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Established 1927

February 3, 2025

MS Consultants
2221 Schrock Road
Columbus, Ohio 43229

Attention: Mr. Sean Jenq, PhD, P.E. – Bridge Manager

Reference: **Roadway Exploration – Final Report**
PIK-CR44-00.16; Turkey Run Road Bridge over Pee Creek
PID No. 115499
Pebble Township, Pike County, Ohio
CTL Project No. 24050010CIN

Dear Mr. Jenq:

CTL Engineering, Inc. (CTL) has completed the final roadway exploration report for the above referenced project. We are providing an electronic version (PDF file) of the report via email.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact me at our office.

Respectfully Submitted,

CTL ENGINEERING, INC.

A handwritten signature in black ink that reads "Doug R. Batt". The signature is written in a cursive, flowing style.

Doug R. Batt, P.E.
Project Manager

ROADWAY EXPLORATION – FINAL REPORT

**PIK-CR44-00.16
TURKEY RUN ROAD BRIDGE OVER PEE PEE CREEK
PID NO. 115499
PEBBLE TOWNSHIP, PIKE COUNTY, OHIO**

CTL PROJECT NO. 24050010CIN

PREPARED FOR:

**MS CONSULTANTS
2221 SCHROCK ROAD
COLUMBUS, OHIO 43229**

PREPARED BY:

**CTL ENGINEERING, INC.
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CINCINNATI, OHIO 45240**

February 3, 2025

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**OHIO DEPARTMENT OF
TRANSPORTATION**

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I. EXECUTIVE SUMMARY

The overall project, identified as PIK-CR44-00.16, consists of replacing an existing 80-foot single-span bridge (SFN 6633447) with a three-span bridge (SFN 6633448) that carries County Road 44 (Turkey Run Road) over Pee Pee Creek as well as improving the roadway horizontal and vertical alignment within the project limit in Pebble Township, Pike County, Ohio. The proposed bridge will be a continuous, reinforced concrete slab supported on capped pile piers and capped pile abutments with a total length of 99.0 feet. The spans vary in length from 30.0 feet to 37.5 feet. According to the structural plans, the bridge begins at Station 8+23.34 and ends at Station 9+20.84. A total of nine (9) test borings were performed for this planned replacement structure and roadway realignment. Three (3) test borings were drilled within the existing roadway pavement, three (3) test borings were drilled off the existing roadway pavement along the new alignment, and the remaining three (3) test borings were drilled within the Pee Pee creek or creek bank.

The test borings encountered both fine-grained and coarse-grained native soils prior to reaching the planned boring termination depths or encountering bedrock. The fine-grained soils were visually described as very stiff to hard, brown and gray sandy silt (A-4a), silt and clay (A-6a), silty clay (A-6b), elastic clay (A-7-5), and clay (A-7-6). The coarse-grained soils encountered were visually described as loose to very dense, brown, black, and gray stone fragments with sand (A-1-b), gravel and/or stone fragments with sand and silt (A-2-4), gravel and stone fragments with sand, silt, and clay (A-2-6 and A-2-7), and sandy silt (A-4a). Bedrock was encountered in five (5) of the nine (9) test borings at a depths ranging from the ground surface to approximately 23.5 feet below ground surface. The bedrock encountered was described as black and dark gray shale, severely to slightly weathered, very weak to slightly strong, and very thick bedding.

Groundwater was encountered five (5) of the nine (9) borings during drilling and/or at the completion of drilling at depths ranging from the ground surface (borings located in stream channel) to 22.0 feet below ground surface. The proposed bridge abutments and center piers may be supported onto H-piles driven to refusal into the underlying bedrock or drilled shafts embedded into bedrock. Refer to the *Analyses and Recommendations* section of this report for additional information.

This roadway exploration was performed in accordance with the State of Ohio's Department of Transportation (ODOT) Specifications of Geotechnical Exploration (SGE), dated July 2024.



II. INTRODUCTION

The Pike County Engineer's Office (PCEO), in conjunction with ODOT District 9, is planning for the replacement of the Turkey Run Road bridge over Pee Pee Creek along with the realignment of the roadway in Pebble Township, Pike County, Ohio. The project site begins approximately 400 feet northeast of the intersection of County Road 44 (Turkey Run Road) and County Road 37 (Buchanan Road). Initial project information was provided to CTL Engineering, Inc. (CTL) by the MS Consultants (MSC) via an email on March 29, 2023 and follow-up comments in an email on June 8, 2023. Additional project information was provided to CTL by MSC via email on March 12 and 19, 2024 as well as April 8, 2024. The information consisted of Stage 1/2 plans showing the plan and profiles of the proposed realigned roadway and bridge in addition to contour maps for Turkey Run Road. The project consists of the replacing the existing single-span, steel pony truss bridge with a three-span bridge and improving the roadway horizontal and vertical alignment within the entire project limit.

According to the Stage 2 plans developed by MSC (dated January 12, 2024), the project begins at Station 4+45.89 and ends at Station 12+17.23. The proposed bridge will be a continuous reinforced concrete slab bridge supported on capped pile piers and capped pile abutments with a total length of 99.0 feet. The spans vary in length from 30.0 feet to 37.5 feet. The bridge begins at Station 8+23.34 and ends at Station 9+20.84, with the two piers at Station 8+53.34 and Station 8+90.84.

MSC requested CTL perform a geotechnical exploration for the bridge replacement and roadway realignment in accordance with the State of Ohio's Department of Transportation (ODOT) Specifications of Geotechnical Exploration (SGE), dated July 2024. CTL's services were performed in accordance with its proposal number 23050023CIN-PPL, dated April 9, 2024.

III. GEOLOGY AND OBSERVATIONS

A. Geology

According to the Ohio Department of Natural Resources (ODNR) Physiographic Regions of Ohio Map (1998), the project site lies within the Shawnee-Mississippian Plateau Physiographic Region that is described as channery colluvium and silt loam underlain by Devonian-age and Mississippian-age shales, siltstones and locally thick sandstones.

According to the Web Soil Survey, *United States Department of Agriculture, Natural Resources Conservation Service*, the following soil unit and its properties are identified within the project area and are described in *Table 1*.



Table 1. Soil Survey Soil Types and Properties

Soil Unit Name	Soil Unit Symbol	Percentage of Project Site	Risk of Corrosion to Concrete	Risk of Corrosion to Steel
Clifty silt loam, occasionally flooded	Cf	44	Moderate	Moderate
Shelocta-Brownsville association, steep	SnF	56	High	Moderate

Geologic mapping (Surficial Geology of the Hillsboro 30 x 60 minute quadrangle, Ohio Division of Geological Survey, 2016) indicates that the overburden soils are mapped to consist of Holocene-age alluvium underlain by Illinoian-Age clay. According to the mapping of bedrock geology in the area, (Reconnaissance bedrock geology of the Summithill, Ohio, Quadrangle, *Digital Map Series BG-2*, Ohio Division of Geological Survey, 1994), the surficial soil deposits on the site are underlain by two sedimentary bedrock formations identified as the Devonian-age Ohio and Olentangy Shales Undivided and the Devonian- and/or Mississippian-age Sunbury Shale, Berea Sandstone, and Bedford Shale Undivided.

- The Ohio Shale is described as brownish black to greenish gray carbonaceous shale that weathers brown. Its bedding thickness ranges from laminated to thin.
- The Olentangy Shale is described as greenish gray to greenish gray clayey shale. Its bedding thickness ranges from laminated to thin.
- The Sunbury Shale is described as black to brown carbonaceous shale that weathers light brown. Its bedding is described as thin and planar.
- The Berea Sandstone is described as brown sandstone and minor shale that weathers light brown to reddish brown. Its bedding is described as planar to lenticular with bedding thicknesses ranging from thin to thick.
- The Bedford Shale is described as gray to brown shale interbedded with sandstone that weathers light gray to light brown. Its bedding is described as planar to lenticular with bedding thicknesses ranging from thin to medium.

According to the mapping of karst features (Known and Probable Karst in Ohio, ODNR Geological Survey Map EG-1, 1999; Revised 2002, 2006), there are no mapped karst features in the general vicinity of the project area. Additionally, karst features were not observed at the ground surface during our field exploration.

According to the mapping of historic and active mines (ODNR Mines of Ohio), there are no documented mines in the general vicinity of the project area.



B. Observations

The existing Turkey Run Road Bridge (Structure File Number: 6633447) is a 2-lane, single-span, steel pony truss bridge that spans approximately 80 feet. The existing bridge deck is a wooden wearing surface and is approximately 18 feet wide. It is located approximately 800 feet northeast of the intersection of Turkey Run Road and Buchanan Road.

A review of historic information (historical aerial imagery, historical topographic mapping, and ODOT's Bridge Inventory and Appraisal database) indicates that Turkey Run Road bridge has existed since around 1980, but a major reconstruction was completed in 2021. No additional reconstruction or rehabilitation was available for review; additionally, the records of the previous earthwork activities including cut and/or fill placement was not provided to CTL.

Field reconnaissance was completed by CTL personnel on March 28, 2024, May 29, 2024, and June 17, 2024. Turkey Run Road is a two-lane, bi-directional road that runs generally north to south within the project limits, but the roadway alignment has a significant horizontal curve in the vicinity of the existing bridge. Pee Pee Creek generally flows from northwest to southeast beneath Turkey Run Road. The topography in the surrounding area is moderately sloping while the ground surface immediately adjacent to the stream slopes steeply downward along the west bank of the creek. The area along the stream is wooded with the surrounding land usage consisting of rural residential and wooded.

Some stream bank erosion was observed in the vicinity of the existing bridge. Significant stream bank erosion was observed on the southwestern bank of the proposed bridge. Erosion protection at the existing bridge abutments was not observed. Corrosion of the steel truss beams was observed. The existing wooden bridge deck was observed to be in fair condition. Extensive roadway pavement cracking was observed on both approaches of the existing bridge and along the entire alignment. Additionally, an underground waterline was observed on the western portion of the project site and runs parallel to the existing roadway alignment.

IV. EXPLORATION

A total of nine (9) test borings (identified in *Table 1*) were drilled for this project. Three (3) of the nine (9) test borings were drilled within the existing roadway pavement, three (3) of the test borings were drilled off the existing roadway pavement, and the remaining three (3) test borings were drilled within the Pee Pee Creek or creek bank. A summary of the test boring locations, ground surface elevations and coordinates along with their depths are presented below in *Table 2*. CTL selected the number and location of the test borings as well as the planned depth of the test borings in accordance with the ODOT Specification for Geotechnical Explorations as a guideline.



Table 2. Boring Locations, Depths, Elevations, and Coordinates

Boring No.	Boring Type	Station & Offset	Ground Surface Elevation (feet)	Latitude (degrees)	Longitude (degrees)	Borehole Depth (feet)
B-001-0-24	A	4+46, 5' LT	706.5	39.143229	-83.091818	7.0
B-002-0-24	B3	4+88, 5' LT	704.9	39.143309	-83.091703	12.5
B-003-0-24	B3	5+68, 41' LT	708.8	39.143531	-83.091578	25.0
B-004-0-24 ⁽¹⁾	A/E1	8+13, 52' LT	699.2	39.144001	-83.090976	25.0
B-005-0-24	E1	8+57, 26' LT	675.6	39.144038	-83.090811	10.5
B-006-0-24	E1	8+76, 20' RT	677.1	39.143997	-83.090644	15.5
B-007-0-24	A/E1	9+20, 18' LT	680.3	39.144157	-83.090654	17.25
B-008-0-24	B1	10+10, 5' LT	681.2	39.144344	-83.090461	10.0
B-009-0-24	A	12+41, 7' LT	687.3	39.144949	-83.090536	7.0

(1) An offset boring (B-004-A-24) was drilled adjacent to perform rock core sampling to a depth of 37.2 feet. A boring log of the offset boring is included in *Appendix A*.

The locations of the test borings B-001-0-24 through B-009-0-24 were determined in the field by the CTL. Adjustment from the planned locations to the drilled locations were made due to access and safety concerns. The coordinates, ground surface elevations, stations and offsets at the drilled test boring locations were determined by the MSC and provided to CTL.

The test borings were drilled by CTL between the dates of June 25, 2024 to June 28, 2024, utilizing 3-¼ inch I.D. hollow-stem augers powered by a track-mounted drill rig. Split-barrel (spoon) samples and Standard Penetration Tests (SPTs) were performed in the test borings using a 140-pound automatic hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches. The automatic hammer was calibrated at an energy ratio of 79.3 percent on November 4, 2022. Rock coring was performed in four (4) of the nine (9) borings using an NQ2-size core barrel.

The soil materials recovered from the split spoon samples obtained during the drilling operations were preserved in glass jars, visually classified in the field, and delivered to CTL's soil laboratory for visual classification, testing and analysis. All samples were also tested for moisture content. Representative samples were subjected to laboratory testing including Atterberg Limits, grain size distribution and hand penetrometer. The percent recovery and Rock Quality Designation (RQD) values were determined for the rock core sampling. Selected recovered rock core samples were subjected to unit weight tests, uniaxial compressive strength tests, and point load strength index testing.

Drilling, sampling, field and laboratory testing were performed according to standard geotechnical engineering practices and current AASHTO/ASTM procedures. Results from field tests are shown on the enclosed test boring records in *Appendix A* and



Appendix B of this report. Results from the laboratory tests are shown on the enclosed laboratory test results in *Appendix C* of this report.

V. FINDINGS

A. Subsurface Conditions

A general description of the soils and rock encountered during our subsurface exploration is presented below. Further details of the subsurface conditions encountered during CTL's geotechnical exploration are presented in the Test Boring Records in *Appendix A* and *Appendix B*. Results of the laboratory tests are presented in *Appendix C*.

1. Surficial Materials

The three (3) test borings (B-001-0-24, B-002-0-24, and B-009-0-24) drilled within the existing roadway pavement encountered three (3) inches of asphalt underlain by five (5) inches of gravel base at the ground surface. The three (3) test borings (B-003-0-24, B-004-0-24, and B-008-24) drilled off the existing roadway pavement encountered three (3) to eight (8) inches of topsoil at the ground surface. The three (3) test borings (B-005-0-24, B-006-24, and B-007-0-24) drilled within the Pee Pee Creek or within the creek bank encountered bedrock or stone fragments with sand (A-1-b) at the ground surface.

2. Native Soils

Beneath the surficial materials, the test borings encountered both fine-grained soils and coarse-grained soils to the boring termination depths or prior to encountering bedrock.

The fine-grained soils were visually described as very stiff to hard, brown and gray sandy silt (A-4a), silt and clay (A-6a), silty clay (A-6b), elastic clay (A-7-5), and clay (A-7-6). SPT N_{60} -values determined within the fine-grained soils ranged from 15 blows per foot (bpf) to 69 bpf with moisture content values ranging from 9 to 26 percent.

The coarse-grained soils encountered were visually described as loose to very dense, brown, black, and gray stone fragments with sand (A-1-b), gravel and/or stone fragments with sand and silt (A-2-4), gravel and stone fragments with sand, silt, and clay (A-2-6 and A-2-7), and sandy silt (A-4a). SPT N_{60} -values determined within the coarse-grained soils ranged from 7 bpf to 87 bpf with moisture content values ranging from 8 to 27 percent.

The N_{60} -value is the SPT blow count corrected for the hammer efficiency delivered by the hammer system utilized, normalized to 60 percent efficiency in bpf.



3. Bedrock

Beneath the overburden soil materials, five (5) of the nine (9) test borings encountered bedrock at a depths ranging from the ground surface to approximately 23.5 feet bgs. The transition from the soil overburden to the underlying bedrock stratum is not always distinct and can be gradual depending on the degree of weathering. The determination of the severely weathered bedrock surface from the overlying soil strata can be estimated from the split-spoon sampling, the increased resistance to the advancement of the drilling equipment, and a review of the recovered materials (color, structure, moisture content and toughness).

Upon achieving auger and/or split spoon refusal into the bedrock, rock coring was performed within test borings B-004-0-24 (more specifically B-004-A-24), B-005-0-24, B-006-0-24, and B-007-0-24 to additional depths ranging from 10 to 12.2 feet. The recovered bedrock samples were described as black and dark gray shale, severely to slightly weathered, very weak to slightly strong, and very thick bedding. The recovered rock core ranged from 96 percent to 100 percent for each coring run. The RQD values for each core run ranged from 16 to 100 percent.

