GEOTECHNICAL EXPLORATION
LOG-US33-9.68 ROUNDABOUT, PID#118109
HUNTSVILLE
LOGAN COUNTY, OHIO

Prepared for:

EMH&T
COLUMBUS, OHIO

Prepared by:

GEOTECHNOLOGY, LLC, DBA UES
CINCINNATI, OHIO

Date:

APRIL 22, 2025

Project No.:

J042054.02

SAFETY
TEAMWORK
RESPONSIVENESS
INTEGRITY
VALUE
EXCELLENCE

April 22, 2025

Mr. Heath Brendlinger
EMH&T
5500 New Albany Road
Columbus, Ohio 43054

Re: Geotechnical Exploration
LOG-33-9.68 Roundabout, PID #118109
Huntsville, Logan County, Ohio
Project No. J042054.02

Dear Mr. Brendlinger:

Presented in this report are the results of our geotechnical exploration completed for the LOG-33-9.68 Roundabout, PID #118109 in Huntsville, Logan County, Ohio. Our services were performed in general accordance with our Proposal P042054.03, which was dated March 29, 2023, and signed for authorization on June 6, 2023. We received approval to proceed with the proposed boring plan on April 15, 2024. This report addresses the comments received from ODOT on our draft geotechnical exploration report dated June 20, 2024, and supersedes the previous geotechnical report.

We appreciate the opportunity to provide the geotechnical services for this project. If you have any questions regarding this report, or if we may be of any additional service to you, please do not hesitate to contact us.

Respectfully submitted,
UES

STATE OF OHIO
SURAJ
KHADKA
E-88807
REGISTERED
PROFESSIONAL ENGINEER

Diwakar K C, PhD, EIT
Project Geotechnical Engineer

Suraj Khadka, PE
Project Manager

DKC/SK:dkc/sk

Copies submitted: EMH&T (email)

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GEOTECHNICAL EXPLORATION
LOG-33-9.68 ROUNDABOUT, PID #118109
HUNTSVILLE, LOGAN COUNTY, OHIO
April 22, 2025 | Project No. J042054.02

1.0 INTRODUCTION

Geotechnology, LLC, DBA UES (UES) prepared this geotechnical exploration report for EMH&T for the LOG-33-9.68 Roundabout, PID #118109 that is be located in Huntsville, Logan County, Ohio. Our services documented in this report were provided in general accordance with the terms and scope of services described in our Proposal P042054.02, which was dated March 29, 2023.

The purposes of the geotechnical exploration were to evaluate the general subsurface profile at the site and the engineering properties of the soils and bedrock; and to develop recommendations for the geotechnical aspects of the design and construction of the project, as defined in our proposal. Our scope of services included a site reconnaissance, geotechnical borings, laboratory testing, engineering analyses, and preparation of this report.

2.0 PROJECT INFORMATION

The following project information was derived from:

- The Google Earth file with the site location transmitted electronically by EMH&T on March 9, 2023;
- The Soil Profile sheets for project LOG-33-5.85 provided electronically by EMH&T on March 13, 2023;
- Field Boring Logs and Soil Profile sheets for project LOG-33-6.05 provided electronically by EMH&T on March 13, 2023;
- Bedrock topography of the Huntsville, Ohio quadrangle, prepared by Vormelker, J.D and Swinford, E.M., dated 1992 and provided by EMH&T on March 13, 2023; and
- Correspondence with EMH&T.

We understand that this project will include the construction of a roundabout at the intersection of US-33 and State Route (SR) 274. The project will extend approximately 700 feet in all directions from the intersection.

3.0 SITE GEOLOGY AND OBSERVATIONS

According to the Ohio Geology Interactive Map published by ODNR[1] Division of Geological Survey, the site is underlain by glacial drift with a thickness approximately 130 feet to 225 feet in the project area.

Based on the Ohio Geology Interactive Map, the bedrock formation underlying the project site belong to Silurian Age Thymocyte Dolomite colored olive gray to yellowish brown with brownish black to gray shale laminae with thickness varying 0 to 140 feet; and Silurian age Greenfield Dolomite colored olive gray to yellowish brown with thickness varying 0 to 80 feet. No karst data points are indicated within the project area based on our ODNR desktop survey. No potential geohazards or geotechnical concerns were observed during field visits and from our ODNR desktop survey.

4.0 SUBSURFACE EXPLORATION

The subsurface exploration consisted of 7 borings (numbered B-001-0-24 through B-007-0-24). The boring locations were selected by us and were staked in the field by us using a handheld Trimble Geo7X GPS unit. The locations of the borings are shown on our Exploration Plan, which is included in Appendix A.

The borings were drilled on May 20, 2024 with a CME-55 drill rig advancing hollow-stem augers, as indicated on the boring logs presented in Appendix B. The energy transfer ratio of the drill rig used was 85 percent. Sampling of the overburden soils was accomplished ahead of the augers at the depths indicated on the boring logs, with a 2-inch-outside-diameter (O.D.) split-barrel sampler in general accordance with the procedures outlined by ASTM D1586. Standard Penetration Tests (SPTs) were performed with the split-barrel sampler to obtain the standard penetration resistance or N-value[2] of the sampled material.

Observations for groundwater were made in the borings during drilling, at the completion of drilling, and before backfilling the boring holes.

