113 will be similar (approximately 18 inches), and therefore the new subgrade was considered at approximately 1.5 feet below proposed grade. Similarly, it was considered that the

thickness of the existing pavement and proposed cul-de-sac pavement buildup for Edmonds Road will be similar (approximately 12 inches). It should be noted that based on the proposed profile information provided by CMT, and considering the existing ground elevation, approximately 3.1, 7.9, and 2.3 feet of new engineered fill are anticipated to be required in the vicinity of borings B-002-0-24 B-004-0-24, and B-008-0-24, respectively, to achieve the proposed subgrade elevations at the proposed SR 4 realignment sections south and north of the intersection, and within the cul-de-sac at the terminus of Edmonds Road, respectively.

Based on the soil conditions encountered during the drilling phase, it is estimated that sections of the subgrade soils within the proposed roundabout and along the existing SR 4 and SR 113 will require some level of stabilization under ODOT GDM. The GDM subgrade analysis summary is presented in Appendix V.

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 75 percent of the subgrade area within the proposed roundabout, and along the existing SR 4 and SR 113, within the project limits, is anticipated to require stabilization. Therefore, global stabilization would be warranted for the proposed subgrade soils. It should be noted that due to the amount of new engineered fill required in the vicinity of borings B-002-0-24 and B-004-0-24 (along the proposed SR 4 realignment sections south and north of the intersection), and B-008-0-24 (within the proposed cul-de-sac at the terminus of Edmonds Road) to bring the area to subgrade elevation, stabilization is not anticipated to be required in the vicinity of these three borings locations. Per ODOT GDM, global stabilization recommendations are based upon the overall average site parameters, noted in Table 4.

Table 4. Average Site Parameters

Average N_{60L}	Average PI	Average Moisture	Average Optimum Moisture	Average Group Index	Average CBR
13	21	22	16	11	6

After applying the averages in Table 4 and considering the conditions and type of soils encountered within the proposed roundabout, and along the proposed SR 4 and SR 113alignments within the project limits, the following stabilization alternatives can be considered to globally stabilize the subgrade within this project:

Option 1: Mechanically stabilize the entire subgrade via 12 inches of over excavation and replacement to proposed subgrade with ODOT Item 703.16C granular material, Type B, C or D installed over ODOT Item

712.09 Geotextile Fabric, Type D as detailed in accordance with ODOT Item 204.

Option 2: Chemically stabilize the entire subgrade with 12 inches of lime, per ODOT CMS Item 206. For estimating purposes, utilize a lime 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. Actual depth of chemical stabilization may vary based on the conditions encountered during construction.

The aforementioned chemical stabilization depths, as well as the excavation and replacement depths, are to be measured from the proposed subgrade elevation, which is estimated to be approximately 1.5 feet below the proposed grade. In addition, the depths of stabilization provided above are estimated based on the soil conditions encountered in the borings performed during the field exploration. Actual depth of stabilization may differ from the recommendations provided.

Per ODOT GDM requirements, the entire subgrade within the proposed roundabout and the proposed SR 4 and SR 113 alignments 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 and/or compaction of new engineered fill materials, 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 12 with an average of 6. 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 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.

As previously discussed, the exposed subgrade soil should be inspected 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 one of the methods discussed in Section 5.1.1. The recommended design CBR of 6 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 6 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 6.

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 180 to 460 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 5. 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

BORING PLAN
HUR-4-8.02 INTERSECTION IMPROVEMENTS
HURON COUNTY, OHIO

RII PROJECT NO. N-23-026		DRAWN ALF
SCALE: 1" = 110' 0 55 110	N	REVIEWED DEK
		DATE 6/14/2024

RESOURCE INTERNATIONAL

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-001-0-24 through B-008-0-24

B-008-1-24

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:

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

SO_4 = 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: HUR 4-8.02 INTERSECTION IMPR.	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 417+10 / 9.1' LT	**EXPLORATION ID B-001-0-24**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: R/W SR 4	
PID: 118005 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 766.1 (MSL) EOB: 6.3 ft.	PAGE 1 OF 1
START: 4/15/24 END: 4/15/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.282142, -82.787008	

MATERIAL DESCRIPTION AND NOTES	ELEV. 766.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
1.0' - ASPHALT (12.5")	765.1																	
0.3' - BASE (3.5")	764.8																	
FILL: MEDIUM DENSE, BROWNISH GRAY **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, MOIST.	763.5	1	14 14 5	29	42	SS-1	-	18	10	39	22	11	NP	NP	NP	12	A-2-4 (0)	
STIFF, ORANGISH BROWN **CLAY**, SOME SILT, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MODERATELY ORGANIC, WET. -SS-2: LOI = 7.0%	760.5	2 3 4	2 2 2	6	56	SS-2	1.75	7	10	12	29	42	69	26	43	43	A-7-6 (19)	
HARD, BROWN TO BROWNISH GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. -COBBLE @ 6.0'	759.8	5	4 7 5	18	42	SS-3	1.50	-	-	-	-	-	-	-	-	46	A-7-6 (V)	
		EOB 6	40 50/2"	-	81	SS-4	-	-	-	-	-	-	-	-	-	22	A-6a (V)	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 5.1'.