B. Groundwater

Groundwater was encountered in five (5) of the nine (9) test borings during and/or after the completion of drilling operations. *Table 3* summarizes the depths of groundwater during and after drilling as well as the borehole cave-in depth. Since test boring B-005-0-24 was located within the creek, the groundwater encountered was influenced by surface water flow. It should be noted that the groundwater depths encountered during this subsurface exploration are generally not a reliable indication of long-term groundwater levels. Fluctuations in the level of the groundwater table (or saturated soils/perched water levels) will occur due to seasonal variances in rainfall, drainage, types of soils present and other factors. We caution that groundwater can be perched at various elevations above the general static groundwater level after periods of rainfall, especially in the lower elevations and natural drainage paths of the site.

Table 3. Groundwater and Borehole Cave-in Depths

Boring No.	Ground Surface Elevation (feet)	Groundwater Depth During Drilling (feet)	Groundwater Depth After Drilling (feet)	Borehole Cave-in Depth (feet)
B-001-0-24	706.5	None	None	2.0
B-002-0-24	704.9	None	None	4.0
B-003-0-24	708.8	None	None	12.0
B-004-0-24 ⁽¹⁾	699.2	19.0	22.0	23.0
B-005-0-24 ⁽²⁾	675.6	0.0	0.0	-
B-006-0-24	677.1	3.0	3.0	5.5



Boring No.	Ground Surface Elevation (feet)	Groundwater Depth During Drilling (feet)	Groundwater Depth After Drilling (feet)	Borehole Cave-in Depth (feet)
B-007-0-24	680.3	4.0	3.0	6.0
B-008-0-24	681.2	6.0	None	5.0
B-009-0-24	687.3	None	None	3.0

- (1) An offset boring (B-004-A-24) was drilled adjacent to perform rock core sampling. A boring log of the offset boring is included in *Appendix A*.
- (2) Test boring was performed within Pee Creek. Water was encountered at or above the ground surface before, during, and at the completion of drilling.

C. Results of Laboratory Tests

Selected soil samples were tested in the laboratory for Atterberg Limits and grain size distribution. The results of the soil laboratory tests are presented on the Test Boring Records in *Appendix A* and *Appendix B* and are summarized in *Table 4* and *Table 5*. The sulfate content of the subgrade material obtained within 3 feet of proposed subgrade ranged from less than 100 ppm to 540 ppm. The results of the sulfate tests are presented in *Appendix C* of this report.

Table 4. Soil Laboratory Test Results

Boring No.	Sample No.	Depth (feet)	ODOT	LL	PI	Sa/Gr (%)	Silt (%)	Clay (%)
B-001-0-24	SS-1	1.0 – 2.5	A-4a	29	10	50	34	16
B-001-0-24	SS-2	2.5 – 4.0	A-6a	32	12	27	48	25
B-002-0-24	SS-4	5.5 – 7.0	A-7-6	58	34	3	36	61
B-003-0-24	SS-1	1.0 – 2.5	A-7-5	57	20	16	65	19
B-003-0-24	SS-2	3.5 – 5.0	A-4a	27	8	35	45	20
B-003-0-24	SS-9	21.0 – 22.5	A-6b	37	16	8	52	40
B-004-0-24	SS-5	7.0 – 8.5	A-7-6	41	17	7	51	42
B-004-0-24	SS-6	8.5 – 10.0	A-2-7	49	25	68	16	16
B-004-0-24	SS-8	11.0 – 12.5	A-2-6	36	16	79	10	11
B-004-0-24	SS-11	16.0 – 17.5	A-2-6	38	18	73	15	12
B-004-0-24	SS-12	17.5 – 19.0	A-4a	25	4	61	29	10
B-004-0-24	SS-13	19.0 – 20.5	A-2-4	32	8	77	13	10
B-004-0-24	SS-14	20.5 – 22.0	A-2-4	29	9	69	21	10
B-007-0-24	SS-1	1.0 – 2.5	A-1-b	NP	NP	83	14	3
B-007-0-24	SS-2	2.5 – 4.0	A-1-b	NP	NP	75	20	5
B-007-0-24	SS-3	4.0 – 5.5	A-2-4	NP	NP	68	26	6
B-008-0-24	SS-1	1.0 – 2.5	A-2-4	32	10	87	8	5
B-009-0-24	SS-1	1.0 – 2.5	A-6a	33	11	48	37	15
B-009-0-24	SS-2	2.5 – 4.0	A-2-4	30	10	78	13	9

SS-# = Split Spoon Sample Number
 LL = Liquid Limit
 PI = Plasticity Index

Silt Fraction (particle size < 0.075 mm)
 Clay Fraction (particle size < 0.005 mm)
 Sa/Gr = Percent Sand and Gravel



Table 5. Rock Laboratory Test Results

Boring No.	Sample No.	Sample Depth (feet)	Sample Elevation (feet)	Rock Sample Description	Unit Weight (pcf)	SDI (%)	Q _u (psi)	S _c (psi)
B-004-A-24	NQ2-1	25.0 – 29.0	674.2 – 672.2	Shale	140.7	98.6	-	3,902
B-004-A-24	NQ2-2	30.2 – 30.8	669.0 – 668.4	Shale	148.5	-	4,170	-
B-005-0-24	NQ2-1	0.5 – 2.5	675.1 – 673.1	Shale	140.1	98.6	-	3,122
B-005-0-24	NQ2-1	4.5 – 5.5	671.1 – 670.1	Shale	142.8	-	-	3,781
B-006-0-24	NQ2-1	5.5 – 9.5	671.6 – 667.6	Shale	150.2	98.7	-	2,717
B-006-0-24	NQ2-2	11.5 – 12.2	665.6 – 664.9	Shale	-	-	-	2,356
B-007-0-24	NQ2-1	7.2 – 11.2	673.1 – 671.1	Shale	147.0	97.9	-	2,237

(1) SDI = Slake Durability Percentage; Slake Durability of Shales and Similar Weak Rock ASTM D4644

(2) Q_u = Uniaxial Compressive Strength of Intact Rock Core Testing conducted in accordance with ASTM D7012, Method C

(3) S_c = Estimated Uniaxial Compressive Strength; Point Load Strength Index of Rock ASTM D5761

VI. ANALYSES AND RECOMMENDATIONS

Based upon the preceding considerations as well as the subsurface information obtained from the field and laboratory testing and CTL's experience with these soil types, our recommendations are presented in the following paragraphs.

A. Site Preparation and Earthwork Recommendations

The following are general recommendations for site preparation. Depending on the final site grading and the conditions encountered, several site preparation options are available for consideration.

1. Any pavement not scheduled to remain should be removed. Depending on the change in site grades the existing aggregate base beneath the asphalt may remain as long as it is proofrolled and recompact prior to placement of additional engineered fill or the new pavement section.
2. During construction, adequate drainage should be provided on the surface of the exposed soils. Absorption of heavy rainfall, accumulations of water and heavy construction traffic may result in softening these soils, hence, severely weakening the subgrade soils.
3. Compaction of the subgrade materials should be performed. Any soft soils encountered during the compaction operations which will not readily compact should be removed and replaced with engineered fill.
4. The side slopes should be seeded and mulched as soon as possible to allow vegetation growth to develop and minimize or limit erosion, sloughing and



potential slope failure.

5. Temporary excavations in excess of 4.0 feet in depth should be sloped, benched or shored in accordance with OSHA regulations.
6. Strip topsoil, vegetation, and other organic or unsuitable surficial materials, remnants of previous structure (if any), from the construction area. These materials should be wasted from the site.
7. Any existing underground utilities located within the construction limits should be removed or relocated, as necessary, to allow construction and operation of the new structure. CTL recommends that existing utility pipes that are to be abandoned, be removed entirely, or after determining their limits, grouted full to prevent potential collapse so that they will not serve as conduits for subsurface erosion. If the pipes are removed the resulting void should be backfilled with properly placed and compacted engineered fill as described in this report.
8. Subsequent to the removal of existing utilities, foundations remnants, topsoil, and unsuitable soil, and prior to any fill placements, all exposed soil surfaces should be compacted with a smooth-drum roller and proofrolled with an approved fully-loaded (25-ton) tandem-axle truck in the presence of the Geotechnical Engineer or his/her qualified designated representative. Soft or loose soils, if encountered, should be mechanically aerated, dried and recompacted or otherwise improved as directed by the Geotechnical Engineer or his qualified designated representative.
9. Fill material, if required, for this project may consist of silt-clay soils having Liquid Limit values that do not exceed 40, a Plasticity Index values that does not exceed 20, a maximum dry density of at least 100 pcf, a maximum particle size of 3 inches, and with proper moisture content maintained during their placement. Organic matter in fill materials should be less than 3 percent by weight. Topsoil and organically contaminated soil are considered unsuitable for engineered fill.
10. New compacted engineered fill should be placed in layers not to exceed 8 inches in loose thickness, with each layer compacted to 100 percent of the maximum dry density as determined by ASTM D-698 standard method (AASHTO T-99), or as otherwise directed by the Geotechnical Engineer. The compacted fill should be placed with moisture content within the range of ± 3 percent of the Optimum Moisture Content. Fill should not be placed in a frozen condition or over frozen subgrade.
11. Isolated zones or pockets of trapped water may be encountered at shallow depths in isolated locations. If groundwater is encountered, temporary dewatering will be required.



B. Roadway Subgrade Considerations

A subgrade analysis was performed utilizing the subsurface information from the drilled borings, ODOT Geotechnical Design Manual (GDM) Section 600, and ODOT's Version 14.7 Subgrade Analysis spreadsheet (dated April 4, 2024). The lowest SPT N_{60L} -value (normalized to equivalent N_{60} values) in the upper 4 feet of the test borings analyzed for the pavement subgrade was 15 bpf. The natural moisture content of the proposed subgrade soils ranged from 10 to 22 percent, averaging 15 percent. The estimated optimum moisture content (OMC) values for these subgrade soils ranged from 0 to 21 percent, averaging 11 percent. The Plasticity Indices (PI) of the soils within the upper 4 feet of the proposed subgrade ranged from 10 to 25 percent with an average PI of 14 percent.

A design CBR value was calculated using procedures outlined in ODOT's GB1. Group Index values were calculated for the materials encountered below the proposed subgrade at the test boring locations. These Group Index values ranged from 0 to 11 averaging 4. This average Group Index value corresponds to an estimated CBR value of 8.

The excavation and backfill areas should be restored to the proposed grade using ODOT Construction and Materials Specification (CMS) Item 703.16, Type B, C or D Granular Material and Item 712.09 Geotextile Fabric, Type D; or if desirable, suitable engineered fill that is compacted to 100 percent of the material's maximum dry density. Low plasticity material are considered suitable for placement as engineered fill. Subgrade materials encountered during the exploration classified as high plastic materials are not considered suitable for use as engineered fill for long term satisfactory performance of the pavement. *Table 5* summarizes the approximate cut and fill depth at each boring location.

Table 5. Summary of Proposed Roadway Cut/Fill Depths

Boring No.	Station	Offset (Feet)	Ground Surface Elevation (feet)	Proposed Subgrade Elevation ⁽¹⁾ , (feet)	Cut (C) / Fill (F) Depth ⁽²⁾ , (feet)
B-001-0-24	4+46	5, LT.	706.5	705.5	0.9 C
B-004-0-24	8+13	5, LT.	699.2	691.8	7.4 C
B-007-0-24	9+20	18, LT.	680.3	687.5	7.2 F
B-008-0-24	10+10	5, LT.	681.2	685.6	4.4 F
B-009-0-24	12+41	7, LT.	687.3	686.5	0.8 C

(1) Determined from centerline of the proposed roadway profile, and with an assumed 12-inch thick pavement section (asphalt and base materials).

(2) Determined from the test boring ground surface elevation and the centerline of the existing roadway profile and proposed roadway subgrade elevation.



C. Global Stability Analysis

The global stability of the proposed roadway cut slope at Station 5+00 was analyzed. The dimensions and geometry of the proposed roadway cut slope was determined from the cross-section sheets included in the Stage 2 plans prepared by MSC. According to the cross-section sheets, the proposed embankment slopes will be constructed at a slope rate of 2 horizontal to 1 vertical (H:V) or flatter.

Global stability analysis was performed for the new cut slope, near Station 5+00. The stability analyses were performed using soil data from the test boring records B-002-0-24 and B-003-0-24, as well as the geometry obtained from the cross sections. The global stability analysis was performed using the SLIDE program.

The SLIDE program is based on two-dimensional limit equilibrium methods in which the calculation of the factor of safety against instability of a slope is performed by the method of slices. The method used was the Morgenstern-Price method for surfaces of a non-circular shape.

The soil parameters used in the analysis are based on the subsurface conditions encountered in the borings, laboratory test results, and ODOT's Office of Geotechnical Engineering (OGE) criteria for embankment construction. The soil parameters used for the analyses are summarized in the *Table 6*.

Table 6. Soil Parameters for Global Stability Analyses

Consistency	ODOT Material	Effective Stress		Total Stress		Unit Weight (pcf)
		Cohesion (psf)	Angle of Internal Friction (degrees)	Cohesion (psf)	Angle of Internal Friction (degrees)	
N/A	Pavement and Base	50 ⁽¹⁾	24	50 ⁽¹⁾	24	140
N/A	Engineered Fill	2000	0	200	26	125
Very Stiff to Hard	A-7-5 A-7-6	3900	0	300	26	126
Hard	A-4a	7500	0	470	28	140
Hard	A-4a	5000	0	350	27	132
Hard	A-4a	3100	0	260	25	125
Very Stiff to Hard	A-6b	2300	0	210	24	124

(1) A cohesion of 50 psf and a friction angle of 24° was used for pavement in slope stability model to mitigate a surficial slip failure.

Results of the stability analyses are summarized below in *Table 7* and are presented in graphical form in *Appendix E* of this report. The graphs present the geometry of the proposed slope, modeled soil strata and their corresponding shear strength parameters, and critical failure surfaces along with their



corresponding factors of safety. The factor of safety is defined as the ratio of forces resisting movement to forces acting on the slope, generally gravity and applied surface loads such as foundations or vehicular traffic. According to Table 500-1 in Section 502 of the ODOT GDM, a minimum factor of safety of 1.3 is considered acceptable for short term conditions and for slopes that do not support a structure and/or traffic.

Table 7. Results of Global Stability Analyses

Analysis Description	Required Minimum Factor of Safety (FS)	Calculated Factor of Safety (FS)	Capacity to Demand Ratio ⁽¹⁾
Long Term – Effective Stress	1.3	2.7	0.48
Short Term – Total Stress	1.3	18.7	0.07

(1) Capacity to Demand Ratio (CDR) = Required Minimum Factor of Safety / Calculated Factor of Safety

Based on the analysis, it is CTL's opinion that the proposed embankment slope rates are considered adequate.

D. Bridge Scour

Scour parameters were developed in general accordance with ODOT's Geotechnical Design Manual Section 1302. *Table 8* summarizes the scour parameters. Calculations for scour parameters of both soil and rock are enclosed in *Appendix G*.

Table 8. Summary of Scour Parameters

Boring No.	Sample No.	Elevation (feet)	D ₅₀ (mm)	τ _c (psf)	D _{50, equiv} (mm)	Erosion Category (EC)
B-004-0-24 (Rear Abutment)						
B-005-0-24 (Pier 1)						
B-006-0-24 (Pier 2)						
B-007-0-24 (Forward Abutment)						



E. Structure Foundation Support

Driven Pile Considerations

It is understood that both HP 10x42 and HP 12x53 are being utilized for this project. Based upon the soil and rock data obtained from the field and laboratory testing performed by CTL, the proposed bridge may be supported onto H-piles placed in prebored H-piles extending into the underlying coreable bedrock. The prebored holes should extend into the underlying coreable bedrock to depths shown in *Table 9*. Preboring should be performed per Section 1305 of ODOT Geotechnical Design Manual (GDM). Temporary casing can be provided through the soil overburden to prevent the soil from caving into the prebored hole.