A geologist/scientist from UES provided technical direction during field exploration, observed drilling and sampling, assisted in obtaining samples, and prepared field logs of the material encountered.

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[1] Ohio Department of Natural Resources

[2] The standard penetration resistance, or N-value, is defined as the number of blows required to drive the split-barrel sampler 12 inches with a 140-pound hammer falling 30 inches. Since the split-barrel sampler is driven 18 inches or until refusal, the blows for the first 6 inches are for seating the sampler, and the number of blows for the final 12 inches is the N-value, which is reported as blows per foot (or bpf). Additionally, “refusal” of the split-barrel sampler occurs when the sampler is driven less than 6 inches with 50 blows of the hammer.

Representative portions of the split-barrel samples were placed in glass jars with lids to preserve the in-situ moisture contents of the samples. The glass jars were marked and labeled in the field for identification when returned to our laboratory.

5.0 LABORATORY REVIEW AND TESTING

Upon completion of the fieldwork, the samples recovered from the borings were transported to our Soil Mechanics Laboratory, where they were visually reviewed and classified by the Project Geotechnical Engineer.

Laboratory testing was performed on selected soil samples to estimate engineering and index properties. Laboratory testing of the selected soil samples included various combinations of the following tests: moisture content, Atterberg limits, gradation (particle-size) analyses and sulphate content. The results are provided on the boring logs, which are included in Appendix B.

The boring logs, which are included in Appendix B, were prepared by the Project Geotechnical Engineer based on the field logs, the visual classification of the soil and bedrock samples in the laboratory, and the laboratory test results.

6.0 SUBSURFACE CONDITIONS

6.1 Stratification

The soils encountered in the borings consisted of soils associated with previous subgrade construction underlain by predominantly native cohesive soils of glacial origin. The cohesive soils encountered were generally soft to very stiff, clay (A-7-6), and silty clay (A-6b). Elastic clay (A-7-5) was encountered to a depth of 1.5 feet at Boring B-006-0-24. A cohesionless very loose coarse and fine sand (A-3) was encountered from 4.5 to 6.0 feet at Boring B-001-0-24. More specific descriptions of the soil are provided on boring logs in Appendix B.

6.2 Groundwater Conditions

Groundwater was observed in B-001-0-24, B-003-0-24, B-005-0-24, B-007-0-24 and it was not encountered in the Borings B-002-0-24, B-004-0-24, B-006-0-24 during our short-term groundwater observations. The groundwater information in summarized in Table 1.

Table 1: Summary of Groundwater

Boring No	Groundwater depth	
	During drilling	After drilling
B-001-0-24	4.0’	Not Encountered
B-003-0-24	8.5’	9.5’
B-005-0-24	6.0’	9.5’
B-007-0-24	5.5’	5.7’

In general, soils associated with previous subgrade construction and native soils of glacial origin were encountered in the test borings, and it is common to encounter groundwater seepage or perched groundwater along the fill/native soil interface or within silt/sand pockets of glacial soils. Additionally, groundwater levels and seepage amounts are expected to vary with time, location, season of the year, and amounts of precipitation. Groundwater fluctuations should be considered during the design and construction of the project.

7.0 ANALYSES AND RECOMMENDATIONS

7.1 Embankment/Cut Slope Recommendations

We recommend that the permanent cut and fill slopes for this project be designed not steeper than 2.5H:1V (2.5 Horizontal to 1 Vertical). Gentler slopes should be used whenever possible for ease of maintenance. All exposed earth slopes should be seeded soon after construction to protect against erosion and then protected with erosion control mats or straw mulch until vegetation is established on the slopes.

Where grades are steeper than 8H:1V (if present), level benches should be excavated to accept the new embankment fill. The benches should have a minimum vertical face height of 1 foot and a maximum vertical face height of 3 feet and should be cut wide enough to accommodate compaction equipment. New embankment fill materials should meet the criteria in CMS Section 203. Embankment fill should be placed and compacted per CMS Section 203. To ensure proper compaction of new embankment fill materials on final slope geometry, it is recommended that the fill slope be overbuilt by about 2-feet and cut back to final geometry.

7.2 Pavement Subgrade Analyses

We understand that the final grade includes cuts up to 1.6 feet and fills up to 1.4 feet. Using the proposed grades as a basis for pavement subgrade elevations and our findings from this exploration as input parameters in ODOT's Geotechnical Bulletin 1 (GB-1) Subgrade Analysis spreadsheet, we were able to determine the pavement design parameters and identify the need for subgrade stabilization throughout the referenced project. The subgrade analysis parameters recommended for use in the pavement design for the roadway are summarized in Table 2 below. The results of the pavement subgrade analyses along with the GB-1 spreadsheet output are included in Appendix C.

Table 2. Summary of GB-1 Analyses.

Average N_{60L}	Average PI	HP[a]	Design CBR	M_R[b] (psi)
7	24	0.85	4	4,800

Notes:
[a] Average hand penetrometer readings in tons per square foot (tsf)
[b] Subgrade Resilient Modulus (M_R) = 1200 × CBR (per ODOT PDM Section 203.1)

7.3 Pavement Design Recommendations

Pavement for this project should be designed in accordance with the latest version of the ODOT Pavement Design Manual (PDM) consistent with the expected axle loads, frequency of loading, life cycle, reliability of the design, and properties of the subgrade. Based on the ODOT GB-1 Subgrade Analysis spreadsheet, which correlates the California Bearing Ratio (CBR) to index property test results, a CBR of **4** is recommended for the pavement design of the proposed roadways.