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

RESOURCE INTERNATIONAL, INC.

PROJECT: HUR 4-8.02 INTERSECTION IMPR.	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 420+90 / 85.5' RT	**EXPLORATION ID B-002-0-24**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: R/W SR 4	
PID: 118005 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 765.1 (MSL) EOB: 8.5 ft.	PAGE 1 OF 1
START: 4/15/24 END: 4/15/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.283031, -82.786238	

MATERIAL DESCRIPTION AND NOTES	ELEV. 765.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.4' - TOPSOIL (4.5")	764.7																	
STIFF, MOTTLED BROWN AND GRAY **CLAY**, SOME SILT, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1	1 2 3	8	83	SS-1	1.50	6	2	23	28	41	41	14	27	26	A-7-6 (14)	
	762.1	2																
VERY DENSE, DARK BROWN **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, DAMP.		3																
-TRACE ORGANICS IN SS-2 AND SS-3		4	5 17 22	59	100	SS-2	-	25	19	25	19	12	30	21	9	19	A-2-4 (0)	
		5																
		6	50/3"	-	67	SS-3	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	
-SS-4 ATTEMPTED @ 8.5' WITH SPT 10/0". BORING TERMINATED.		7																
	756.6	8 EOB																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING.

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

RESOURCE INTERNATIONAL, INC.

PROJECT: HUR 4-8.02 INTERSECTION IMPR.	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 424+96 / 60' RT	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: R/W SR 4	**B-003-0-24**	
PID: 118005 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 763.3 (MSL) EOB: 9.4 ft.	PAGE	
START: 4/15/24 END: 4/15/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.284105, -82.785839	1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV. 763.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.4' - TOPSOIL (4.5")	762.9																	
STIFF, MOTTLED BROWN AND ORANGE **CLAY**, SOME SILT, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MODERATELY ORGANIC, DAMP TO MOIST.		1	2 3 3	9	33	SS-1	2.00	13	7	24	28	28	43	20	23	25	A-7-6 (10)	
-SS-1: LOI = 5.0%	760.3	2																
HARD, LIGHT BROWN **CLAY**, SOME SILT, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.		3																
		4	3 6 10	24	56	SS-2	4.5+	1	1	2	28	68	48	22	26	21	A-7-6 (16)	
		5																
		6	12 50/2"	-	100	SS-3	4.5+	-	-	-	-	-	-	-	-	18	A-7-6 (V)	
-COBBLE FROM 6.7' TO 8.0'		7																
		8																
	753.9	9	10 50/5"	-	100	SS-4	4.5+	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
		EOB																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.1'.

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

RESOURCE INTERNATIONAL, INC.

PROJECT: HUR 4-8.02 INTERSECTION IMPR.	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 428+49 / 47.7' LT	**EXPLORATION ID B-004-0-24**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: R/W SR 4	
PID: 118005 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 743.6 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 4/15/24 END: 4/15/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.285116, -82.785779	

MATERIAL DESCRIPTION AND NOTES	ELEV. 743.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
BORING PERFORMED ON RECENTLY DISC-HARROWED FARM FIELD. NOT TOPSOIL OR SURFACE MATERIAL MEASURABLE.																		
VERY STIFF TO HARD, MOTTLED BROWN AND GRAY TO LIGHT GRAY **CLAY**, SOME SILT, LITTLE TO NONE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		1 2 3 4 5 6 7 8 9 10	2 3 3 3 4 6 3 4 7 6 9 18	9	81	SS-1	2.25	6	3	9	24	58	57	21	36	26	A-7-6 (19)	
				15	33	SS-2	4.00	1	0	0	22	77	54	22	32	23	A-7-6 (19)	
				17	100	SS-3	4.00	-	-	-	-	-	-	-	-	23	A-7-6 (V)	
	733.6	EOB		41	56	SS-4	4.5+	-	-	-	-	-	-	-	-	17	A-7-6 (V)	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.4'.

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

RESOURCE INTERNATIONAL, INC.