The maximum factored structural resistance (P_r , max) for HP10x42 and HP 12x53 piles placed in prebored holes without driving and extended into the bedrock are also provided in *Table 9*. Additionally, the bottom of pile cap, estimated prebored depth into bedrock, the estimated pile tip elevations, estimated pile length, and order length are also provided in *Table 9*. Per ODOT Bridge Design Manual (BDM) Section 305.3.5.1, the estimated pile length includes a 2-foot penetration into the pile cap at the abutments and a 1.5-foot penetration into the pier cap at the piers and was rounded up to the nearest 5-foot length.

The Maximum Factored Structural Resistance (P_r) for the piles in each substructure are provided in *Table 10*. The P_r is based on ODOT BDM Section 305.3.3 and does include the shown resistance factor, ϕ_c .

Table 9. Driven Pile Information

Boring No. (Substructure Location)	Bottom of Pile Cap Elevation (feet) ⁽¹⁾	Pile Type and Size	Estimated Prebored Depth into Bedrock (feet)	Estimated Pile Tip Elevation (feet)	Estimated Design Pile Length (feet) ⁽²⁾	Pile Order Length (feet) ⁽³⁾
B-004-0-24 (Rear Abutment)	682.6	HP10x42	5.0	669.2	25.0	30.0
B-005-0-24 (Pier 1)	687.3	HP12x53	10.5	665.1	25.0	30.0
B-006-0-24 (Pier 2)	685.9	HP12x53	15.5	661.6	30.0	35.0
B-007-0-24 (Forward Abutment)	679.3	HP10x42	17.5	655.5	30.0	35.0

(1) Bottom of pile cap elevation provided by MS Consultants.

(2) Estimated Design Pile Length = Estimated Pile Length rounded up to the next 5-foot interval.

(3) Order Length = Estimated Design Pile Length plus 5 feet



Table 10. Pile Axial Structural Resistance

Boring No. (Substructure Location)	Pile Type	Maximum Factored Structural Resistance, $P_{r, \max}$ (kips)⁽¹⁾	Resistance Factor, ϕ_c⁽²⁾
B-004-0-24 (Rear Abutment)	HP10x42	580	0.95
B-005-0-24 (Pier 1)	HP12x53	730	0.95
B-006-0-24 (Pier 2)	HP12x53	730	0.95
B-007-0-24 (Forward Abutment)	HP10x42	580	0.95

(1) P_r value shown does not include a reduction for corrosion loss. The corrosion loss reduction will be determined by the structural engineer.

(2) According ODOT BDM Section 305.3.5.7, $\phi_c = 0.95$ for piles that are placed in prebored holes.

As stated in ODOT Geotechnical Design Manual Section 1305.5, when using piles placed in prebored holes in bedrock, include BDM Plan Notes 606.7-7 and 606.7-8 in the structure General Notes. Modify the plan notes as necessary to fit the type and size of pile used, and the type of abutment.

Drilled Shaft Considerations

According to ODOT BDM Section 305.3.2.1, if the design flood scour reaches the top of rock, do not use driven piles. Due to potential scour concerns of the bedrock, CTL recommends that drilled shafts be considered.

Based upon the soil and rock information obtained from the boring data, it is CTL's opinion that the proposed bridge can be supported onto drilled shaft foundations socketed into the underlying bedrock. Based on the laboratory test results performed on the recovered rock samples along with requirements outlined in the ODOT BDM Section 305.2.1.2.b, the underlying rock is considered as non-scour resistant. Per ODOT BDM Section 305.4.1.1, if the underlying rock is non-scour resistant then the drilled shafts should penetrate a minimum of 10 feet below the controlling scour elevation in the bedrock. For the purpose of this draft report, CTL assumed the controlling scour elevation for design flood and check flood conditions to be at the top of coreable bedrock.

The preliminary analysis of the drilled shaft foundations may be proportioned using a factored nominal unit tip resistance value not exceeding those provided in *Table 11*. According to AASHTO Table 10.5.5.2.4-1, a resistance factor of 0.5 should be used for Unit Tip Resistance for the Strength Limit State.

The socket tip should extend at least 1.5 times the socket diameter into the bedrock per ODOT BDM 305.4.2 (AASHTO LRFD 10.8.3.5.4c).



Table 11. Drilled Shaft Nominal Unit Tip Resistance

Boring No. (Substructure Location)	Bottom of Pile Cap Elevation (feet)⁽¹⁾	Assumed Scour Elevation (feet)⁽²⁾	Tip Elevation (feet)⁽³⁾	Factored Unit Tip Resistance, q_p (ksf)⁽⁴⁾
B-004-0-24 (Rear Abutment)	682.6	674.2	At or below 669.2	702.4
B-005-0-24 (Pier 1)	687.3	675.1	At or below 670.1	562.0
B-006-0-24 (Pier 2)	685.9	671.6	At or below 661.6	424.1
B-007-0-24 (Forward Abutment)	679.3	673.0	At or below 663.0	402.7

(1) Bottom of pile cap elevation provided by MS Consultants.

(2) Scour Elevation assumed to be at the top of coreable bedrock. This elevation will need to be provided by MS Consultants.

(3) According ODOT BDM Section 305.4.1.1, within non-scour resistant rock, drilled shafts should penetrate a minimum of 10-ft below the controlling scour elevation in the bedrock. For scour resistant rock the drilled shaft should penetrate a minimum of 5 f-ft below the controlling scour elevation

(4) Includes a resistance factor of 0.5 according to AASHTO Table 10.5.5.2.4-1.

VII. CHANGED CONDITIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface conditions using generally accepted geotechnical engineering practices. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates drilled, they are not necessarily representative of the subsurface conditions between boring locations or subsurface conditions during other seasons of the year.

In the event that changes in the project are proposed, additional information becomes available, or if it is apparent that subsurface conditions are different from those provided in this report, CTL should be notified so that our recommendations can be modified, if required.

VIII. TESTING AND OBSERVATION

During the design process, it is recommended that CTL work with the project designers to confirm that the geotechnical recommendations are properly incorporated into the final plans and specifications, and to assist with establishing criteria for the construction observation and testing.

CTL is not responsible for independent conclusions, opinions and recommendations made by others based on the data and recommendations provided in this report. It is



recommended that CTL be retained to provide construction quality control services on this project. If CTL is not retained for these services, CTL shall assume no responsibility for compliance with the design concepts or recommendations provided.

IX. CLOSING

The report was prepared by CTL Engineering, Inc. (Consultant) solely for the use of Client in accordance with an executed contract. The Client's use of or reliance on this report is limited by the terms and conditions of the contract and by the qualifications and limitations stated in the report. It is also acknowledged that the Client's use of and reliance of this report is limited for reasons which include: actual site conditions that may change with time; hidden conditions, not discoverable within the scope of the assessment, may exist at the site; and the scope of the investigation may have been limited by time, budget and other constraints imposed by the Client.

Neither the report, nor its contents, conclusions or recommendations, are intended for the use of any party other than the Client. Consultant and the Client assume no liability for any reliance placed on this report by such party. The rights of the Client under contract may not be assigned to any person or entity, without the consent of the Consultant which consent shall not be unreasonably withheld. This geotechnical report does not address the environmental conditions of the site. The Consultant is not responsible for consequences or conditions arising from facts that were concealed, withheld, or not fully disclosed at the time the assessment was conducted.

To the fullest extent permitted by law, the Consultant and Client agree to indemnify and hold each other, and their officers and employees harmless from and against claims, damages, losses and expenses arising out of unknown or concealed conditions. Furthermore, neither the Consultant nor its employees shall be liable to the Owner in an amount in excess of the available professional liability insurance coverage of the Consultant. In addition, Client and Consultant agree neither shall be liable for any special, indirect or consequential damages of any kind or nature.

The Consultant's services have been provided consistent with its professional standard of care. No other warranties are made, either expressed or implied.

Respectfully Submitted,

CTL ENGINEERING, INC.



Christopher D. Carey, E.I.
Project Engineer



Doug R. Batt, P.E.
Project Engineer
Licensed Ohio No. E-58801



APPENDIX A

GEOTECHNICAL PROFILE - ROADWAY



PROJECT DESCRIPTION

THE OVERALL PROJECT, IDENTIFIED AS PIK- CR44- 00.16, CONSISTS OF REPLACING AN EXISTING 80-FOOT, SINGLE-SPAN STEEL TRUSS BRIDGE (SFN 6633447) WITH A THREE-SPAN BRIDGE (SFN 6633448) THAT CARRIES COUNTY ROAD 44 (TURKEY RUN ROAD) OVER PEE PEE CREEK IN PEBBLE TOWNSHIP, PIKE COUNTY, OHIO. THE NEW BRIDGE IS TO BE LOCATED UPSTREAM OF THE EXISTING BRIDGE ON A NEW ALIGNMENT. THE PROJECT BEGINS AT STATION 4+45.89 AND ENDS AT STATION 12+17.23.

THE PROPOSED BRIDGE WILL BE A CONTINUOUS REINFORCED CONCRETE SLAB SUPPORTED ON CAPPED PILE PIERS AND CAPPED PILE ABUTMENTS WITH A TOTAL LENGTH OF 99.0 FEET. THE SPANS VARY IN LENGTH FROM 30.0 FEET TO 37.5 FEET. ACCORDING TO THE STRUCTURAL PLANS, THE BRIDGE BEGINS AT STATION 8+23.34 AND ENDS AT STATION 9+20.84, WITH THE TWO PIERS AT STATION 8+53.34 AND STATION 8+90.84.

HISTORIC RECORDS

HISTORIC GEOTECHNICAL RECORDS WERE SEARCHED FOR ON THE ODOT TMS WEBSITE. NO HISTORIC RECORDS WERE FOUND FOR THIS PROJECT.

GEOLOGY

THE PROJECT SITE IS LOCATED WITHIN THE SHAWNEE- MISSISSIPPIAN PLATEAU PHYSIOGRAPHIC REGION THAT IS DESCRIBED AS CHANNERY COLLUVIUM AND SILT LOAM UNDERLAIN BY DEVONIAN-AGE AND MISSISSIPPIAN-AGE SHALES, SILTSTONES AND LOCALLY THICK SANDSTONES. THE PROJECT SITE IS COVERED BY HOLOCENE- AGE ALLUVIUM UNDERLAIN BY ILLINOIAN- AGE CLAY. THE UNDERLYING BEDROCK CONSISTS OF TWO SEDIMENTARY BEDROCK FORMATIONS IDENTIFIED AS THE DEVONIAN- AGE OHIO AND OLENTANGY SHALES UNDIVIDED AND THE DEVONIAN- AND/OR MISSISSIPPIAN-AGE SUNBURY SHALE, BEREA SANDSTONE, AND BEDFORD SHALE UNDIVIDED.

RECONNAISSANCE

FIELD RECONNAISSANCE WAS COMPLETED BY CTL PERSONNEL ON MARCH 28, 2024, MAY 29, 2024, AND JUNE 17, 2024. COUNTY ROAD 44 (TURKEY RUN ROAD) IS A TWO-LANE, BI-DIRECTIONAL ROAD THAT RUNS GENERALLY NORTH TO SOUTH WITHIN THE PROJECT LIMITS, BUT THE ROADWAY ALIGNMENT HAS A SIGNIFICANT HORIZONTAL CURVE IN THE VICINITY OF THE EXISTING BRIDGE. PEE PEE CREEK GENERALLY FLOWS NORTHWEST TO SOUTHEAST BENEATH TURKEY RUN ROAD. THE TOPOGRAPHY IN THE SURROUNDING AREA IS MODERATELY SLOPING WHILE THE GROUND SURFACE IMMEDIATELY ADJACENT TO THE STREAM SLOPES STEEPLY DOWNWARD ALONG THE WEST BANK OF THE CREEK. THE SURROUNDING LAND USAGE CONSISTS OF RURAL RESIDENTIAL AND WOODED.

EROSION PROTECTION AT THE ABUTMENTS WAS NOT OBSERVED. THE EXISTING WOODEN BRIDGE DECK WAS IN FAIR CONDITION. CORROSION OF THE STEEL TRUSS BEAMS WAS OBSERVED. ROADWAY PAVEMENT CRACKING AND POTHOLES WERE OBSERVED; THEREFORE, THE ROADWAY ASPHALT PAVEMENT SURFACE WAS IN POOR CONDITION. STREAM BANK EROSION WAS OBSERVED ON THE SOUTHWESTERN BANK OF THE PROPOSED BRIDGE.

SUBSURFACE EXPLORATION

NINE (9) TEST BORINGS, IDENTIFIED AS B-001-0-24 THROUGH B-009-0-24, WERE COMPLETED FOR THIS SUBSURFACE EXPLORATION. THREE (3) OF THE TEST BORINGS (B-001-0-24, B-002-0-24, AND B-009-0-24) WERE DRILLED WITHIN THE EXISTING ROADWAY PAVEMENT, THREE (3) OF THE TEST BORINGS (B- 003-0-24, B- 004-0-24, AND B- 008-24) WERE DRILLED OFF THE EXISTING ROADWAY PAVEMENT, AND THE REMAINING THREE (3) TEST BORINGS (B-005-0-24, B-006-24, AND B-007-0-24) WERE DRILLED WITHIN THE CREEK CHANNEL OR WITHIN THE CREEK BANK. THE TEST BORINGS WERE DRILLED TO DEPTHS RANGING FROM 7.0 FEET TO 37.2 FEET BELOW THE EXISTING GROUND SURFACE.

THE TEST BORINGS WERE DRILLED ON JUNE 25, 2024, JUNE 26, 2024, JUNE 27, 2024, AND JUNE 28, 2024 UTILIZING 3-1/4 INCH I.D. HOLLOW-STEM AUGERS POWERED BY A TRACK-MOUNTED ROTARY DRILL RIG. SPLIT-BARREL (SPOON) DISTURBED SOIL SAMPLES AND STANDARD PENETRATION TEST WERE PERFORMED IN ACCORDANCE WITH AASHTO T206 AT 1.5-, 2.5-, AND 5- FOOT INTERVALS. THE AUTOMATIC HAMMER WAS CALIBRATED ON NOVEMBER 4, 2022 HAD AN ENERGY RATIO OF 79.3 PERCENT. ROCK CORE SAMPLING WAS PERFORMED USING A WIRE-LINE SYSTEM EQUIPPED WITH A NQ- 2 DOUBLE TUBE CORE BARREL AND A DIAMOND BIT.

EXPLORATION FINDINGS

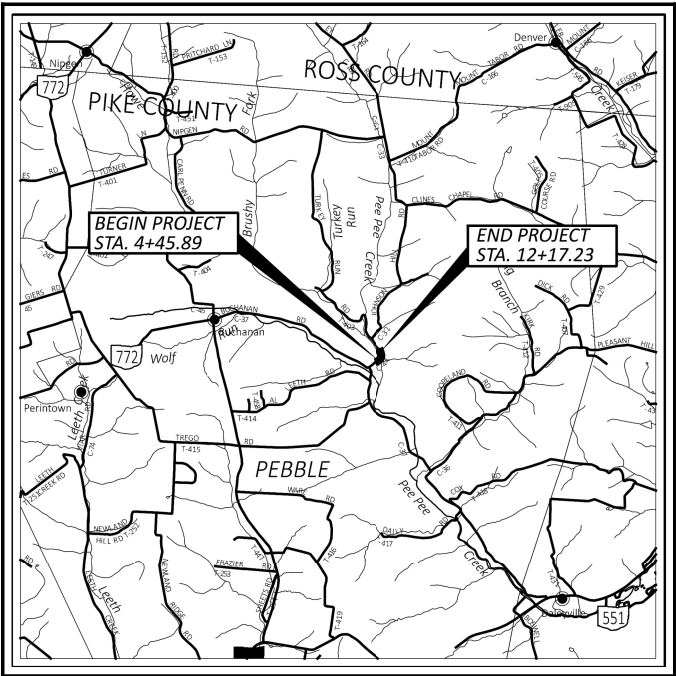
THE THREE (3) TEST BORINGS DRILLED WITHIN THE EXISTING ROADWAY PAVEMENT ENCOUNTERED THREE (3) INCHES OF ASPHALT UNDERLAIN BY FIVE (5) INCHES OF GRAVEL BASE AT THE GROUND SURFACE. THE THREE (3) TEST BORINGS DRILLED OFF THE EXISTING ROADWAY PAVEMENT ENCOUNTERED THREE (3) TO EIGHT (8) INCHES OF TOPSOIL AT THE GROUND SURFACE. THE THREE (3) TEST BORINGS DRILLED WITHIN THE CREEK CHANNEL OR WITHIN THE CREEK BANK ENCOUNTERED BEDROCK OR GRAVEL AND STONE FRAGMENTS WITH SAND (A-1-b) AT THE GROUND SURFACE.