Based on the results of the GB-1 analyses and guidance provided in the ODOT GB-1 document, subgrade stabilization is required in the areas represented by each of the borings except B-003-0-24.

Based on our field and laboratory test results, and guidance provided in the ODOT GB-1 document, undercutting or stabilization of the soils is anticipated at the pavement subgrade for the proposed roadway. Since more than 30% of the project does require stabilization, it is recommended that stabilization be considered for the entire project length. Currently, ODOT uses two options for establishing a stable subgrade: chemical stabilization or excavate and replace.

For chemical stabilization the subgrade should be stabilized with Lime to at least 14 inches below the final subgrade. Sulfate testing was performed on the subgrade soils from each boring location. The sulfate content was 275 ppm or less at all locations, indicating that sulfate should not be an issue if chemical stabilization is performed. For the “excavate and replace” option, the subgrade should be excavated to at least 18 inches below the bottom of the planned subgrade. In accordance with GB-1, the bottom of the excavation is to be lined with Item 712.09 Type D Geotextile and Item 204 Granular Material Type B fill placed and compacted to final subgrade. Note that the elastic clay (A-7-5) encountered within the first 1.5 feet of Boring B-006-0-24 should be completely undercut since it falls within 36 inches below proposed subgrade.

For a project of this size (less than 1 mile), the undercut and replace option will typically be more economical, provided good weather conditions are encountered during construction. Areas where subgrade soils have deteriorated due to trafficking or water-softening, additional undercut may be required to provide a suitable surface for fill placement and/or stabilization methods. If wet weather conditions are encountered during construction, undercutting and placement of coarse aggregate and geogrid may be required.

We recommend that the pavement subgrade be prepared in accordance with the requirements established in Section 204 of the ODOT Construction and Materials Specifications (CMS) Manual.

8.0 RECOMMENDED ADDITIONAL SERVICES

The conclusions and recommendations given in this report are based on: UES’s understanding of the proposed design and construction, as outlined in this report; site observations; interpretation of the exploration data; and our experience. Since the intent of the design recommendations is best understood by UES, we recommend that UES be included in the final design and construction

process and be retained to review the project plans and specifications to confirm that the recommendations given in this report have been correctly implemented. We recommend that UES be retained to participate in prebid and preconstruction conferences to reduce the risk of misinterpretation of the conclusions and recommendations in this report relative to the proposed construction of the subject project.

Since actual subsurface conditions between boring locations may vary from those encountered in the borings, our design recommendations are subject to adjustment in the field based on the subsurface conditions encountered during construction. Therefore, we recommend that UES be retained to provide construction observation services as a continuation of the design process to confirm the recommendations in this report and to revise them accordingly to accommodate differing subsurface conditions. Construction observation is intended to enhance compliance with project plans and specifications. It is not insurance, nor does it constitute a warranty or guarantee of any type. Regardless of construction observation, contractors, suppliers, and others are solely responsible for the quality of their work and for adhering to plans and specifications.

9.0 LIMITATIONS

This report has been prepared on behalf of, and for the exclusive use of, EMH&T for specific application to the named project as described herein. If this report is provided to other parties, it should be provided in its entirety with all supplementary information. In addition, EMH&T should make it clear that the information is provided for factual data only, and not as a warranty of subsurface conditions presented in this report.

UES has attempted to conduct the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. The recommendations and conclusions contained in this report are professional opinions. The report is not a bidding document and should not be used for that purpose.

Our scope for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client. Our scope did not include an assessment of the effects of flooding and erosion of creeks or rivers adjacent to or on the project site.

The analyses, conclusions, and recommendations contained in this report are based on the data obtained from the subsurface exploration. The field exploration methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Consequently, subsurface conditions may vary gradually, abruptly, and/or nonlinearly between sample locations and/or intervals.

The conclusions or recommendations presented in this report should not be used without UES's review and assessment if the nature, design, or location of the facilities is changed, if there is a substantial lapse in time between the submittal of this report and the start of work at the site, or if there is a substantial interruption or delay during work at the site. If changes are contemplated or delays occur, UES must be allowed to review them to assess their impact on the findings, conclusions, and/or design recommendations given in this report. UES will not be responsible for any claims, damages, or liability associated with any other party's interpretations of the subsurface data or with reuse of the subsurface data or engineering analyses in this report.

The recommendations included in this report have been based in part on assumptions about variations in site stratigraphy that may be evaluated further during earthwork and foundation construction. UES should be retained to perform construction observation and continue its geotechnical engineering service using observational methods. UES cannot assume liability for the adequacy of its recommendations when they are used in the field without UES being retained to observe construction.

A copy of "Important Information about This Geotechnical-Engineering Report" that is published by the Geotechnical Business Council (GBC) of the Geoprofessional Business Association (GBA) is included in Appendix D for your review. The publication discusses some other limitations, as well as ways to manage risk associated with subsurface conditions.