PROJECT: HUR 4-8.02 INTERSECTION IMPR.	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 432+42 / 6.4' RT	**EXPLORATION ID B-005-0-24**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: R/W SR 4	
PID: 118005 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 744.1 (MSL) EOB: 6.8 ft.	PAGE 1 OF 1
START: 4/15/24 END: 4/15/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.286083, -82.785114	

MATERIAL DESCRIPTION AND NOTES	ELEV. 744.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.8' - ASPHALT (9.0")	743.3																	
0.5' - BASE (6.0")	742.8	1				SS-1A	-	-	-	-	-	-	-	-	-	-		
FILL: MEDIUM DENSE, GRAYISH BROWN **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST. -2S SAMPLER USED WITHIN SS-1B INTERVAL TO RECOVER SAMPLE. 2S-1B SAMPLE RECOVERY = 100% -ASPHALT FRAGMENTS IN SS-1B	741.8	2	9 5 4	14	0	SS-1B	-	59	23	7	6	5	29	18	11	20	A-2-6 (0)	
STIFF TO VERY STIFF, GRAYISH BROWN TO GRAY **CLAY**, SOME SILT, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. -2S SAMPLER USED WITHIN SS-3 INTERVAL TO RECOVER SAMPLE. 2S-3A SAMPLE RECOVERY = 100%		3 4 5 6	2 2 3	8	33	SS-2	2.25	20	7	5	29	39	42	25	17	29	A-7-6 (10)	
			3 3 5	12	0	SS-3	2.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
			2 2 5	11	33	SS-4	2.50	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
	737.3	EOB																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 4.8'.

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

RESOURCE INTERNATIONAL, INC.

PROJECT: HUR 4-8.02 INTERSECTION IMPR.	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 159+32 / 8.9' RT	**EXPLORATION ID B-006-0-24**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: SR 113	
PID: 118005 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 764.9 (MSL) EOB: 7.2 ft.	PAGE 1 OF 1
START: 4/15/24 END: 4/15/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.283451, -82.786941	

MATERIAL DESCRIPTION AND NOTES	ELEV. 764.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
1.3' - ASPHALT (15.5")	763.6	1																
0.5' - BASE (6.0")	763.1																	
STIFF TO VERY STIFF, BROWNISH GRAY TO LIGHT BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		2	2 2 3	8	42	SS-1	2.50	4	4	25	46	21	26	14	12	22	A-6a (7)	
		3																
	760.1	4	2 2 4	9	47	SS-2	3.50	2	5	11	52	30	35	23	12	29	A-6a (9)	
HARD, DARK BROWN **SILT AND CLAY**, LITTLE FINE GRAVEL, DAMP.		5	6 10 17	41	61	SS-3	-	-	-	-	-	-	-	-	-	17	A-6a (V)	
	757.7	6																
EOB		7	15 50/5"	-	50	SS-4	-	-	-	-	-	-	-	-	-	10	A-6a (V)	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING.

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

RESOURCE INTERNATIONAL, INC.

PROJECT: HUR 4-8.02 INTERSECTION IMPR.	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 167+76 / 13.7' LT	**EXPLORATION ID B-007-0-24**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: SR 113	
PID: 118005 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 755.3 (MSL) EOB: 7.4 ft.	PAGE 1 OF 1
START: 4/15/24 END: 4/15/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.284678, -82.784332	

MATERIAL DESCRIPTION AND NOTES	ELEV. 755.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
1.4' - ASPHALT (16.5")	753.9	1																
0.2' - BASE (3.0")	753.7																	
FILL: STIFF, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.		2	3 4 4	12	64	SS-1A	-	-	-	-	-	-	-	-	-	-		
	752.4					SS-1B	1.50	3	7	42	32	16	20	13	7	16	A-4a (3)	
STIFF TO VERY STIFF, BROWN TO LIGHT GRAYISH BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE TO LITTLE FINE GRAVEL, MOIST.		3	1 1 2	5	53	SS-2	1.25	11	5	24	31	29	35	15	20	24	A-6b (9)	
		4																
		5	1 2 4	9	81	SS-3	3.75	-	-	-	-	-	-	-	-	22	A-6b (V)	
		6																
		7	5 8 12	30	56	SS-4	3.75	-	-	-	-	-	-	-	-	21	A-6b (V)	
	747.9	EOB																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 5.4'.

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

RESOURCE INTERNATIONAL, INC.

PROJECT: HUR 4-8.02 INTERSECTION IMPR.	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 698+81 / 38.6' LT	**EXPLORATION ID B-008-0-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: EDMONDS ROAD		
PID: 118005 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 761.8 (MSL) EOB: 4.5 ft.		PAGE 1 OF 1
START: 4/15/24 END: 4/15/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.284183, -82.786506		

MATERIAL DESCRIPTION AND NOTES	ELEV. 761.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.3' - TOPSOIL (4.0")	761.5																	
VERY STIFF, BROWN AND ORANGE **SILTY CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.		1	1 2 3	8	67	SS-1	3.50	16	12	22	26	24	36	18	18	21	A-6b (6)	
	758.3	2																
DENSE, BROWN **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, DRY. -AUGER REFUSAL @ 4.5' DUE COBBLES FROM 3.5' TO 4.5'. BORING OFFSET 10.3' N/NE, RESUME SAMPLING @ 6.0'	757.3	3	50/2"	-	100	SS-3	-	-	-	-	-	-	-	-	-	5	A-2-4 (V)	
		EOB 4																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING.