BELOW THE SURFICIAL MATERIALS, THE TEST BORING ENCOUNTERED BOTH FINE-GRAINED, COHESIVE SOILS AND COARSE- GRAINED, GRANULAR SOILS BEFORE REACHING THE TERMINATION DEPTH. THE FINE-GRAINED SOILS WERE DESCRIBED AS VERY STIFF TO HARD

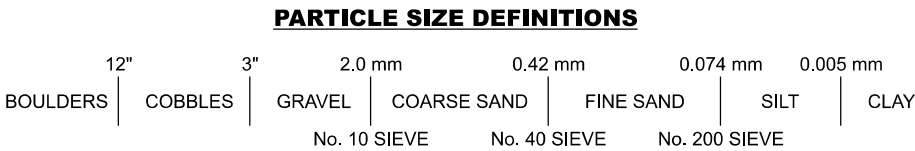
LEGEND

DESCRIPTION	ODOT CLASS	CLASSIFIED MECH./VISUAL	
GRAVEL AND/OR STONE FRAGMENTS WITH SAND	A-1-b (0)	2	1
GRAVEL AND/OR STONE FRAGMENTS W/SAND AND SILT	A-2-4 (0)	5	4
GRAVEL AND/OR STONE FRAGMENTS W/SAND, SILT AND CLAY	A-2-6 (1)	2	4
GRAVEL AND/OR STONE FRAGMENTS W/SAND, SILT AND CLAY	A-2-7 (3)	1	0
SANDY SILT	A-4a (3)	3	4
SILT AND CLAY	A-6a (6)	2	4
SILTY CLAY	A-6b (10)	1	3
ELASTIC CLAY	A-7-5 (15)	1	0
CLAY	A-7-6 (16)	2	7
	TOTAL	19	27
SHALE	VISUAL		
PAVEMENT OR BASE = X = APPROXIMATE THICKNESS	VISUAL		
SOD AND TOPSOIL = X = APPROXIMATE THICKNESS	VISUAL		
PROJECT BORING LOCATION - PLAN VIEW			
DRIVE SAMPLE AND/OR ROCK CORE BORING PLOTTED TO VERTICAL SCALE ONLY. HORIZONTAL BAR INDICATES A CHANGE IN STRATIGRAPHY.			
WC	INDICATES WATER CONTENT IN PERCENT.		
N ₆₀	INDICATES STANDARD PENETRATION RESISTANCE NORMALIZED TO 60% DRILL ROD ENERGY RATIO.		
W	INDICATES FREE WATER AT COMPLETION.		
	INDICATES FREE WATER ELEVATION.		
SS	INDICATES A SPLIT SPOON SAMPLE.		
NP	INDICATES A NON-PLASTIC SAMPLE.		
TR	INDICATES TOP OF ROCK ELEVATION.		
NQ2	INDICATES ROCK CORE SAMPLE		
	INDICATES A PLASTIC MATERIAL WITH A MOISTURE CONTENT EQUAL TO OR GREATER THAN THE LIQUID LIMIT MINUS 3		

INDEX OF SHEETS			
LOCATION		PLAN VIEW	PROFILE
FROM STA.	TO STA.	SHEET	SHEET
COVER SHEET 1 & 2			
SUMMARY OF SOIL TEST DATA 3			
CR - 44 (TURKEY RUN ROAD)			
04+45.89	12+17.18	4	4
STRUCTURE NO. PIK-CR44-00.16		5	5
BORING LOGS & ROCK CORE PHOTOS 6 TO 11			



LOCATION MAP
SCALE IN MILES



BEDROCK TEST SUMMARY					
BORING NO.	SAMPLE ELEVATION	SAMPLE DEPTH	ESTIMATED Sc (PSI)	Qu (PSI)	LITHOLOGY
B-004-A-24	674.2' - 670.2'	25.0' - 29.0'	3,902	-	SHALE
B-004-A-24	669.0' - 668.4'	30.2' - 30.8'	-	4,170	SHALE
B-005-0-24	675.1' - 673.1'	0.5' - 2.5'	3,122	-	SHALE
B-005-0-24	671.1' - 670.1'	4.5' - 5.5'	3,781	-	SHALE
B-006-0-24	671.6' - 667.6'	5.5' - 9.5'	2,717	-	SHALE
B-006-0-24	665.6' - 664.9'	11.5' - 12.2'	2,356	-	SHALE
B-007-0-23	673.1' - 669.1'	7.2' - 11.2'	2,237	-	SHALE

RECON. - CTL 03/28/2024, 05/29/2024 & 06/17/2024
DRILLING - CTL 06/25/2024, 06/26/2024, 06/27/2024 & 06/28/2024
DRAWN - N.K.S 08/30/2024
REVIEWED - DRB 12/13/2024

DESIGN AGENCY

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DESIGNER

N.K.S

REVIEWER

DB 12-13-24

PROJECT ID

115499

SUBSET

1 TOTAL 11

SHEET

P.38 TOTAL 48

EXPLORATION FINDINGS (CONT.)

SANDY SILT (A-4a), SILT AND CLAY (A-6a), SILTY CLAY (A-6b), ELASTIC CLAY (A-7-5), AND CLAY (A-7-6). THE COARSE-GRAINED, GRANULAR SOILS WERE DESCRIBED AS MEDIUM DENSE TO VERY DENSE GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT (A-2-4), GRAVEL AND STONE FRAGMENTS WITH SAND, SILT AND CLAY (A-2-6 AND A-2-7), AND SANDY SILT (A-4a).

BELOW THE NATIVE SOIL MATERIAL, FIVE (5) OF THE NINE (9) TEST BORINGS ENCOUNTERED WEATHERED BEDROCK. THE BEDROCK WAS DESCRIBED AS BLACK AND DARK GRAY, SEVERELY TO SLIGHTLY WEATHERED SHALE.

GROUNDWATER WAS ENCOUNTERED IN FIVE (5) OF THE NINE (9) TEST BORINGS DURING DRILLING AND/OR AT THE COMPLETION OF DRILLING AT DEPTHS RANGING FROM THE GROUND SURFACE (BORINGS LOCATED IN STREAM CHANNEL) TO 22.0 FEET BELOW GROUND SURFACE.

SPECIFICATIONS

THIS GEOTECHNICAL EXPLORATION WAS PERFORMED IN ACCORDANCE WITH THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, OFFICE OF GEOTECHNICAL ENGINEERING, SPECIFICATIONS FOR GEOTECHNICAL EXPLORATIONS, DATED JULY 2024.

AVAILABLE INFORMATION

THE SOIL AND GROUNDWATER INFORMATION COLLECTED FOR THIS SUBSURFACE EXPLORATION THAT CAN BE CONVENIENTLY DISPLAYED ON THE GEOTECHNICAL PROFILE SHEETS HAS BEEN PRESENTED. GEOTECHNICAL REPORTS, IF PREPARED, ARE AVAILABLE FOR REVIEW ON THE OFFICE OF CONTRACT SALES WEBSITE.

BRIDGE SCOUR ANALYSIS						
SCOUR DATA						
BORING NO.	SAMPLE NO.	ELEVATION (ft.)	D ₅₀ (mm)	T _c (PSF)	D ₅₀ , equiv (mm)	EROSION CATEGORY (EC)
B-004-0-24 (REAR ABUTMENT)	SS-11	683.2 - 681.7	2.6184	0.0716	3.4267	3.6124
	SS-12	681.7 - 680.2	0.5704	0.0119	0.5704	1.9074
	SS-13	680.2 - 678.7	3.5212	0.0735	3.5212	2.8560
	SS-14	678.7 - 677.2	2.1063	0.0440	2.1063	2.5882
B-005-0-24 (PIER 1)	SS-1	675.6 - 675.2	N/A	0.7659	36.6623	3.4000
	NQ2-1	675.1 - 673.1	N/A	127.4693	6101.9273	3.4000
B-006-0-24 (PIER 2)	SS-3	673.1 - 672.8	N/A	1.0014	47.9391	3.4000
	NQ2-1	671.6 - 667.6	N/A	78.2789	3747.1964	3.4000
B-007-0-24 (FORWARD ABUTMENT)	SS-1	679.3 - 677.8	9.5418	0.1993	9.5418	3.3756
	SS-2	677.8 - 676.3	2.4228	0.0506	2.4228	2.6612
	SS-3	676.3 - 674.8	1.5466	0.0323	1.5466	2.4272

DESIGN AGENCY



DESIGNER

N.K.S

REVIEWER

DB 12-13-24

PROJECT ID

115499

SUBSET TOTAL

2 11

SHEET TOTAL

P.39 48

PIK-CR44-00.16

MODEL: Sheet PAPERSIZE: 11x17 (in.) DATE: 13-12-2024 TIME: 13:19:38 USER: hp
D:\Drop_Box\CTL_2024\December\Dept_05\CIN\Carey\24050010CIN_ODOT\115499ID001.dgn

SUMMARY OF SOIL TEST DATA
PIK-CR44-00.16

EXPLORATION NO., STATION & OFFSET	FROM TO	SAMPLE ID	N ₆₀	% REC	HP tsf	% GR	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	ODOT CLASS (GI)	ppm SO ₄	
B-001-0-24 STA. 4+46, 5' LT. LATITUDE = 39.143229 LONGITUDE = 83.091818	01.00 - 02.50	SS-1	24	100	4.5	26	8	16	34	16	29	19	10	12	A-4a (3)	540	
	02.50 - 04.00	SS-2	22	100	4.5	16	6	5	48	25	32	20	12	13	A-6a (8)	-	
	04.00 - 05.50	SS-3	22	100	4.5				SAME AS SS-2						19	A-6a (VISUAL)	-
	05.50 - 07.00	SS-4	36	100	4.0				SAME AS SS-2						22	A-6a (VISUAL)	-
B-002-0-24 STA. 4+88, 5' LT. LATITUDE = 39.143309 LONGITUDE = 83.091703	01.00 - 02.50	SS-1	24	100	3.0				VERY STIFF, BROWN CLAY						16	A-7-6 (VISUAL)	240
	02.50 - 04.00	SS-2	38	100	4.5				HARD, BROWN CLAY						13	A-7-6 (VISUAL)	-
	04.00 - 05.50	SS-3	21	100	4.5				SAME AS SS-2						13	A-7-6 (VISUAL)	-
	05.50 - 07.00	SS-4	32	100	4.5	0	1	2	36	61	58	24	34	24	A-7-6 (20)	-	
	08.50 - 10.00	SS-5	29	67	4.5				VERY STIFF, BROWN CLAY						17	A-7-6 (VISUAL)	-
	11.00 - 12.50	SS-6	20	100	4.5				HARD, BROWN CLAY						19	A-7-6 (VISUAL)	-
B-003-0-24 STA. 5+68, 41' LT. LATITUDE = 39.143531 LONGITUDE = 83.091578	01.00 - 02.50	SS-1	58	56	2.5	8	3	5	65	19	57	37	20	26	A-7-5 (15)	-	
	03.50 - 05.00	SS-2	69	100	4.5	23	7	5	45	20	27	19	8	12	A-4a (6)	-	
	06.00 - 07.50	SS-3	57	100	4.5				SAME AS SS-2						9	A-4a (VISUAL)	-
	08.50 - 10.00	SS-4	65	100	4.5				SAME AS SS-2						13	A-4a (VISUAL)	-
	11.00 - 12.50	SS-5	40	100	4.5				SAME AS SS-2						14	A-4a (VISUAL)	-
	13.50 - 15.00	SS-6	25	100	4.5				SAME AS SS-2						17	A-4a (VISUAL)	-
	16.00 - 17.50	SS-7	16	100	4.0				VERY STIFF, BROWN SILTY CLAY						17	A-6b (VISUAL)	-
	18.50 - 20.00	SS-8	21	100	3.0				SAME AS SS-7						22	A-6b (VISUAL)	-
	21.00 - 22.50	SS-9	15	100	4.5	2	2	4	52	40	37	21	16	21	A-6b (10)	-	
	33.50 - 25.00	SS-10	22	100	4.5				SAME AS SS-9						17	A-6b (VISUAL)	-

FOR STRUCTURE BORINGS B-004-0-24, B-004-A-24, B-005-0-24, B-006-0-24 AND B-007-0-24. SEE BORING LOGS ON SHEETS 6,7,9,10, AND 11, RESPECTIVELY.

B-008-0-24 STA. 10+10, 5' LT. LATITUDE = 39.144344 LONGITUDE = 83.090461	01.00 - 02.50	SS-1	15	100	-	72	10	5	8	5	32	22	10	10	A-2-4 (0)	<100	
	03.50 - 05.00	SS-2	21	78	-	SAME AS SS-1									11	A-2-4 (VISUAL)	-
	06.00 - 06.90	SS-3	2/50/5"	64	-	SHALE, BLACK, HIGHLY WEATHERED									18	ROCK (VISUAL)	-
	08.50 - 08.80	SS-4	50/3"	100	-	SAME AS SS-3									11	ROCK (VISUAL)	-
B-009-0-24 STA. 12+41, 7' LT. LATITUDE = 39.144949 LONGITUDE = 83.090536	01.00 - 02.50	SS-1	16	67	3.0	30	8	10	37	15	33	22	11	16	A-6a (4)	<100	
	02.50 - 04.00	SS-2	24	100	-	57	15	6	13	9	30	20	10	12	A-2-4 (0)	-	
	04.00 - 05.50	SS-3	32	67	-	DENSE, BROWN GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT									11	A-2-4 (VISUAL)	-
	05.50 - 07.00	SS-4	56	100	-	VERY DENSE, BROWN GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT									11	A-2-4 (VISUAL)	-