APPENDIX A – PLANS

Exploration Plan, Sheet No. 1

Date Printed: 4/24/2024 2:59 PM Path: \\10.1.12.10\cin\data\projects\J042\J042054.02-LOG-US33-9.78 Roundabout\Draw\J042054.02-Exploration Plan.dwg

LEGEND

INDICATES TEST BORING LOCATIONS

0 50 100 200

SCALE: 1" = 100'

NOTE: BASE MAP FROM RAB EXHIBIT RECEIVED FROM EMH&T ON APRIL 4, 2024 AND AERIAL IMAGERY DOWNLOADED FROM MICROSOFT BING ON APRIL 4, 2024.

UES

Project: LOG-US33-9.78 ROUNDABOUT

Location: LOGAN COUNTY, OHIO

Title: EXPLORATION PLAN

Client: EMH&T

Date: 4/24/2024

Project No.: J042054.02

Sheet No.: 1

APPENDIX B – BORING INFORMATION

ODOT Boring Logs

ODOT Quick Reference Guide for Visual Description of Soils and Classification of Soils Sheets

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/14/24 16:21 - \\10.1.12.10\CINDATA\PROJECTS\J042\J042054.02-LOG-US33-9.78 ROUNDABOUT\DATA\LOGS\J042054.02_US 3

PROJECT: LOG-US33-9.68 ROUNDABOUT	DRILLING FIRM / OPERATOR: ADC / ADAM	DRILL RIG: CME 550X ATV	STATION / OFFSET: 100+66, 18' RT.	EXPLORATION ID B-001-0-24
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: UES / CLAIRE	HAMMER: CME AUTOMATIC	ALIGNMENT: US 33	
PID: 118109 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 4/28/23	ELEVATION: 1054.7 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 5/20/24 END: 5/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85	LAT / LONG: 40.446490, -83.821330	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL, (4 INCHES)	1054.7																	
	1054.4																	
SOFT TO MEDIUM STIFF, GRAY, **CLAY**, LITTLE TO SOME SAND, MOIST		1	1 3	6	22	SS-1	0.50	0	10	12	27	51	43	23	20	28	A-7-6 (13)	
		2	3 4	10	22	SS-2	1.00	0	8	11	27	54	42	22	20	22	A-7-6 (12)	
		3	1 2 1	4	100	SS-3	0.50	2	2	24	26	46	43	22	21	23	A-7-6 (12)	
	1050.2	W 1050.7 4																
LOOSE, BROWN, **COARSE AND FINE SAND**, MOIST		5	0 2 5	10	78	SS-4	-	-	-	-	-	-	-	-	-	16	A-3 (V)	
	1048.7	6																
STIFF TO VERY STIFF, GRAY, **CLAY**, MOIST		7	4 8 13	30	100	SS-5	2.50	-	-	-	-	-	-	-	-	28	A-7-6 (V)	
		8																
		9	5 6 8	20	100	SS-6	1.50	-	-	-	-	-	-	-	-	-	A-7-6 (V)	
	1044.7	EOB 10																

NOTES: GROUNDWATER AT 4' DURING AND NOT ENCOUNTERED AFTER DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

PROJECT: LOG-US33-9.68 ROUNDABOUT	DRILLING FIRM / OPERATOR: ADC / ADAM	DRILL RIG: CME 550X ATV	STATION / OFFSET: 107+25, 40' RT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: UES / CLAIRE	HAMMER: CME AUTOMATIC	ALIGNMENT: US 33
PID: 118109 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 4/28/23	ELEVATION: 1048.4 (MSL) EOB: 10.0 ft.
START: 5/20/24 END: 5/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85	LAT / LONG: 40.445220, -83.819690

EXPLORATION ID B-002-0-24

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL, (6 INCHES)	1048.4																	
	1047.9																	
MEDIUM STIFF TO STIFF, BROWN, **CLAY**, MOIST		1	0 5 5	14	100	SS-1	1.00	0	0	2	30	68	63	28	35	33	A-7-6 (20)	
	1045.4	2	1 3 3	9	100	SS-2	0.50	-	-	-	-	-	-	-	-	28	A-7-6 (V)	
MEDIUM STIFF TO STIFF, GRAY, **SILTY CLAY**, MOIST		3	2 3 5	11	100	SS-3	1.00	7	4	10	25	54	38	21	17	22	A-6b (11)	
		4	1 4 7	16	67	SS-4	1.50	-	-	-	-	-	-	-	-	18	A-6b (V)	
		5	2 3 8	16	67	SS-5	1.50	-	-	-	-	-	-	-	-	-	A-6b (V)	
	1039.9	6																
STIFF, GRAY, **CLAY**, MOIST		7	5 6 9	21	100	SS-6	2.00	-	-	-	-	-	-	-	-	-	A-7-6 (V)	
	1038.4	EOB 8																
		9																
		10																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING AND AFTER DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/14/24 16:22 - \\10.1.12.10\CINDATA\PROJECTS\J042\J042054.02-LOG-US33-9.78 ROUNDABOUT\DATA\LOGS\J042054.02_US 3

PROJECT: LOG-US33-9.68 ROUNDABOUT	DRILLING FIRM / OPERATOR: ADC / ADAM	DRILL RIG: CME 550X ATV	STATION / OFFSET: 111+15, 10' RT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: UES / CLAIRE	HAMMER: CME AUTOMATIC	ALIGNMENT: US 33
PID: 118109 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 4/28/23	ELEVATION: 1048.7 (MSL) EOB: 10.0 ft.
START: 5/20/24 END: 5/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85	LAT / LONG: 40.444710, -83.818500