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

RESOURCE INTERNATIONAL, INC.

PROJECT: HUR 4-8.02 INTERSECTION IMPR.	DRILLING FIRM / OPERATOR: RII / TG	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 698+90 / 44.6' LT	**EXPLORATION ID B-008-1-24**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / MJ	HAMMER: AUTOMATIC	ALIGNMENT: EDMONDS ROAD	
PID: 118005 SFN: NA	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/21/22	ELEVATION: 760.5 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 4/15/24 END: 4/15/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.284203, -82.786479	

MATERIAL DESCRIPTION AND NOTES	ELEV. 760.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.3' - TOPSOIL (4.0")	760.2																	
-NO SAMPLING TO 6.0'																		
	754.5	W 754.5																
VERY STIFF TO HARD, MOTTLED GRAY AND BROWN **CLAY**, SOME SILT, TRACE COARSE TO FINE SAND, MOIST.			5 8 11	29	83	SS-1	4.50	0	1	4	34	61	52	22	30	24	A-7-6 (18)	
			2 5 9	21	56	SS-2	3.75	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
	750.5	EOB																

NOTES: GROUNDWATER INTIALLY ENCOUNTERED @ 6.0' AND @ 3.8' UPON COMPLETION OF DRILLING; CAVE-IN DEPTH @ 6.0'.

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

APPENDIX IV

PAVEMENT CORE DATA SHEET

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

Pavement Core Data Summary

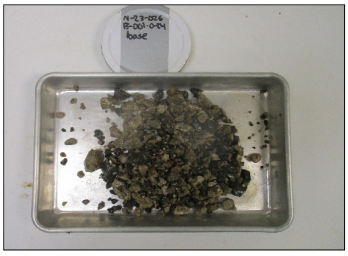
PROJECT	HUR-4-8.02 Intersection Improvements
LOCATION	Huron County, Ohio
JOB No.	N-23-026
BORING/CORE No.	B-001-0-24
DATE CORE OBTAINED	4/15/2024
CORE OBTAINED BY	T.G, I.S, M.J

Core Composition

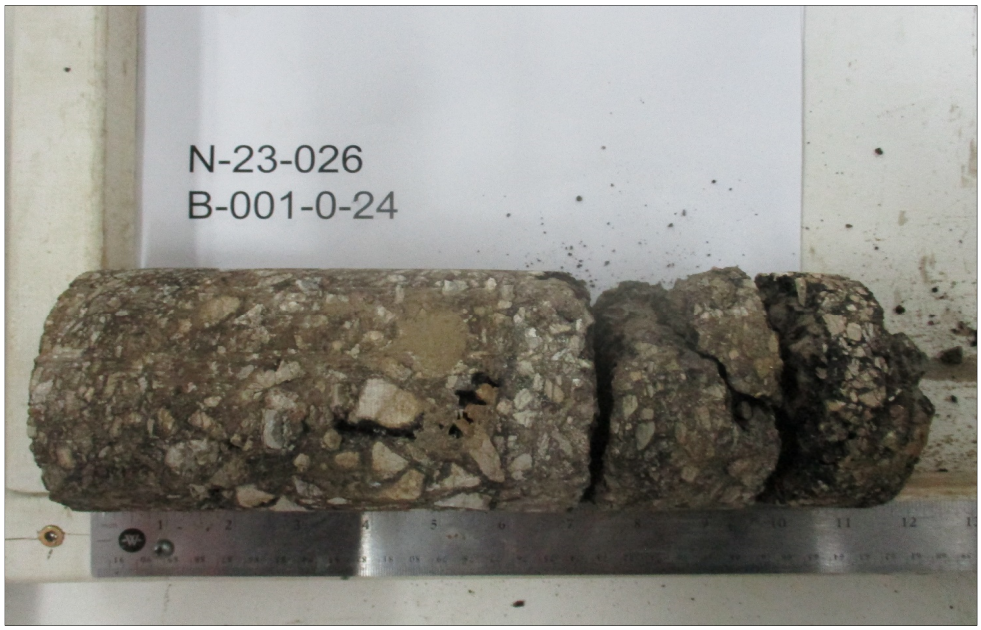
Core Number	Layer Thickness (in.)	Pavement Layer Number	Asphalt: Surface Binder	Asphalt: Intermediate Binder	Asphalt: Base Binder	Concrete	Aggregate/Granular Base	Other		
B-001-0-24	1.00	6	✓							
	1.50	5	✓							
	3.50	4		✓						
	1.00	3	✓							
	2.25	2		✓						
	3.25	1		✓						
	3.50						✓			