DESIGN AGENCY



ENGINEERING
2880 FISHER ROAD
COLUMBIA, MO 65204
PHONE: (636) 868-8129
FAX: (636) 268-8577

DESIGNER

N.K.S

REVIEWER

DB 12-13-24

PROJECT ID

115499

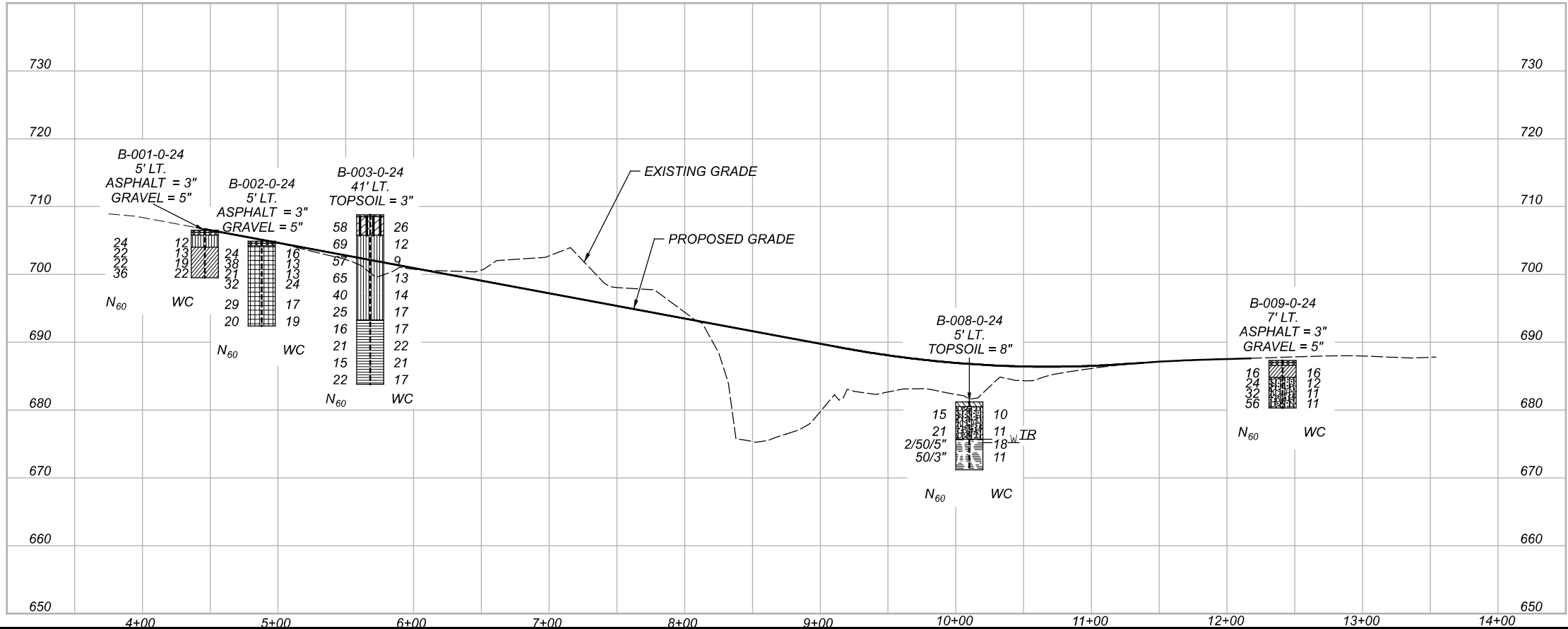
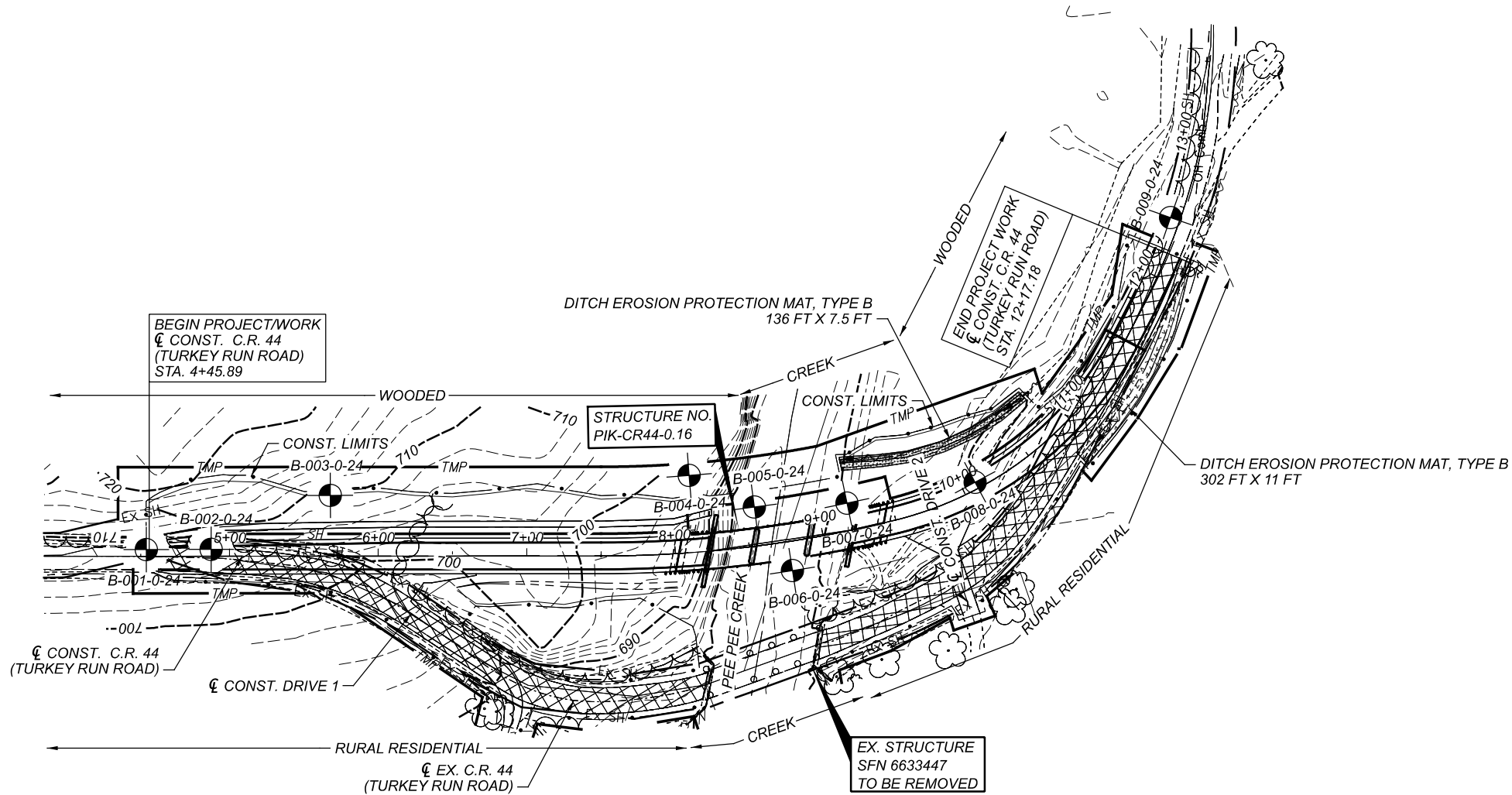
SUBSET TOTAL

3 11

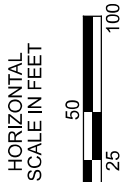
SHEET TOTAL

P.40 48

GEOTECHNICAL PROFILE - ROADWAY
SUMMARY OF SOIL TEST DATA



GEOTECHNICAL PROFILE - ROADWAY
STA. 4+45.89 TO STA. 12+17.18 (CR 44)



DESIGN AGENCY



DESIGNER

N.K.S

REVIEWER

DB 12-13-24

PROJECT ID

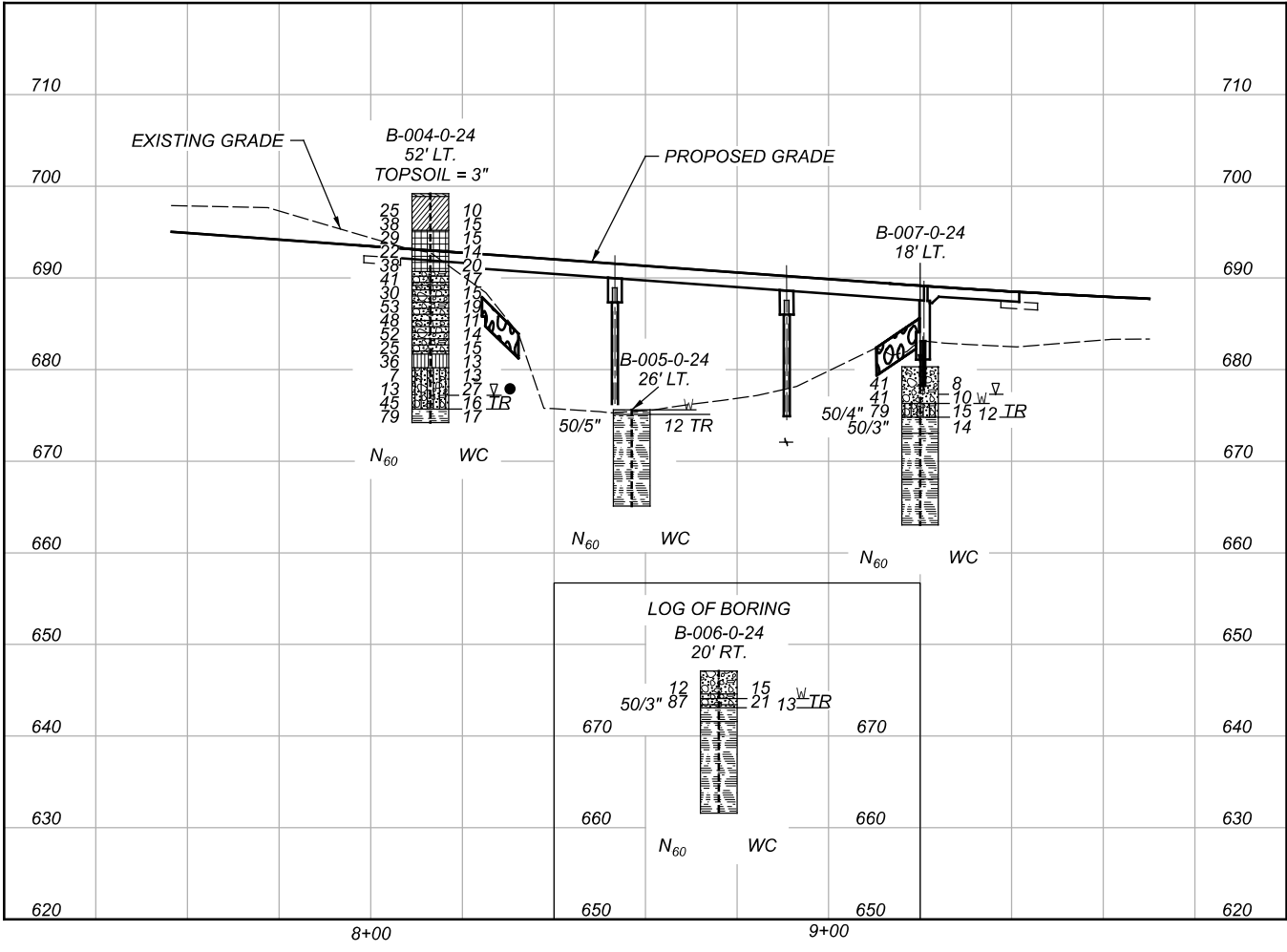
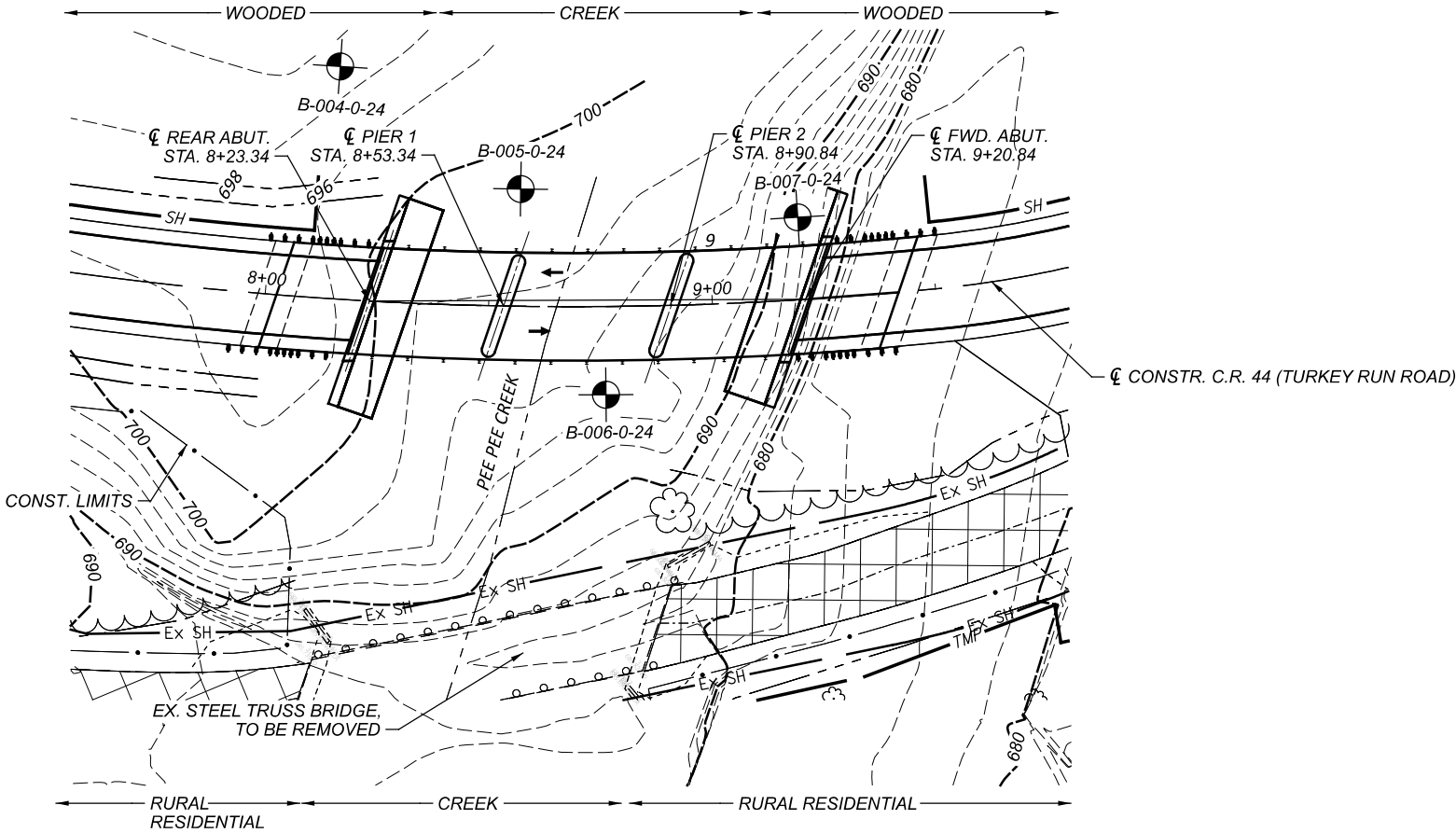
115499

SUBSET TOTAL

4 11

SHEET TOTAL

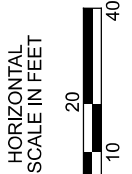
P.41 48



GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. PIK-CR44-00.16 OVER PEE PEE CREEK (TURKEY RUN ROAD)

DESIGN AGENCY
CTL
ENGINEERING
2860 FISHER ROAD
COLUMBUS, OHIO 43224
PHONE: (614) 276-8123
FAX: (614) 276-6377

DESIGNER
N.K.S
REVIEWER
DB 12-13-24
PROJECT ID
115499
SUBSET TOTAL
5 11
SHEET TOTAL
P.42 48



PROJECT: PIK-CR44-00.16			DRILLING FIRM / OPERATOR: CTL / H. BROWN			STATION / OFFSET: 8+13.52' LT.			EXPLORATION ID: B-004-0-24			
TYPE: BRIDGE			SAMPLING FIRM / LOGGER: CTL / T. MILLER			ALIGNMENT: TANGENT			PAGE: 1 OF 1			
P.D.: 115499 SFN: 6633448			DRILLING METHOD: 3.25" HSA			ELEVATION: 699.2 (MSL) EOB: 25.0 ft.						
START: 6-26-24 END: 6-26-24			SAMPLING METHOD: SPT			LAT / LONG: 39.144001, -83.090976						
MATERIAL DESCRIPTION AND NOTES			ELEV.	DEPTHS	SPT/ RQD	REC SAMPLE ID	HP (tsf)	GRADATION (%)	ATTERBERG	W.C.	ODOT CLASS (GI)	SO4 FILL
			699.2			N ₆₀		GR CS	LL	PL		
TOPSOIL (3") VERY STIFF, BROWN, SILT AND CLAY, LITTLE GRAVEL, LITTLE SAND, CONTAINS STONE FRAGMENTS, DAMP @2.5"; TRACE GRAVEL			698.9	1	7							
				2	8	100	SS-1	3.00		-	10	A-6a (V)
				3	10	100	SS-2	4.00		-	15	A-6a (V)
			695.2	4	13	100	SS-3	2.50		-	15	A-7.6 (V)
				5	16	100	SS-4	4.50		-	14	A-7.6 (V)
				6	9	100	SS-5	4.50		-	20	A-7.6 (11)
				7	11	100	SS-6	4.00		-	17	A-2.7 (3)
				8	14	100	SS-7	-		-	15	A-2.6 (V)
				9	15	100	SS-8	-		-	19	A-2.6 (0)
				10	17	100	SS-9	-		-	11	A-2.6 (V)
DENSE BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND, SILT, AND CLAY, DAMP MEDIUM DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND, SILT, AND CLAY, DAMP @11.5"; VERY DENSE @13.0"; DENSE @14.5"; VERY DENSE @16.0"; MEDIUM DENSE			699.2	11	13	100	SS-10	-		-	14	A-2.6 (V)
				12	18	100	SS-11	-		-	15	A-2.6 (1)
				13	22	100	SS-12	-		-	13	A-4a (1)
				14	5	100	SS-13	-		-	13	A-2.4 (0)
				15	9	100	SS-14	-		-	27	A-2.4 (0)
				16	10	100	SS-15	-		-	16	A-2.4 (V)
				17	11	100	SS-16	-		-	17	Rock (V)
				18	13	100	SS-17	-		-		
				19	14	100	SS-18	-		-		
				20	17	100	SS-19	-		-		
DENSE, BROWN, SANDY SILT, "AND" GRAVEL, LITTLE CLAY, DAMP LOOSE, GRAY, GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT, TRACE CLAY, DAMP @20.5"; MEDIUM DENSE, BROWN, WET @22.0"; DENSE, MOIST SHALE, BLACK, SEVERELY WEATHERED.			681.7	21	8	100	SS-20	-		-		
				22	9	100	SS-21	-		-		
				23	10	100	SS-22	-		-		
				24	11	100	SS-23	-		-		
				25	13	100	SS-24	-		-		
				26	14	100	SS-25	-		-		
				27	15	100	SS-26	-		-		
				28	16	100	SS-27	-		-		
				29	18	100	SS-28	-		-		
				30	22	100	SS-29	-		-		