EXPLORATION ID B-003-0-24

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1048.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT, (12 INCHES)	1047.7																	
MEDIUM DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, MOIST	1046.2	1	41 12 7	27	72	SS-1	-	43	28	10	12	7	20	16	4	6	A-1-b (0)	
MEDIUM STIFF, BROWN, **CLAY**, MOIST		2 3 4 5 6 7	4 5 7	17	100	SS-2	1.50	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
			2 2 4	9	100	SS-3	1.00	3	3	7	27	60	50	23	27	26	A-7-6 (17)	
			2 3 4	10	100	SS-4	1.00	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
	1040.2	W 1040.2																
STIFF, GRAY, **CLAY**, MOIST		▽ 1039.2	3 5 7	17	100	SS-5	1.50	-	-	-	-	-	-	-	-	-	A-7-6 (V)	
	1038.7	EOB 10																

NOTES: GROUNDWATER AT 8.5' DURING DRILLING AND 9.5' AFTER DRILLING

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

PROJECT: LOG-US33-9.68 ROUNDABOUT	DRILLING FIRM / OPERATOR: ADC / ADAM	DRILL RIG: CME 550X ATV	STATION / OFFSET: 200+46, 3' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: UES / CLAIRE	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 274
PID: 118109 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 4/28/23	ELEVATION: 1056.9 (MSL) EOB: 10.0 ft.
START: 5/20/24 END: 5/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85	LAT / LONG: 40.445610, -83.822380

EXPLORATION ID B-004-0-24

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT, (12 INCHES)	1056.9 1055.9																	
MEDIUM STIFF TO STIFF, BROWN AND GRAY, **CLAY**, LITTLE SAND, MOIST		1	17 4 5	13	67	SS-1	1.00	0	4	11	29	56	43	22	21	25	A-7-6 (13)	
		2																
		3	3 4 6	14	100	SS-2	1.00	-	-	-	-	-	-	-	-	23	A-7-6 (V)	
		4																
		5	2 2 5	10	100	SS-3	1.00	0	2	8	25	65	52	25	27	26	A-7-6 (17)	
		6																
		7	2 4 5	13	100	SS-4	1.00	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
	1048.4	8																
VERY STIFF, BROWN AND GRAY, **SILTY CLAY**, MOIST	1046.9	9	8 11 17	40	100	SS-5	3.50	8	6	10	23	53	36	20	16	16	A-6b (10)	
		EOB 10																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING AND AFTER DRILLING

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

PROJECT: LOG-US33-9.68 ROUNDABOUT	DRILLING FIRM / OPERATOR: ADC / ADAM	DRILL RIG: CME 550X ATV	STATION / OFFSET: 204+70, 46' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: UES / CLAIRE	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 274
PID: 118109 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 4/28/23	ELEVATION: 1049.8 (MSL) EOB: 10.0 ft.
START: 5/20/24 END: 5/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85	LAT / LONG: 40.445930, -83.820950

EXPLORATION ID B-005-0-24

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1049.8	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
SOFT TO MEDIUM STIFF, DARK GRAY TO BROWN, **CLAY**, LITTLE SAND, MOIST		1	1 1 3	6	100	SS-1	0.50	0	3	13	23	61	58	27	31	33	A-7-6 (20)	
		2	1 2 3	7	100	SS-2	0.50	-	-	-	-	-	-	-	-	28	A-7-6 (V)	
		3	2 2 4	9	100	SS-3	1.00	0	2	13	23	62	55	24	31	27	A-7-6 (19)	
		4	1 1 2	4	100	SS-4	0.50	-	-	-	-	-	-	-	-	34	A-7-6 (V)	
		5																
		W 1043.8 6	1 1 2	4	100	SS-5	0.50	-	-	-	-	-	-	-	-	-	A-7-6 (V)	
	1041.3	7																
VERY STIFF, GRAY, **CLAY**, MOIST		▽ 1040.3 8	6 10 13	33	100	SS-6	3.00	-	-	-	-	-	-	-	-	-	A-7-6 (V)	
	1039.8	EOB 9 10																

NOTES: GROUNDWATER AT 6' DURING DRILLING AND 9.5' AFTER DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/14/24 16:22 - \\10.1.12.10\CINDATA\PROJECTS\J042\J042054.02-LOG-US33-9.78 ROUNDABOUT\DATA\LOGS\J042054.02_US 3

PROJECT: LOG-US33-9.68 ROUNDABOUT	DRILLING FIRM / OPERATOR: ADC / ADAM	DRILL RIG: CME 550X ATV	STATION / OFFSET: 208+33, 4' RT.	EXPLORATION ID B-006-0-24
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: UES / CLAIRE	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 274	
PID: 118109 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 4/28/23	ELEVATION: 1048.5 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 5/20/24 END: 5/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85	LAT / LONG: 40.446150, -83.819670	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
	1048.5																	
TOPSOIL, (6 INCHES)	1048.0																	
SOFT, DARK GRAY, **ELASTIC CLAY**, LITTLE SAND, MOIST	1047.0	1	2 2 3	7	78	SS-1	0.50	3	9	11	30	47	58	30	28	26	A-7-5 (19)	
MEDIUM STIFF, DARK GRAY, **CLAY**, MOIST		2	1 3 4	10	100	SS-2	1.00	-	-	-	-	-	-	-	-	31	A-7-6 (V)	
		3	2 2 4	9	100	SS-3	1.00	0	1	5	29	65	57	25	32	29	A-7-6 (19)	
	1042.5	4	2 2 5	10	100	SS-4	1.00	-	-	-	-	-	-	-	-	28	A-7-6 (V)	
MEDIUM STIFF TO STIFF, BROWN AND GRAY, **CLAY**, MOIST		5	1 4 5	13	100	SS-5	1.00	-	-	-	-	-	-	-	-	-	A-7-6 (V)	
	1040.0	6																
VERY STIFF, GRAY, **CLAY**, MOIST		7	6 8 12	28	100	SS-6	3.00	-	-	-	-	-	-	-	-	-	A-7-6 (V)	
	1038.5 EOB	8																
		9																
		10																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING AND AFTER DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