Comments/Remarks

- Layer 1 is cracked and highly deteriorated.
- Layer 2 is deteriorated and cracked diagonally from 8.00" to 9.00".
- Layer 4 has voids due to loss of aggregate.
- The core is separated between layers 1, 2 & 3.
- Aggregate Base: Gravel (visual)



Total Pavement Thickness =	12.50	in.	Total Asphalt Thickness =	12.50	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

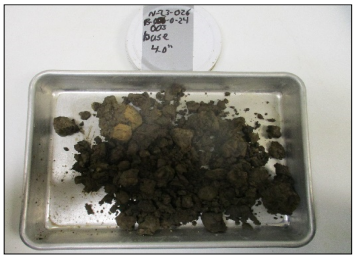
PROJECT	HUR-4-8.02 Intersection Improvements
LOCATION	Huron County, Ohio
JOB No.	N-23-026
BORING/CORE No.	X-003-0-24
DATE CORE OBTAINED	4/15/2024
CORE OBTAINED BY	T.G, I.S, M.J

Core Composition

Core Number	Layer Thickness (in.)	Pavement Layer Number	Asphalt: Surface Binder	Asphalt: Intermediate Binder	Asphalt: Base Binder	Concrete	Aggregate/Granular Base	Other		
X-003-0-24	1.00	7	✓							
	2.50	6		✓						
	1.75	5	✓							
	1.75	4	✓							
	3.50	3		✓						
	2.50	2	✓							
	2.25	1	✓							
	4.00						✓			

Comments/Remarks

- Layer 1 is broken vertically from 13.00" to 15.25".
- Layer 3 is highly deteriorated.
- Layer 4 is broken vertically from 5.25" to 7.00".
- The core is separated between layers 1, 2, 3, 4 & 5.
- Aggregate Base: Gravel with sand and silt (visual)



Total Pavement Thickness =	15.25	in.	Total Asphalt Thickness =	15.25	in.	Total Concrete Thickness =	0.00	in.	Total Base Thickness =	4.00	in.

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Pavement Core Data Summary

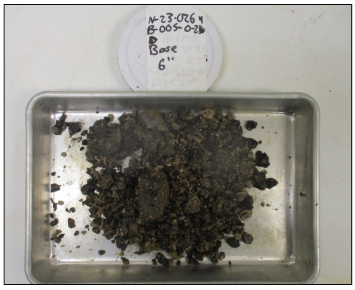
PROJECT	HUR-4-8.02 Intersection Improvements
LOCATION	Huron County, Ohio
JOB No.	N-23-026
BORING/CORE No.	B-005-0-24
DATE CORE OBTAINED	4/15/2024
CORE OBTAINED BY	T.G, I.S, M.J

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-005-0-24	0.75	4	✓							
	2.25	3	✓							
	4.00	2		✓						
	2.00	1		✓						
	6.00						✓			

Comments/Remarks

- Layers 1 & 2 are highly deteriorated and partially disintegrated, it is no possible to discern layers.
- Layer 3 is slightly deteriorated at the bottom.
- Aggregate Base: Gravel with sand (visual)



Total Pavement Thickness =	9.00	in.	Total Asphalt Thickness =	9.00	in.	Total Concrete Thickness =	0.00	in.	Total Base Thickness =	6.00	in.

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Pavement Core Data Summary

PROJECT	HUR-4-8.02 Intersection Improvements
LOCATION	Huron County, Ohio
JOB No.	N-23-026
BORING/CORE No.	B-006-0-24
DATE CORE OBTAINED	4/15/2024
CORE OBTAINED BY	T.G, I.S, M.J

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-006-0-24	1.00	8	✓							
	1.50	7	✓							
	2.25	6		✓						
	1.75	5	✓							
	2.00	4		✓						
	1.50	3	✓							
	3.00	2		✓						
	2.50	1		✓						
	6.00						✓			

Comments/Remarks

- The core is separated between layers 1, 2 & 3.
- Layer 2 has some voids and contains a slag mix.
- Aggregate Base: Gravel (visual)

Total Pavement Thickness =	15.50	in.	Total Asphalt Thickness =	15.50	in.	Total Concrete Thickness =	0.00 in.	Total Base Thickness =	6.00 in.