NOTES: CAVED AT 23'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE CHIPS MIXED WITH SOIL CUTTINGS

PROJECT: PIK-CR44-00.16		DRILLING FIRM / OPERATOR: CTL / H. BROWN		DRILL RIG: CME 55 #393		STATION / OFFSET: 8+13.52' L.T.		EXPLORATION ID																			
TYPE: BRIDGE		SAMPLING FIRM / LOGGER: CTL / T. MILLER		HAMMER: CME AUTOMATIC		ALIGNMENT: TANGENT		B-004-A-24																			
PID: 115499 SFN: 6633448		DRILLING METHOD: 3.25" HSA / NQ2		CALIBRATION DATE: 11-4-22		ELEVATION: 699.2 (MSL) EOB: 37.2 ft.		PAGE																			
START: 6-28-24 END: 6-28-24		SAMPLING METHOD: SPT		ENERGY RATIO (%): 79.3		LAT / LONG: 39.144001, -83.090143		1 OF 1																			
MATERIAL DESCRIPTION AND NOTES		ELEV.		REC SAMPLE		GRADATION (%)		ATTERBERG		BACK																	
		699.2		ID		(tsf)		FS SI CL LL PL PI		WC ODOT CLASS (GI) SO4 ppm																	
SEE TEST BORING B-004-0-24 FOR SOIL DESCRIPTION		SPT/		N ₆₀		ID		FS		SI		CL		LL		PL		PI		WC		ODOT CLASS (GI)		SO4 ppm		BACK FILL	
		RQD																									
		DEPTHS		1																							
				2																							
				3																							
				4																							
				5																							
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				34																							
				35																							
		36																									
		37																									
		EOB																									

STANDARD ODOT LOG W/ SULFATES (11 X 17) - OH DOT.GDT - 12-8-24 16:54 - G:\2024\AUGUST\01\24050010CIN\24050010CIN.GPJ

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE CHIPS MIXED WITH SOIL CUTTINGS

DESIGN AGENCY



ENGINEERING

DESIGNER

N.K.S

REVIEWER

DB 12-13-24

PROJECT ID

115499

SUBSET

7

TOTAL

11

SHEET

P.44

TOTAL

48

GEOTECHNICAL PROFILE - BRIDGE

BORING LOG B-004-A-24

B-004-A-24



Run #:	Depth		Recovery		RQD	
NQ2-1	25.0'	30.0'	60"/60"	100%	22"/60"	36%
NQ2-2	30.0'	35.0'	58"/60"	96%	40"/60"	66%
PIK-CR44-00.16; PID 115499; Turkey Run Road Bridge over Pee Pee Creek						



B-004-A-24



Run #:	Depth		Recovery		RQD	
NQ2-3	35.0'	37.2'	26"/26"	100%	26"/26"	100%
PIK-CR44-00.16; PID 115499; Turkey Run Road Bridge over Pee Pee Creek						



PROJECT: PIK-CR44-00.16		DRILLING FIRM / OPERATOR: CTL / H. BROWN		DRILL RIG: CME 55 #393		STATION / OFFSET: 8+57, 26' LT.		EXPLORATION ID	
TYPE: BRIDGE		SAMPLING FIRM / LOGGER: CTL / T. MILLER		HAMMER: CME AUTOMATIC		ALIGNMENT: TANGENT		B-005-0-24	
PID: 115499 SFN: 6633448		DRILLING METHOD: 3.25" HSA / NQ2		CALIBRATION DATE: 11-4-22		ELEVATION: 675.6 (MSL) EOB: 10.5 ft.		PAGE	
START: 6-27-24 END: 6-27-24		SAMPLING METHOD: SPT		ENERGY RATIO (%): 79.3		LAT / LONG: 39.144038, -83.090811		1 OF 1	
MATERIAL DESCRIPTION AND NOTES		ELEV.		REC SAMPLE		GRADATION (%)		ABANDONED	
		DEPTH		ID		FS		CLASS (GI)	
SHALE, DARK GRAY AND BLACK, HIGHLY WEATHERED. SHALE, DARK GRAY, SLIGHTLY WEATHERED, STRONG, VERY THICK BEDDED. @ 0.5' - 2.5'; γ = 140.1 pcf, Sc = 3,122 psi @ 4.5' - 5.5'; γ = 142.8 pcf, Sc = 3,781 psi		675.6		SS-1		GR CS		ODOT	
		675.1		96		GR CS		CLASS (GI)	
		665.1		98		GR CS		CLASS (GI)	
		665.1		98		GR CS		CLASS (GI)	
		665.1		98		GR CS		CLASS (GI)	
		665.1		98		GR CS		CLASS (GI)	
		665.1		98		GR CS		CLASS (GI)	
		665.1		98		GR CS		CLASS (GI)	
		665.1		98		GR CS		CLASS (GI)	
		665.1		98		GR CS		CLASS (GI)	
		665.1		98		GR CS		CLASS (GI)	

STANDARD ODOT LOG W/ SULFATES (6.5 X 11) - OH DOT.GDT - 12-8-24 16:50 - G:\2024\AUGUST\T01124050010CIN\24050010CIN.GPJ

NOTES: NONE
ABANDONMENT METHODS, MATERIALS, QUANTITIES: BOREHOLE WAS NOT BACKFILLED AND ALLOWED TO COLLAPSE AND FILL NATURALLY IN ACCORDANCE WITH ODOT SGE.

B-005-0-24



PIK-CR44-00.16

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 13-12-2024 TIME: 13:57:01 USER: hp
D:\Drop Box\CTL 2024\December\Dept 05\CIN\Carey\24050010CIN_ODOT\115499ZL005.dgn

[illegible]

@ 11.5' - 12.2': **S_c**= 2,356 psi

NOTES: CAVED AT 5.5'

ABANDONMENT METHODS. MATERIALS. QUANTITIES: BACKFILLED WITH BENTONITE CHIPS MIXED WITH SOIL CUTTINGS



DESIGN AGENCY  ENGINEERING INC. 2860 FISHER ROAD COLUMBUS, OHIO 43204 PHONE: (614) 276-8123 FAX: (614) 276-8377	
DESIGNER	
N.K.S	
REVIEWER	
DB 12-13-24	
PROJECT ID	
115499	
SUBSET	TOTAL
10	11
SHEET	TOTAL
P.47	48

GEOTECHNICAL PROFILE - BRIDGE
BORING LOG & ROCK CORE PHOTO FOR B-006-0-24

PROJECT: PIK-CR44-00.16

TYPE: BRIDGE

PID: 115499 SFN: 6633448

START: 6-25-24 END: 6-25-24

DRILLING FIRM / OPERATOR: CTL / H. BROWN

SAMPLING FIRM / LOGGER: CTL / T. MILLER

DRILLING METHOD: 3.25" HSA / NQ2

SAMPLING METHOD: SPT

MATERIAL DESCRIPTION AND NOTES

DENSE, BROWN, STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, DAMP

VERY DENSE, GRAY, BROWN, AND BLACK, STONE FRAGMENTS WITH SAND AND SILT, TRACE CLAY, DAMP

SHALE, BLACK, HIGHLY WEATHERED, CONTAINS LIMESTONE FRAGMENTS.

SHALE, DARK GRAY, MODERATELY WEATHERED, SLIGHTLY STRONG, VERY THICK BEDDED.

@ 7.2' - 11.2'; γ = 147.0 pcf, S_c = 2,237 psi

SHALE, DARK GRAY, SLIGHTLY WEATHERED, SLIGHTLY STRONG, VERY THICK BEDDED.

ELEV: 680.3

676.3

674.8

673.0

668.0

663.1

DEPTHS

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

SPT/ RQD

8

16

15

15

8

43

50/4"

50/3"

16

46

REC SAMPLE ID

SS-1

SS-2

SS-3

SS-4

SS-5

NQ2-1

NQ2-2

N₆₀ (%)

41

41

79

-

-

100

100

HP (tsf)

-

-

-

-

-

-

-

GR

CS

FS

SI

CL

LL

PL

WC

GRADATION (%)

69

52

49

-

-

-

-

-

ATTERBERG

NP

NP

NP

-

-

-

-

ODOT CLASS (GI)

A-1-b (0)

A-1-b (0)

A-2-4 (0)

Rock (V)

Rock (V)

CORE

CORE

SO4 ppm

-

-

-

-

-

-

-

BACK FILL

STATION / OFFSET: 9+20, 18' LT.

ALIGNMENT: TANGENT

ELEVATION: 680.3 (MSL) EOB: 17.25 ft.

LAT / LONG: 39.144157, -83.090654

DRILL RIG: CME 55 #393

HAMMER: CME AUTOMATIC

CALIBRATION DATE: 11-4-22

ENERGY RATIO (%): 79.3

EXPLORATION ID

B-007-0-24

PAGE

1 OF 1

STANDARD ODOT LOG W/ SULFATES (6.5 X 11) - OH DOT.GDT - 12-8-24 16:50 - G:\2024\AUGUST\T10\124050010CIN\24050010CIN.GPJ

NOTES: CAVED AT 6'
ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE CHIPS MIXED WITH SOIL CUTTINGS

B-007-0-24



APPENDIX B

TEST BORING RECORDS



STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT GDT - 8/28/24 08:40 - O:\PROJECT\2024\CIN-05\24050010\CIN MS CONSULTANTS INC. PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBLE

PROJECT: PIK-CR44-00.16		DRILLING FIRM / OPERATOR: CTL / H. BROWN		DRILL RIG: CME 55 #393		STATION / OFFSET: 4+46, 5' LT.		EXPLORATION ID												
TYPE: SUBGRADE		SAMPLING FIRM / LOGGER: CTL / T. MILLER		HAMMER: CME AUTOMATIC		ALIGNMENT: TANGENT		B-001-0-24												
PID: 115499 SFN: N/A		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 11/4/22		ELEVATION: 706.5 (MSL) EOB: 7.0 ft.		PAGE												
START: 6/26/24 END: 6/26/24		SAMPLING METHOD: SPT		ENERGY RATIO (%): 79.3		LAT / LONG: 39.143229, -83.091818		1 OF 1												
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	SO4 ppm	BACK FILL
		706.5							GR	CS	FS	SI	CL	LL	PL	PI	WC			
ASPHALT (3")		706.2																		
GRAVEL (5")		705.8	1	7																
HARD, BROWN, SANDY SILT, SOME GRAVEL, LITTLE CLAY, CONTAINS STONE FRAGMENTS, DAMP		704.0	2	8 10	24	100	SS-1	4.50	26	8	16	34	16	29	19	10	12	A-4a (3)	540	
HARD, BROWN, SILT AND CLAY, LITTLE GRAVEL, LITTLE SAND, DAMP			3	9 8	22	100	SS-2	4.50	16	6	5	48	25	32	20	12	13	A-6a (8)	-	
@5.5'; MOIST			4	6 8	22	100	SS-3	4.50	-	-	-	-	-	-	-	-	19	A-6a (V)	-	
			5	9 8	22	100	SS-3	4.50	-	-	-	-	-	-	-	-	-	A-6a (V)	-	
			6	9 12	36	100	SS-4	4.00	-	-	-	-	-	-	-	-	22	A-6a (V)	-	
		699.5	7	15																
			EOB																	
NOTES: CAVED AT 2'																				
ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; BACKFILLED WITH BENTONITE CHIPS MIXED WITH SOIL CUTTINGS																				

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT GDT - 8/28/24 08:40 - O:\PROJECT\2024\CIN-05\24050010\CIN_MS CONSULTANTS INC. PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBL

PROJECT: <u>PIK-CR44-00.16</u>		DRILLING FIRM / OPERATOR: <u>CTL / H. BROWN</u>		DRILL RIG: <u>CME 55 #393</u>		STATION / OFFSET: <u>4+88, 5' LT.</u>		EXPLORATION ID													
TYPE: <u>ROADWAY</u>		SAMPLING FIRM / LOGGER: <u>CTL / T. MILLER</u>		HAMMER: <u>CME AUTOMATIC</u>		ALIGNMENT: <u>TANGENT</u>		B-002-0-24													
PID: <u>115499</u> SFN: <u>N/A</u>		DRILLING METHOD: <u>3.25" HSA</u>		CALIBRATION DATE: <u>11/4/22</u>		ELEVATION: <u>704.9 (MSL)</u> EOB: <u>12.5 ft.</u>		PAGE													
START: <u>6/26/24</u> END: <u>6/26/24</u>		SAMPLING METHOD: <u>SPT</u>		ENERGY RATIO (%): <u>79.3</u>		LAT / LONG: <u>39.143309, -83.091703</u>		1 OF 1													
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	SO4 ppm	BACK FILL	
		704.9							GR	CS	FS	SI	CL	LL	PL	PI	WC				
ASPHALT (3")		704.6																			
GRAVEL (5")		704.2																			
VERY STIFF, BROWN, CLAY , LITTLE GRAVEL, LITTLE SAND, TRACE SILT, CONTAINS STONE FRAGMENTS, DAMP @2.5'; HARD, TRACE GRAVEL @5.5'; BROWN AND GRAY, NO GRAVEL, TRACE SAND, "AND" SILT, MOIST @8.5'; VERY STIFF, DAMP @11.0'; HARD			1	5	24	100	SS-1	3.00	-	-	-	-	-	-	-	-	16	A-7-6 (V)	240		
			2	8	10																
			3	8	12	38	100	SS-2	4.50	-	-	-	-	-	-	-	-	13	A-7-6 (V)	-	
			4	5	17																
			5	7	9	21	100	SS-3	4.50	-	-	-	-	-	-	-	-	13	A-7-6 (V)	-	
			6	9	11	32	100	SS-4	4.50	0	1	2	36	61	58	24	34	24	A-7-6 (20)	-	
			7	13																	
			8																		
			9	10	10	29	67	SS-5	3.50	-	-	-	-	-	-	-	-	17	A-7-6 (V)	-	
			10	12																	
			11	6	7	20	100	SS-6	4.50	-	-	-	-	-	-	-	-	19	A-7-6 (V)	-	
			12	8																	
		692.4	EOB																		
NOTES: CAVED AT 4'																					
ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; BACKFILLED WITH BENTONITE CHIPS MIXED WITH SOIL CUTTINGS																					

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT GDT - 8/28/24 08:40 - O:\PROJECT\2024\CIN-05\24050010\CIN MS CONSULTANTS INC. PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBL

PROJECT: PIK-CR44-00.16		DRILLING FIRM / OPERATOR: CTL / H. BROWN		DRILL RIG: CME 55 #393		STATION / OFFSET: 8+13, 52' LT.		EXPLORATION ID												
TYPE: BRIDGE		SAMPLING FIRM / LOGGER: CTL / T. MILLER		HAMMER: CME AUTOMATIC		ALIGNMENT: TANGENT		B-004-0-24												
PID: 115499 SFN: 6633448		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 11/4/22		ELEVATION: 699.2 (MSL) EOB: 25.0 ft.		PAGE												
START: 6/26/24 END: 6/26/24		SAMPLING METHOD: SPT		ENERGY RATIO (%): 79.3		LAT / LONG: 39.144001, -83.090976		1 OF 1												
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	SO4 ppm	BACK FILL
		699.2							GR	CS	FS	SI	CL	LL	PL	PI	WC			
TOPSOIL (3")		698.9																		
VERY STIFF, BROWN, SILT AND CLAY, LITTLE GRAVEL, LITTLE SAND, CONTAINS STONE FRAGMENTS, DAMP			1	7																
@2.5'; TRACE GRAVEL			2	8 11	25	100	SS-1	3.00	-	-	-	-	-	-	-	-	10	A-6a (V)	-	
			3	10 13 16	38	100	SS-2	4.00	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
VERY STIFF, BROWN, CLAY, TRACE SAND, "AND" SILT, DAMP		695.2	4	9																
@5.5'; HARD, BROWN AND GRAY			5	11 11	29	100	SS-3	2.50	-	-	-	-	-	-	-	-	15	A-7-6 (V)	-	
			6	6 8 9	22	100	SS-4	4.50	-	-	-	-	-	-	-	-	14	A-7-6 (V)	-	
			7	11 14 15	38	100	SS-5	4.50	0	1	6	51	42	41	24	17	20	A-7-6 (11)	-	
DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND, SILT, AND CLAY, DAMP		690.7	8	13 14 17	41	100	SS-6	4.00	52	10	6	16	16	49	24	25	17	A-2-7 (3)	-	
MEDIUM DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND, SILT, AND CLAY, DAMP		689.2	9	15 15 17	30	100	SS-7	-	-	-	-	-	-	-	-	-	15	A-2-6 (V)	-	
@11.5'; VERY DENSE			10	28 18 22	53	100	SS-8	-	63	12	4	10	11	36	20	16	19	A-2-6 (0)	-	
@13.0'; DENSE			11	5 14 22	48	100	SS-9	-	-	-	-	-	-	-	-	-	11	A-2-6 (V)	-	
@14.5'; VERY DENSE			12	12 17 22	52	100	SS-10	-	-	-	-	-	-	-	-	-	14	A-2-6 (V)	-	
@16.0'; MEDIUM DENSE			13	8 9 10	25	100	SS-11	-	56	12	5	15	12	38	20	18	15	A-2-6 (1)	-	
DENSE, BROWN, SANDY SILT, "AND" GRAVEL, LITTLE CLAY, DAMP		681.7	14	11 13 14	36	100	SS-12	-	40	13	8	29	10	25	21	4	13	A-4a (1)	-	
LOOSE, GRAY, GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT, TRACE CLAY, DAMP		680.2	15	3 2 3	7	100	SS-13	-	60	12	5	13	10	32	24	8	13	A-2-4 (0)	-	
@20.5'; MEDIUM DENSE, BROWN, WET			16	2 3 7	13	100	SS-14	-	51	12	6	21	10	29	20	9	27	A-2-4 (0)	-	
@22.0'; DENSE, MOIST			17	18 16 18	45	100	SS-15	-	-	-	-	-	-	-	-	-	16	A-2-4 (V)	-	
SHALE, BLACK, SEVERELY WEATHERED.		675.7	18	8 14 46	79	100	SS-16	-	-	-	-	-	-	-	-	-	17	Rock (V)	-	
		674.2	19																	
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STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT GDT - 8/28/24 08:40 - O:\PROJECT\2024\CIN-05\24050010\CIN MS CONSULTANTS INC. PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBLE

PROJECT: PIK-CR44-00.16		DRILLING FIRM / OPERATOR: CTL / H. BROWN		DRILL RIG: CME 55 #393		STATION / OFFSET: 8+57, 26' LT.		EXPLORATION ID														
TYPE: BRIDGE		SAMPLING FIRM / LOGGER: CTL / T. MILLER		HAMMER: CME AUTOMATIC		ALIGNMENT: TANGENT		B-005-0-24														
PID: 115499 SFN: 6633448		DRILLING METHOD: 3.25" HSA / NQ2		CALIBRATION DATE: 11/4/22		ELEVATION: 675.6 (MSL) EOB: 10.5 ft.		PAGE														
START: 6/27/24 END: 6/27/24		SAMPLING METHOD: SPT		ENERGY RATIO (%): 79.3		LAT / LONG: 39.144038, -83.090811		1 OF 1														
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	SO4 ppm	ABAN- DONED		
										GR	CS	FS	SI	CL	LL	PL	PI	WC				
<p>SHALE, DARK GRAY AND BLACK, HIGHLY WEATHERED.</p> <p>SHALE, DARK GRAY, SLIGHTLY WEATHERED, STRONG, VERY THICK BEDDED. @ 0.5' - 2.5'; γ = 140.1 pcf, Sc= 3,122 psi</p> <p>@ 4.5' - 5.5'; γ = 142.8 pcf, Sc= 3,781 psi</p>		675.6	W																			
		675.1	5.6	50/5"	-	100	SS-1	-	-	-	-	-	-	-	-	-	-	12	Rock (V)	-	< 7	
			1																		> 7	
			2																		> 7	
			3	60		96	NQ2-1													CORE		> 7
			4																			> 7
			5																			> 7
			6																			> 7
			7																			> 7
			8	52		98	NQ2-2														CORE	
		665.1	EOB																	> 7		
NOTES: NONE																						
ABANDONMENT METHODS, MATERIALS, QUANTITIES: BOREHOLE WAS NOT BACKFILLED AND ALLOWED TO COLLAPSE AND FILL NATURALLY IN ACCORDANCE WITH ODOT SGE.																						

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT GDT - 8/28/24 08:40 - O:\PROJECT\2024\CIN-05\24050010\CIN MS CONSULTANTS INC. PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBL

PROJECT: PIK-CR44-00.16		DRILLING FIRM / OPERATOR: CTL / H. BROWN		DRILL RIG: CME 55 #393		STATION / OFFSET: 8+76, 20' RT.		EXPLORATION ID															
TYPE: BRIDGE		SAMPLING FIRM / LOGGER: CTL / T. MILLER		HAMMER: CME AUTOMATIC		ALIGNMENT: TANGENT		B-006-0-24															
PID: 115499 SFN: 6633448		DRILLING METHOD: 3.25" HSA / NQ2		CALIBRATION DATE: 11/4/22		ELEVATION: 677.1 (MSL) EOB: 15.5 ft.		PAGE															
START: 6/26/24 END: 6/26/24		SAMPLING METHOD: SPT		ENERGY RATIO (%): 79.3		LAT / LONG: 39.143997, -83.090644		1 OF 1															
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	SO4 ppm	BACK FILL			
		677.1							GR	CS	FS	SI	CL	LL	PL	PI	WC						
MEDIUM DENSE, BROWN, STONE FRAGMENTS WITH SAND, TRACE SILT, TRACE CLAY, DAMP		674.6	W 674.1	1	10																		
				2	4	5	12	100	SS-1	-	-	-	-	-	-	-	-	15	A-1-b (V)	-			
VERY DENSE, GRAY, GRAVEL AND STONE FRAGMENTS WITH SAND, SILT, AND CLAY, WET		673.1	TR	3	3																		
				4	16	50	87	67	SS-2	-	-	-	-	-	-	-	-	21	A-2-6 (V)	-			
SHALE, BLACK, SEVERELY TO HIGHLY WEATHERED.		671.6		5	60/3"	-	67	SS-3	-	-	-	-	-	-	-	-	13	Rock (V)	-				
SHALE, DARK GRAY, HIGHLY TO MODERATELY WEATHERED, STRONG, VERY THICK BEDDED. @ 5.5' - 9.5'; γ = 150.2 pcf, S_c = 2,717 psi		661.6	EOB	6																			
				7																			
				8	26		100	NQ2-1												CORE			
				9																			
				10																			
				11																			
				12																			
				13	84		100	NQ2-2													CORE		
				14																			
				15																			
NOTES: CAVED AT 5.5'																							
ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE CHIPS MIXED WITH SOIL CUTTINGS																							

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT GDT - 8/28/24 08:40 - O:\PROJECT\2024\CIN-05\24050010\CIN - MS CONSULTANTS INC. PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBL

PROJECT: PIK-CR44-00.16		DRILLING FIRM / OPERATOR: CTL / H. BROWN		DRILL RIG: CME 55 #393		STATION / OFFSET: 9+20, 18' LT.		EXPLORATION ID													
TYPE: BRIDGE		SAMPLING FIRM / LOGGER: CTL / T. MILLER		HAMMER: CME AUTOMATIC		ALIGNMENT: TANGENT		B-007-0-24													
PID: 115499 SFN: 6633448		DRILLING METHOD: 3.25" HSA / NQ2		CALIBRATION DATE: 11/4/22		ELEVATION: 680.3 (MSL) EOB: 17.25 ft.		PAGE													
START: 6/25/24 END: 6/25/24		SAMPLING METHOD: SPT		ENERGY RATIO (%): 79.3		LAT / LONG: 39.144157, -83.090654		1 OF 1													
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	SO4 ppm	BACK FILL	
		680.3							GR	CS	FS	SI	CL	LL	PL	PI	WC				
DENSE, BROWN, STONE FRAGMENTS WITH SAND , LITTLE SILT, TRACE CLAY, DAMP		676.3	▽ 677.3 W 676.3	1	8																
				2	16	41	100	SS-1	-	69	8	6	14	3	NP	NP	NP	8	A-1-b (0)	-	
				3	15	41	100	SS-2	-	52	14	9	20	5	NP	NP	NP	10	A-1-b (0)	-	
VERY DENSE, GRAY, BROWN, AND BLACK, STONE FRAGMENTS WITH SAND AND SILT , TRACE CLAY, DAMP		674.8	TR	4	8																
				5	43	79	67	SS-3	-	49	10	9	26	6	NP	NP	NP	15	A-2-4 (0)	-	
SHALE, BLACK, HIGHLY WEATHERED, CONTAINS LIMESTONE FRAGMENTS.		673.0		6	50/4"	-	100	SS-4	-	-	-	-	-	-	-	-	12	Rock (V)	-		
				7	50/3"	-	100	SS-5	-	-	-	-	-	-	-	-	-	14	Rock (V)	-	
SHALE, DARK GRAY, MODERATELY WEATHERED, SLIGHTLY STRONG, VERY THICK BEDDED. @ 7.2' - 11.2'; γ = 147.0 pcf, Sc= 2,237 psi		668.0		8																	
				9																	
				10	16		100	NQ2-1											CORE		
				11																	
				12																	
SHALE, DARK GRAY, SLIGHTLY WEATHERED, SLIGHTLY STRONG, VERY THICK BEDDED.		663.1		13																	
				14																	
				15	46		100	NQ2-2											CORE		
				16																	
				17																	
			EOB																		
NOTES: CAVED AT 6'																					
ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE CHIPS MIXED WITH SOIL CUTTINGS																					

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT GDT - 8/28/24 08:40 - O:\PROJECT\2024\CIN-05124050010\CIN MS CONSULTANTS INC. PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBL

PROJECT: <u>PIK-CR44-00.16</u>		DRILLING FIRM / OPERATOR: <u>CTL / H. BROWN</u>		DRILL RIG: <u>CME 55 #393</u>		STATION / OFFSET: <u>10+10, 5' LT.</u>		EXPLORATION ID														
TYPE: <u>ROADWAY</u>		SAMPLING FIRM / LOGGER: <u>CTL / T. MILLER</u>		HAMMER: <u>CME AUTOMATIC</u>		ALIGNMENT: <u>TANGENT</u>		B-008-0-24														
PID: <u>115499</u> SFN: <u>N/A</u>		DRILLING METHOD: <u>3.25" HSA</u>		CALIBRATION DATE: <u>11/4/22</u>		ELEVATION: <u>681.2 (MSL)</u> EOB: <u>10.0 ft.</u>		PAGE														
START: <u>6/25/24</u> END: <u>6/25/24</u>		SAMPLING METHOD: <u>SPT</u>		ENERGY RATIO (%): <u>79.3</u>		LAT / LONG: <u>39.144344, -83.090461</u>		1 OF 1														
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	SO4 ppm	BACK FILL		
		681.2							GR	CS	FS	SI	CL	LL	PL	PI	WC					
TOPSOIL (8")		680.5																				
MEDIUM DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT, TRACE CLAY, DAMP				1																		
				2	5	4	15	100	SS-1	-	72	10	5	8	5	32	22	10	10	A-2-4 (0)	<100	
				3																		
				4	10	10	21	78	SS-2	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	-	
SHALE, BLACK, HIGHLY WEATHERED.		675.7	W TR 5.2	5																		
				6	2																	
				7	50/5"	-	64	SS-3	-	-	-	-	-	-	-	-	-	18	Rock (V)	-		
				8																		
		671.2	EOB	9	60/3"	-	100	SS-4	-	-	-	-	-	-	-	-	11	Rock (V)	-			
				10																		
NOTES: CAVED AT 5'																						
ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE CHIPS MIXED WITH SOIL CUTTINGS																						

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT GDT - 8/28/24 08:40 - O:\PROJECT\2024\CIN-05\24050010\CIN - MS CONSULTANTS INC. PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBLE

PROJECT: PIK-CR44-00.16		DRILLING FIRM / OPERATOR: CTL / H. BROWN		DRILL RIG: CME 55 #393		STATION / OFFSET: 12+41, 7' LT.		EXPLORATION ID												
TYPE: SUBGRADE		SAMPLING FIRM / LOGGER: CTL / T. MILLER		HAMMER: CME AUTOMATIC		ALIGNMENT: TANGENT		B-009-0-24												
PID: 115499 SFN: N/A		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 11/4/22		ELEVATION: 687.3 (MSL) EOB: 7.0 ft.		PAGE												
START: 6/25/24 END: 6/25/24		SAMPLING METHOD: SPT		ENERGY RATIO (%): 79.3		LAT / LONG: 39.144949, -83.090536		1 OF 1												
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	SO4 ppm	BACK FILL
		687.3							GR	CS	FS	SI	CL	LL	PL	PI	WC			
ASPHALT (3")		687.0																		
GRAVEL (5")		686.6	1	4																
VERY STIFF, BROWN, SILT AND CLAY, SOME GRAVEL, LITTLE SAND, DAMP		684.8	2	5 7	16	67	SS-1	3.00	30	8	10	37	15	33	22	11	16	A-6a (4)	<100	
MEDIUM DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT, TRACE CLAY, DAMP			3	7 11	24	100	SS-2	-	57	15	6	13	9	30	20	10	12	A-2-4 (0)	-	
@4.0'; DENSE			4	15 10 14	32	67	SS-3	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	-	
@5.5'; VERY DENSE			5	11 20 22	56	100	SS-4	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	-	
		680.3	6																	
			7																	
			EOB																	
NOTES: CAVED AT 3'																				
ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; BACKFILLED WITH BENTONITE CHIPS MIXED WITH SOIL CUTTINGS																				