PROJECT: LOG-US33-9.68 ROUNDABOUT
TYPE: ROADWAY
PID: 118109 SFN:
START: 5/20/24 END: 5/20/24

DRILLING FIRM / OPERATOR: ADC / ADAM
SAMPLING FIRM / LOGGER: UES / CLAIRE
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 550X ATV
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 4/28/23
ENERGY RATIO (%): 85

STATION / OFFSET: 212+78, 9' RT.
ALIGNMENT: SR 274
ELEVATION: 1051.8 (MSL) EOB: 10.0 ft.
LAT / LONG: 40.446030, -83.818100

EXPLORATION ID: B-007-0-24

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
	1051.8																	
ASPHALT, (12 INCHES)	1050.8																	
SOFT TO MEDIUM STIFF, DARK GRAY TO BROWN, **CLAY**, LITTLE TO SOME SAND, MOIST		1	11 4 3	10	33	SS-1	1.00	4	5	23	26	42	43	24	19	24	A-7-6 (11)	
		2	2 1 3	6	28	SS-2	0.50	-	-	-	-	-	-	-	-	30	A-7-6 (V)	
		3	1 1 1	3	67	SS-3	0.50	5	4	12	25	54	46	24	22	30	A-7-6 (14)	
	1046.3 ▽	4																
		5	1 2 3	7	100	SS-4	0.50	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
		6																
	1043.3	7																
VERY STIFF, BROWN, **CLAY**, MOIST		8	5 10 12	31	28	SS-5	3.00	-	-	-	-	-	-	-	-	-	A-7-6 (V)	
	1041.8	9																
	EOB	10																

NOTES: GROUNDWATER AT 5.5' DURING AND AFTER DRILLING

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

APPENDIX A.1 - ODOT Quick Reference for Visual Description of Soils

1) STRENGTH OF SOIL:

Non-Cohesive (granular) Soils - Compactness	
Description	**Blows Per Ft.**
Very Loose	≤ 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

2) COLOR :

If a color is a uniform color throughout, the term is single, modified by an adjective such as light or dark. If the predominate color is shaded by a secondary color, the secondary color precedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term "mottled"

3) PRIMARY COMPONENT

Use **DESCRIPTION** from ODOT Soil Classification Chart on Back

Cohesive (fine grained) Soils - Consistency

Description	Qu (TSF)	Blows Per Ft.	Hand Manipulation
Very Soft	<0.25	<2	Easily penetrates 2" by fist
Soft	0.25-0.5	2 - 4	Easily penetrates 2" by thumb
Medium Stiff	0.5-1.0	5 - 8	Penetrates by thumb with moderate effort
Stiff	1.0-2.0	9 - 15	Readily indents by thumb, but not penetrate
Very Stiff	2.0-4.0	16 - 30	Readily indents by thumbnail
Hard	>4.0	>30	Indent with difficulty by thumbnail

4) COMPONENT MODIFIERS:

Description	Percentage By Weight
Trace	0% - 10%
Little	10% - 20%
Some	20% - 35%
"And"	35% -50%

5) Soil Organic Content

Description	% by Weight
Slightly Organic	2% - 4%
Moderately Organic	4% - 10%
Highly Organic	> 10%

6) Relative Visual Moisture

Description	Criteria	
	Cohesive Soil	**Non-cohesive Soils**
Dry	Powdery; Cannot be rolled; Water content well below the plastic limit	No moisture present
Damp	Leaves very little moisture when pressed between fingers; Crumbles at or before rolled to $^1/_8$"; Water content below plastic limit	Internal moisture, but no to little surface moisture
Moist	Leaves small amounts of moisture when pressed between fingers; Rolled to $^1/_8$" or smaller before crumbling; Water content above plastic limit to -3% of the liquid limit	Free water on surface, moist (shiny) appearance
Wet	Very mushy; Rolled multiple times to $^1/_8$" or smaller before crumbles; Near or above the liquid limit	Voids filled with free water, can be poured from split spoon.

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 AASHTO	Classifcation OHIO	LL_0/LL x 100*	% Pass #40	% Pass #200	Liquid Limit (LL)	Plastic Index (PI)	Group Index Max.	REMARKS
	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	
F S	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

P Peat

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

APPENDIX C – ANALYSIS

Subgrade Analysis: GB-1

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.)