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Pavement Core Data Summary

PROJECT	HUR-4-8.02 Intersection Improvements
LOCATION	Huron County, Ohio
JOB No.	N-23-026
BORING/CORE No.	B-007-0-24
DATE CORE OBTAINED	4/15/2024
CORE OBTAINED BY	T.G, I.S, M.J

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-007-0-24	1.25	9	✓							
	2.25	8	✓							
	1.75	7	✓							
	1.25	6		✓						
	1.00	5		✓						
	2.00	4	✓							
	2.50	3	✓							
	1.50	2	✓							
	3.00	1	✓							
	3.00						✓			

Comments/Remarks

- Layer 1 is disintegrated.
- Layer 2 & 3 are cracked diagonally from 9.50" to 13.00".
- Layer 4 is deteriorating.
- The core is separated between layers 1 and 2, and layers 3, 4 & 5.
- Aggregate Base: Gravel (visual)

Total Pavement Thickness =	16.50	in.	Total Asphalt Thickness =	16.50	in.	Total Concrete Thickness =	0.00	in.	Total Base Thickness =	3.00	in.

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Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT	HUR-4-8.02 Intersection Improvements
LOCATION	Huron County, Ohio
JOB No.	N-23-026
BORING/CORE No.	X-008-0-24
DATE CORE OBTAINED	4/15/2024
CORE OBTAINED BY	T.G, I.S, M.J

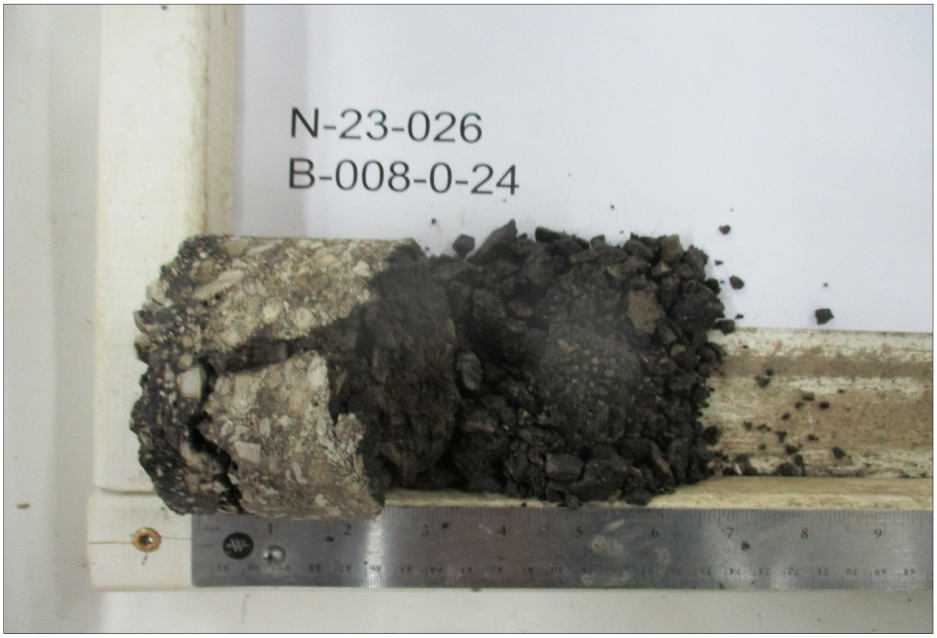
Core Composition

Core Number	Layer Thickness (in.)	Pavement Layer Number	Asphalt: Surface Binder	Asphalt: Intermediate Binder	Asphalt: Base Binder	Concrete	Aggregate/Granular Base	Other		
X-008-0-24	1.00	3	✓							
	2.00	2		✓						
	3.50	1		✓						
	5.00						✓			

Comments/Remarks

- Layer 1 is disintegrated, cannot discern layers.
- Layer 2 cracked vertically from 1.00" to 4.00" and horizontally.
- Aggregate Base: Gravel (visual)

Total Pavement Thickness =	6.50	in.	Total Asphalt Thickness =	6.50	in.	Total Concrete Thickness =	0.00	in.	Total Base Thickness =	5.00	in.



APPENDIX V

ODOT 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.)

HUR-4-8.02
118005

HUR-4-8.02 Intersection Improvement

Resource International, Inc.

Prepared By: Johnnatan Garcia-Ruiz, Ph.D.
Date prepared: Friday, September 27, 2024

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

NO. OF BORINGS: 7

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.7 4/4/2024

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-24	R/W SR 4	417+10	9.1'	Lt.	Diedrich D-50	90.0	766.1	764.7	1.4 C
2	B-002-0-24	R/W SR 4	420+90	85.5'	Rt.	Diedrich D-50	90.0	765.1	768.2	3.1 F
3	B-003-0-24	R/W SR 4	424+96	60.0'	Rt.	Diedrich D-50	90.0	763.3	763.0	0.3 C
4	B-004-0-24	R/W SR 4	428+49	47.7'	Lt.	Diedrich D-50	90.0	743.6	751.5	7.9 F
5	B-005-0-24	R/W SR 4	432+42	6.4'	Rt.	Diedrich D-50	90.0	744.1	742.7	1.4 C
6	B-006-0-24	SR 113	159+32	8.9'	Rt.	Diedrich D-50	90.0	764.9	763.5	1.4 C
7	B-007-0-24	SR 113	167+76	13.7'	Lt.	Diedrich D-50	90.0	755.3	753.7	1.6 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.7 4/4/2024