US33-9.68 Roundabout
PID 118109

Roadway Borings

Geotechnology, LLC dba UES

Prepared By: Sunil Badam
Date prepared: Tuesday, April 22, 2025

Suraj Khadka, PE
UES
1780 Carillon Boulevard
Cincinnati, Ohio, 45240
419-450-6373
skhadka@teamues.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	US 33	100+66	18	RT	CME 550X ATV	85	1054.7	1053.5	1.2 C
2	B-002-0-24	US 33	107+25	40	RT	CME 550X ATV	85	1048.4	1047.4	1.0 C
3	B-003-0-24	US 33	111+15	10	RT	CME 550X ATV	85	1048.7	1047.7	1.0 C
4	B-004-0-24	SR 274	200+46	3	LT	CME 550X ATV	85	1056.9	1055.9	1.0 C
5	B-005-0-24	SR 274	204+70	46	LT	CME 550X ATV	85	1049.8	1048.8	1.0 C
6	B-006-0-24	SR 274	208+33	4	RT	CME 550X ATV	85	1048.5	1049.9	1.4 F
7	B-007-0-24	SR 274	212+78	9	RT	CME 550X ATV	85	1051.8	1050.2	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	0.0	1.5	-1.2	0.3	6		0.5	43	23	20	27	51	78	28	20	A-7-6	13	166		HP & Mc		24''	12''
	001-0	SS-2	1.5	3.0	0.3	1.8	10		1	42	22	20	27	54	81	22	19	A-7-6	12						204 Geotextile
	24	SS-3	3.0	4.5	1.8	3.3	4		0.5	43	22	21	26	46	72	23	19	A-7-6	12						
		SS-4	4.5	6.0	3.3	4.8	10	4								16.2	8	A-3	0						
2	B	SS-1	0.0	1.5	-1.0	0.5	14		1	63	28	35	30	68	98	33	25	A-7-6	20	107		HP & Mc		12''	30''
	002-0	SS-2	1.5	3.0	0.5	2.0	9		0.5							28	18	A-7-6	16			HP & Mc		24''	204 Geotextile
	24	SS-3	3.0	4.5	2.0	3.5	11		1	38	21	17	25	54	79	22	16	A-6b	11						
		SS-4	4.5	6.0	3.5	5.0	16	9	1.5							18	16	A-6b	16						
3	B	SS-1	1.0	2.5	0.0	1.5	27			20	16	4	12	7	19	6	6	A-1-b	0	275					
	003-0	SS-2	2.5	4.0	1.5	3.0	17		1.5							29	18	A-7-6	16			HP & Mc			
	24	SS-3	4.0	5.5	3.0	4.5	9		1	50	23	27	27	60	87	26	20	A-7-6	17						
		SS-4	5.5	7.0	4.5	6.0	10	9	1							29	18	A-7-6	16						
4	B	SS-1	1.0	2.5	0.0	1.5	13		1	43	22	21	29	56	85	25	19	A-7-6	13	100		HP & Mc		12''	12''
	004-0	SS-2	2.5	4.0	1.5	3.0	14		1							23	18	A-7-6	16			HP & Mc			204 Geotextile
	24	SS-3	4.0	5.5	3.0	4.5	10		1	52	25	27	25	65	90	26	22	A-7-6	17						
		SS-4	5.5	7.0	4.5	6.0	13	10	1							21	18	A-7-6	16						
5	B	SS-1	0.0	1.5	-1.0	0.5	6		0.5	58	27	31	23	61	84	33	24	A-7-6	20	213		HP & Mc		24''	36''
	005-0	SS-2	1.5	3.0	0.5	2.0	7		0.5							28	18	A-7-6	16			HP & Mc		24''	204 Geotextile
	24	SS-3	3.0	4.5	2.0	3.5	9		1	55	24	31	23	62	85	27	21	A-7-6	19						
		SS-4	4.5	6.0	3.5	5.0	4	4	0.5							34	18	A-7-6	16						
6	B	SS-1	0.0	1.5	1.4	2.9	7		0.5	58	30	28	30	47	77	26		A-7-5	19	166	A-7-5	HP	35''		36''
	006-0	SS-2	1.5	3.0	2.9	4.4	10		1							31	18	A-7-6	16						204 Geotextile
	24	SS-3	3.0	4.5	4.4	5.9	9		1	57	25	32	29	65	94	29	22	A-7-6	19						
		SS-4	4.5	6.0	5.9	7.4	10	7	1							28	18	A-7-6							
7	B	SS-1	1.0	2.5	-0.6	0.9	10		1	43	24	19	26	42	68	24	21	A-7-6	11	100		HP & Mc		12''	30''
	007-0	SS-2	2.5	4.0	0.9	2.4	6		0.5							30	18	A-7-6	16			HP & Mc		24''	204 Geotextile
	24	SS-3	4.0	5.5	2.4	3.9	3		0.5	46	24	22	25	54	79	30	21	A-7-6	14						
		SS-4	5.5	7.0	3.9	5.4	7	3	0.5							22	18	A-7-6	16						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.7 4/4/2024

PID: PID 118109

County-Route-Section: US33-9.68 Roundabout
No. of Borings: 7

Geotechnical Consultant: Geotechnology, LLC dba UES
Prepared By: Sunil Badam
Date prepared: 4/22/2025

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	No
	Lime Stabilization	Option
206	Depth	14''

Excavate and Replace Stabilization Options	
Global Geotextile	
Average(N60L):	18''
Average(HP):	15''
Global Geogrid	
Average(N60L):	0''
Average(HP):	0''

Design CBR	4

% Samples within 3 feet of subgrade			
$N_{60} \leq 5$	7%	HP ≤ 0.5	29%
$N_{60} < 12$	54%	0.5 < HP ≤ 1	36%
$12 \leq N_{60} < 15$	11%	1 < HP ≤ 2	4%
$N_{60} \geq 20$	4%	HP > 2	0%
M+	36%		
Rock	0%		
Unsuitable Soil	100%		

Excavate and Replace at Surface	
Average	22''
Maximum	36''
Minimum	0''

% Proposed Subgrade Surface	
Unstable & Unsuitable	71%
Unstable	65%
Unsuitable (Soil & Rock)	6%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	10	7	0.85	47	24	24	26	53	78	26	18	15
Maximum	27	10	1.50	63	30	35	30	68	98	34	25	20
Minimum	3	3	0.50	20	16	4	12	7	19	6	6	0

Classification Counts by Sample

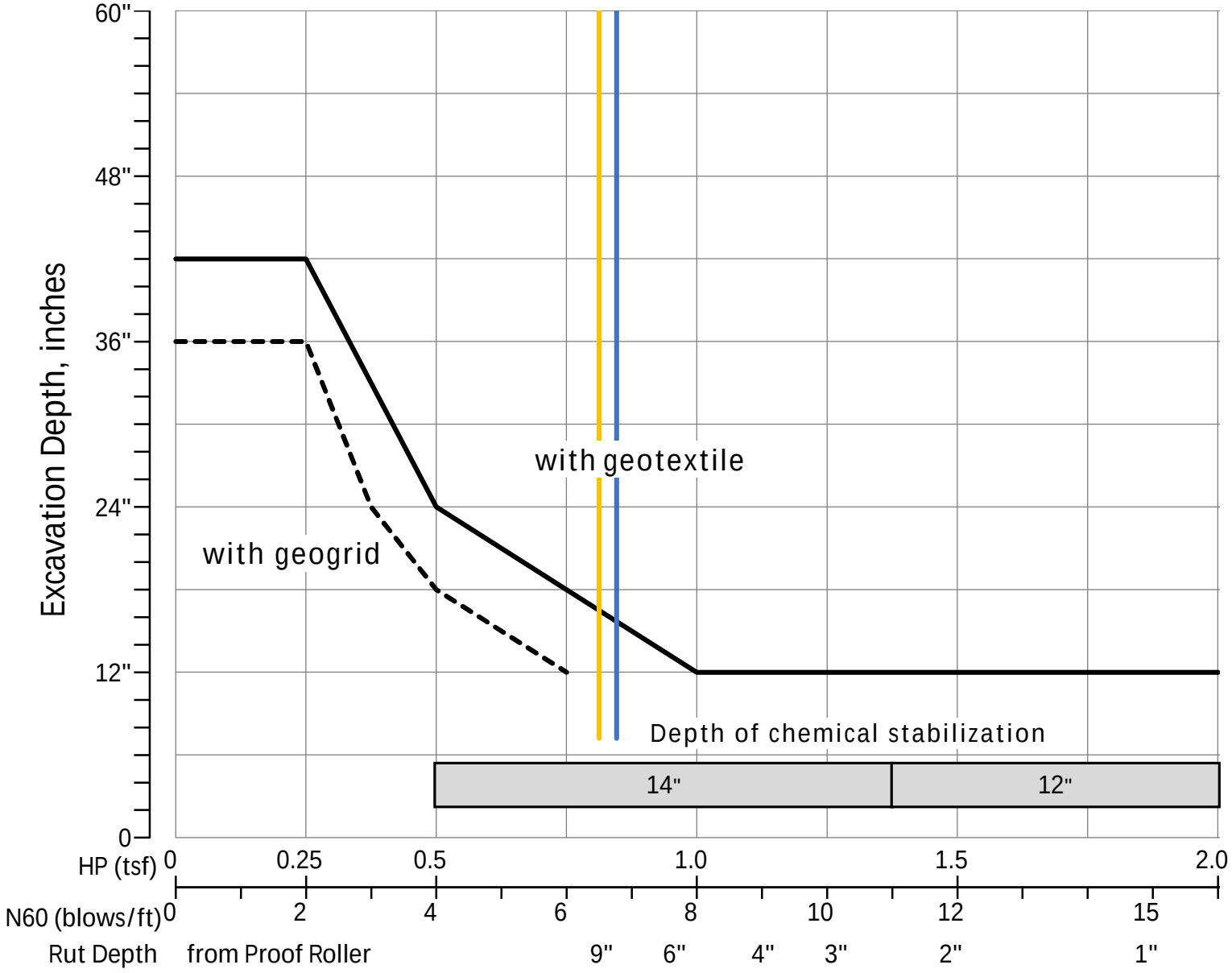
ODOT Class	UCF	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2	1	23	0	0	28
Percent	0%	0%	0%	4%	0%	0%	0%	0%	4%	0%	0%	0%	0%	0%	7%	4%	82%	0%	0%	100%
% Rock|Granular|Cohesive	0%	0%	7%									93%								100%
Surface Class Count	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	14	0	0	17
Surface Class Percent	0%	0%	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	6%	6%	82%	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
0.85	0.50	☐ HP
6.57	6.00	☐ N60L

Average HP

Average N_{60L}

APPENDIX D – IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

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