#	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	1.1	2.6	-0.3	1.2	29			NP	NP	NP	22	11	33	12	10	A-2-4	0	300					206 Lime
	001-0	SS-2	2.6	4.1	1.2	2.7	6		1.75	69	26	43	29	42	71	43	23	A-7-6	19		High LL	HP & Mc	33"		204 Geotextile
	24	SS-3	4.1	5.6	2.7	4.2	18		1.5							46	18	A-7-6	16						
		SS-4	5.6	6.3	4.2	4.9	72	29								22	14	A-6a	10						
2	B	SS-1	1.0	2.5	4.1	5.6	8		1.5	41	14	27	28	41	69	26	18	A-7-6	14	200					
	002-0	SS-2	3.5	5.0	6.6	8.1	59			30	21	9	19	12	31	19	10	A-2-4							
	24	SS-3	6.0	6.3	9.1	9.4	72									8	10	A-2-4							
								8																	
3	B	SS-1	1.0	2.5	0.7	2.2	9		2	43	20	23	28	28	56	25	18	A-7-6	10	220		N_{60} & Mc		12"	206 Lime
	003-0	SS-2	3.5	5.0	3.2	4.7	24		4.5	48	22	26	28	68	96	21	19	A-7-6	16						204 Geotextile
	24	SS-3	6.0	6.7	5.7	6.4	72		4.5							18	18	A-7-6							
		SS-4	8.5	9.4	8.2	9.1	72	9	4.5							16	18	A-7-6							
4	B	SS-1	1.0	2.5	8.9	10.4	9		2.25	57	21	36	24	58	82	26	18	A-7-6		380					
	004-0	SS-2	3.5	5.0	11.4	12.9	15		4	54	22	32	22	77	99	23	19	A-7-6							
	24	SS-3	6.0	7.5	13.9	15.4	17		4							23	18	A-7-6							
		SS-4	8.5	10.0	16.4	17.9	41		4.5							17	18	A-7-6							
5	B	SS-1B	1.3	2.3	-0.1	0.9	14			29	18	11	6	5	11	20	10	A-2-6	0			N_{60} & Mc		12"	206 Lime
	005-0	SS-2	2.3	3.8	0.9	2.4	8		2.25	42	25	17	29	39	68	29	22	A-7-6	10	300		N_{60} & Mc		12"	204 Geotextile
	24	SS-3	3.8	5.3	2.4	3.9	12		2							27	18	A-7-6	16						
		SS-4	5.3	6.8	3.9	5.4	11	14	2.5							25	18	A-7-6	16						
6	B	SS-1	1.8	3.3	0.4	1.9	8		2.5	26	14	12	46	21	67	22	14	A-6a	7	180		N_{60} & Mc		12"	206 Lime
	006-0	SS-2	3.3	4.8	1.9	3.4	9		3.5	35	23	12	52	30	82	29	18	A-6a	9			N_{60} & Mc			204 Geotextile
	24	SS-3	4.8	6.3	3.4	4.9	41									17	14	A-6a	10						
		SS-4	6.3	7.2	4.9	5.8	72	8								10	14	A-6a	10						
7	B	SS-1B	2.0	2.9	0.4	1.3	12		1.5	20	13	7	32	16	48	16	10	A-4a	3	380		HP & Mc		12"	206 Lime
	007-0	SS-2	2.9	4.4	1.3	2.8	5		1.25	35	15	20	31	29	60	24	16	A-6b	9			HP & Mc			204 Geotextile
	24	SS-3	4.4	5.9	2.8	4.3	9		3.75							22	16	A-6b	16						
		SS-4	5.9	7.4	4.3	5.8	30	12	3.75							21	16	A-6b	16						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.7 4/4/2024

PID: 118005

County-Route-Section: HUR-4-8.02
No. of Borings: 7

Geotechnical Consultant: Resource International, Inc.
Prepared By: Johnnatan Garcia-Ruiz, Ph.D.
Date prepared: 9/27/2024

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

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

Design CBR	6

% Samples within 3 feet of subgrade			
$N_{60} \leq 5$	5%	HP ≤ 0.5	0%
$N_{60} < 12$	35%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	15%	1 < HP ≤ 2	30%
$N_{60} \geq 20$	5%	HP > 2	20%
M+	40%		
Rock	0%		
Unsuitable Soil	0%		

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

% Proposed Subgrade Surface	
Unstable & Unsuitable	75%
Unstable	67%
Unsuitable (Soil & Rock)	8%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	28	13	2.90	41	20	21	28	34	62	22	16	11
Maximum	72	29	4.50	69	26	43	52	77	99	46	23	19
Minimum	5	8	1.25	20	13	7	6	5	11	8	10	0

Classification Counts by Sample

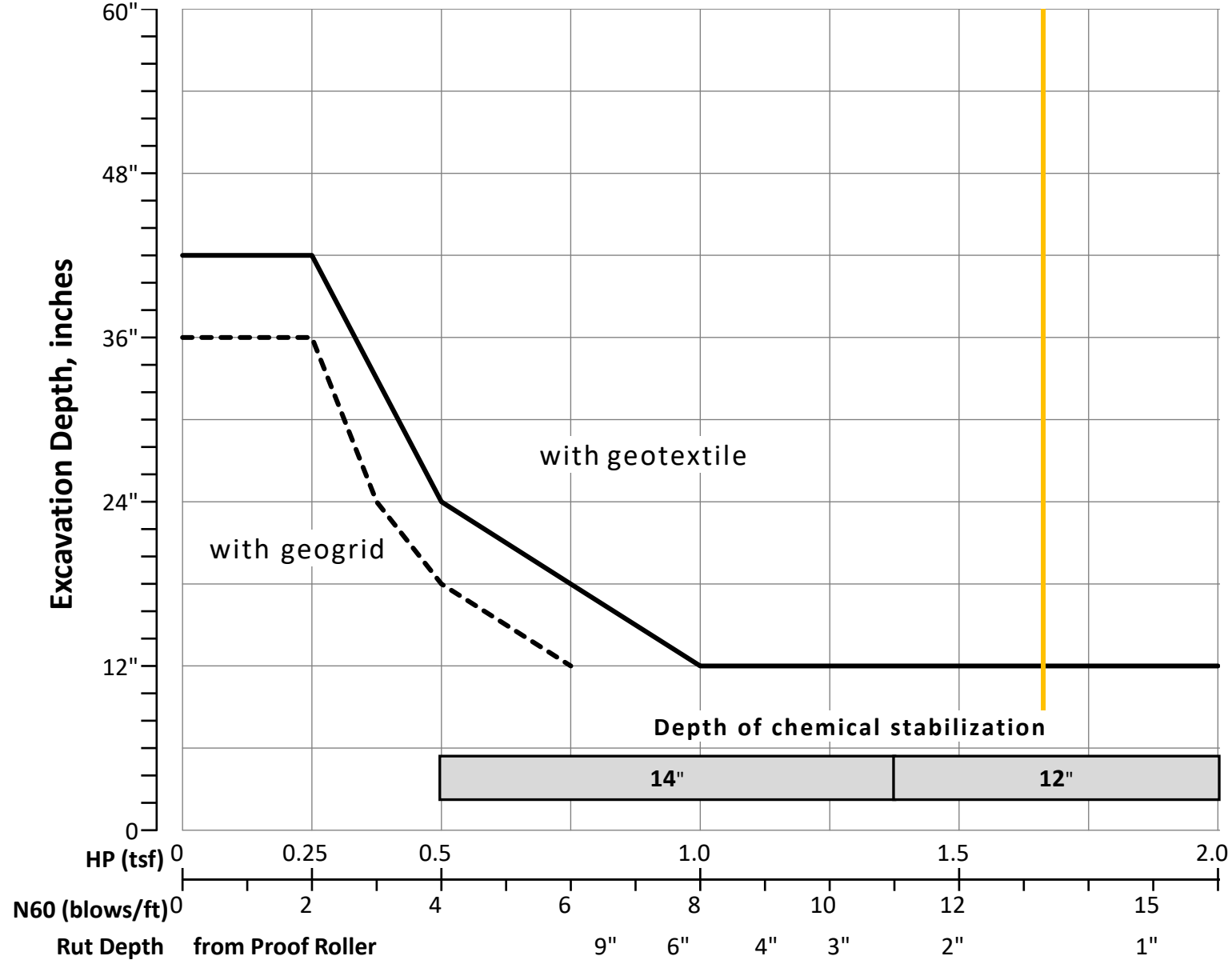
ODOT Class	UCF	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	3	0	1	0	0	0	1	0	0	5	3	0	14	0	0	27
Percent	0%	0%	0%	0%	11%	0%	4%	0%	0%	0%	4%	0%	0%	19%	11%	0%	52%	0%	0%	100%
% Rock|Granular|Cohesive	0%	0%	19%									81%								100%
Surface Class Count	0	0	0	0	1	0	1	0	0	0	1	0	0	2	2	0	5	0	0	12
Surface Class Percent	0%	0%	0%	0%	8%	0%	8%	0%	0%	0%	8%	0%	0%	17%	17%	0%	42%	0%	0%	100%

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.7 4/4/2024

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
2.90		☐ HP
13.33		☐ N60L

Average HP

Average N_{60L}