APPENDIX C

LABORATORY TEST RESULTS





OHIO DEPARTMENT OF TRANSPORTATION
OFFICE OF GEOTECHNICAL ENGINEERING

GRAIN SIZE DISTRIBUTION

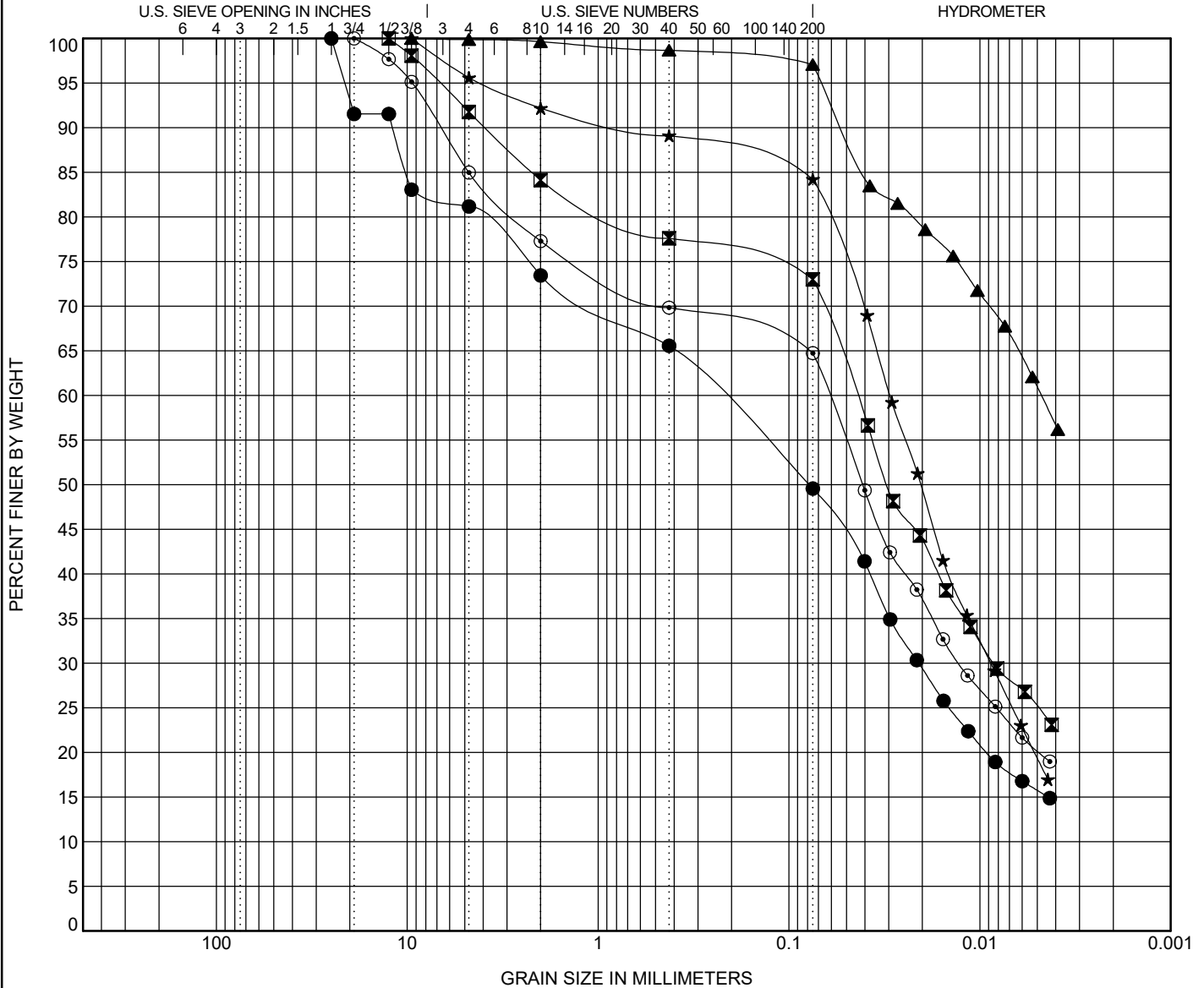
PROJECT PIK-CR44-00.16

PID 115499

CTL PROJECT 24050010CIN

PROJECT TYPE ROADWAY

GRAIN SIZE - OH DOT.GDT - 7/26/24 08:25 - O:\PROJECT\2024\CIN-0524050010CIN_MS CONSULTANTS INC_PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBLE TWP PIKE CO OH\LAB AND LOGS\GINT\24050010CIN.GPJ



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Specimen Identification		ODOT (Modified AASHTO) ~ USCS Classification								LL	PL	PI
●	B-001-0-24 1.0	A-4a ~ CLAYEY SAND with GRAVEL(SC)								29	19	10
☒	B-001-0-24 2.5	A-6a ~ LEAN CLAY with SAND(CL)								32	20	12
▲	B-002-0-24 5.5	A-7-6 ~ FAT CLAY(CH)								58	24	34
★	B-003-0-24 1.0	A-7-5 ~ ELASTIC SILT with SAND(MH)								57	37	20
◎	B-003-0-24 3.5	A-4a ~ SANDY LEAN CLAY with GRAVEL(CL)								27	19	8
Specimen Identification		D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	B-001-0-24 1.0	11.895	0.079	0.021		26	8	16	34	16		
☒	B-001-0-24 2.5	3.889	0.03	0.008		16	6	5	48	25		
▲	B-002-0-24 5.5	0.052				0	1	2	36	61		
★	B-003-0-24 1.0	0.667	0.02	0.009		8	3	5	65	19		
◎	B-003-0-24 3.5	6.693	0.041	0.013		23	7	5	45	20		



OHIO DEPARTMENT OF TRANSPORTATION
OFFICE OF GEOTECHNICAL ENGINEERING

GRAIN SIZE DISTRIBUTION

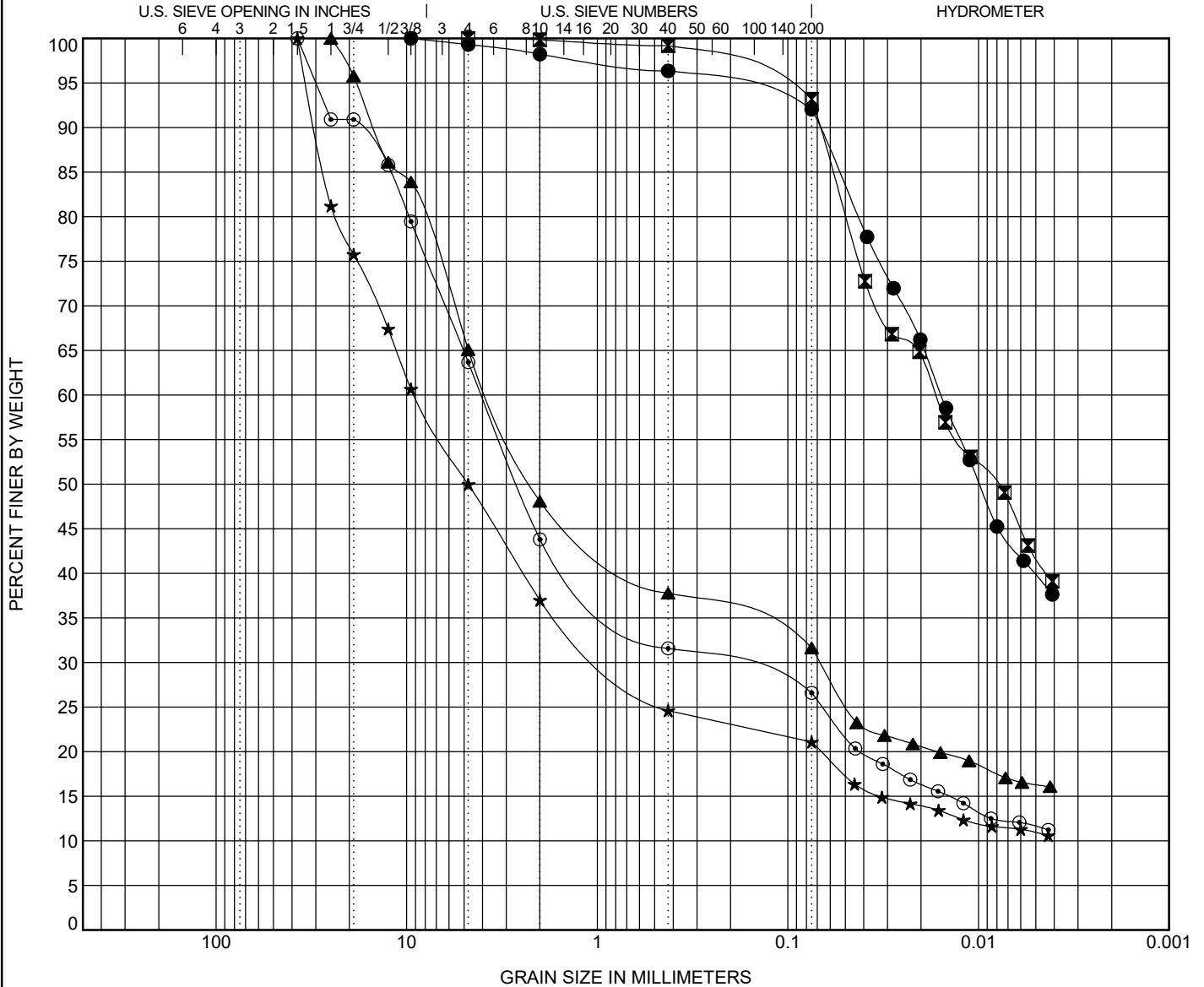
PROJECT PIK-CR44-00.16

PID 115499

OGE NUMBER PIK-CR44-00.16

PROJECT TYPE ROADWAY

GRAIN SIZE - OH DOT.GDT - 7/26/24 08:25 - O:\PROJECT\2024\GIN-0524050010CIN_MS CONSULTANTS INC_PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBLE TWP PIKE CO OH\LAB AND LOGS\GIN\24050010CIN.GPJ



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Specimen Identification			ODOT (Modified AASHTO) ~ USCS Classification								LL	PL	PI
●	B-003-0-24	21.0	A-6b ~ LEAN CLAY(CL)								37	21	16
☒	B-004-0-24	7.0	A-7-6 ~ LEAN CLAY(CL)								41	24	17
▲	B-004-0-24	8.5	A-2-7 ~ CLAYEY GRAVEL with SAND(GC)								49	24	25
★	B-004-0-24	11.5	A-2-6 ~ CLAYEY GRAVEL with SAND(GC)								36	20	16
⊙	B-004-0-24	16.0	A-2-6 ~ CLAYEY SAND with GRAVEL(SC)								38	20	18
Specimen Identification			D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	B-003-0-24	21.0	0.068	0.01			2	2	4	52	40		
☒	B-004-0-24	7.0	0.068	0.008			0	1	6	51	42		
▲	B-004-0-24	8.5	14.796	2.205	0.067		52	10	6	16	16		
★	B-004-0-24	11.5	30.223	4.758	0.835		63	12	4	10	11		
⊙	B-004-0-24	16.0	17.637	2.618	0.245		56	12	5	15	12		



OHIO DEPARTMENT OF TRANSPORTATION
OFFICE OF GEOTECHNICAL ENGINEERING

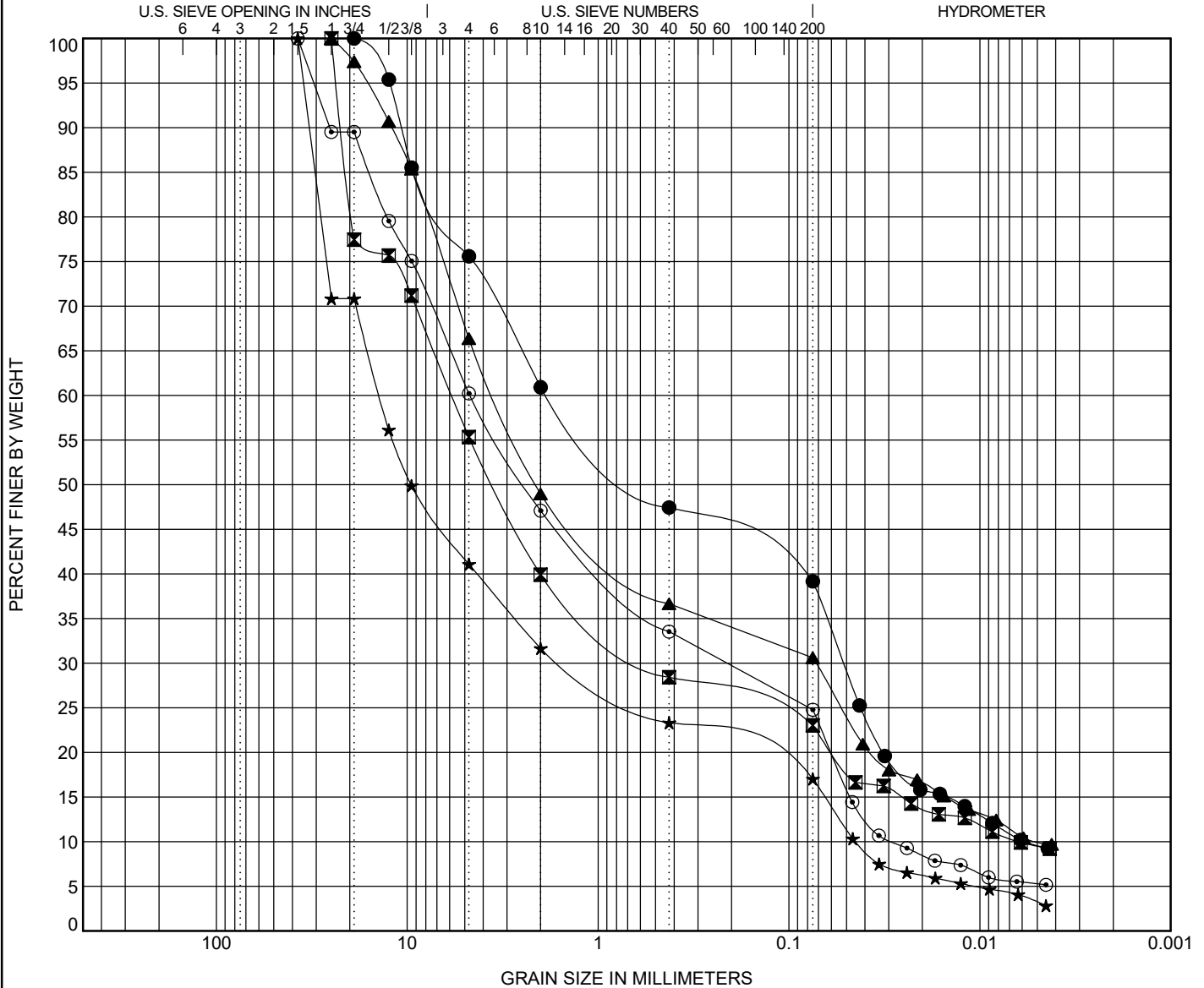
GRAIN SIZE DISTRIBUTION

PROJECT PIK-CR44-00.16

PID 115499

OGE NUMBER PIK-CR44-00.16

PROJECT TYPE ROADWAY



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Specimen Identification			ODOT (Modified AASHTO) ~ USCS Classification								LL	PL	PI
●	B-004-0-24	17.5	A-4a ~ SILTY, CLAYEY SAND with GRAVEL(SC-SM)								25	21	4
■	B-004-0-24	19.0	A-2-4 ~ SILTY GRAVEL with SAND(GM)								32	24	8
▲	B-004-0-24	20.5	A-2-4 ~ CLAYEY SAND with GRAVEL(SC)								29	20	9
★	B-007-0-24	1.0	A-1-b ~ SILTY GRAVEL with SAND(GM)								NP	NP	NP
◎	B-007-0-24	2.5	A-1-b ~ SILTY GRAVEL with SAND(GM)								NP	NP	NP
Specimen Identification			D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	B-004-0-24	17.5	10.758	0.57	0.052	0.006	40	13	8	29	10	0.26	315.50
■	B-004-0-24	19.0	22.134	3.521	0.526	0.006	60	12	5	13	10	7.60	931.61
▲	B-004-0-24	20.5	12.056	2.106	0.072	0.005	51	12	6	21	10	0.31	716.12
★	B-007-0-24	1.0	32.63	9.542	1.471	0.045	69	8	6	14	3	3.48	312.88
◎	B-007-0-24	2.5	25.471	2.423	0.211	0.029	52	14	9	20	5	0.33	163.32

GRAIN SIZE - OH DOT.GDT - 7/26/24 08:25 - O:\PROJECT\2024\GIN-0524050010CIN_MS CONSULTANTS INC_PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBLE TWP PIKE CO OH\LAB AND LOGS\GIN\24050010CIN.GPJ



OHIO DEPARTMENT OF TRANSPORTATION
OFFICE OF GEOTECHNICAL ENGINEERING

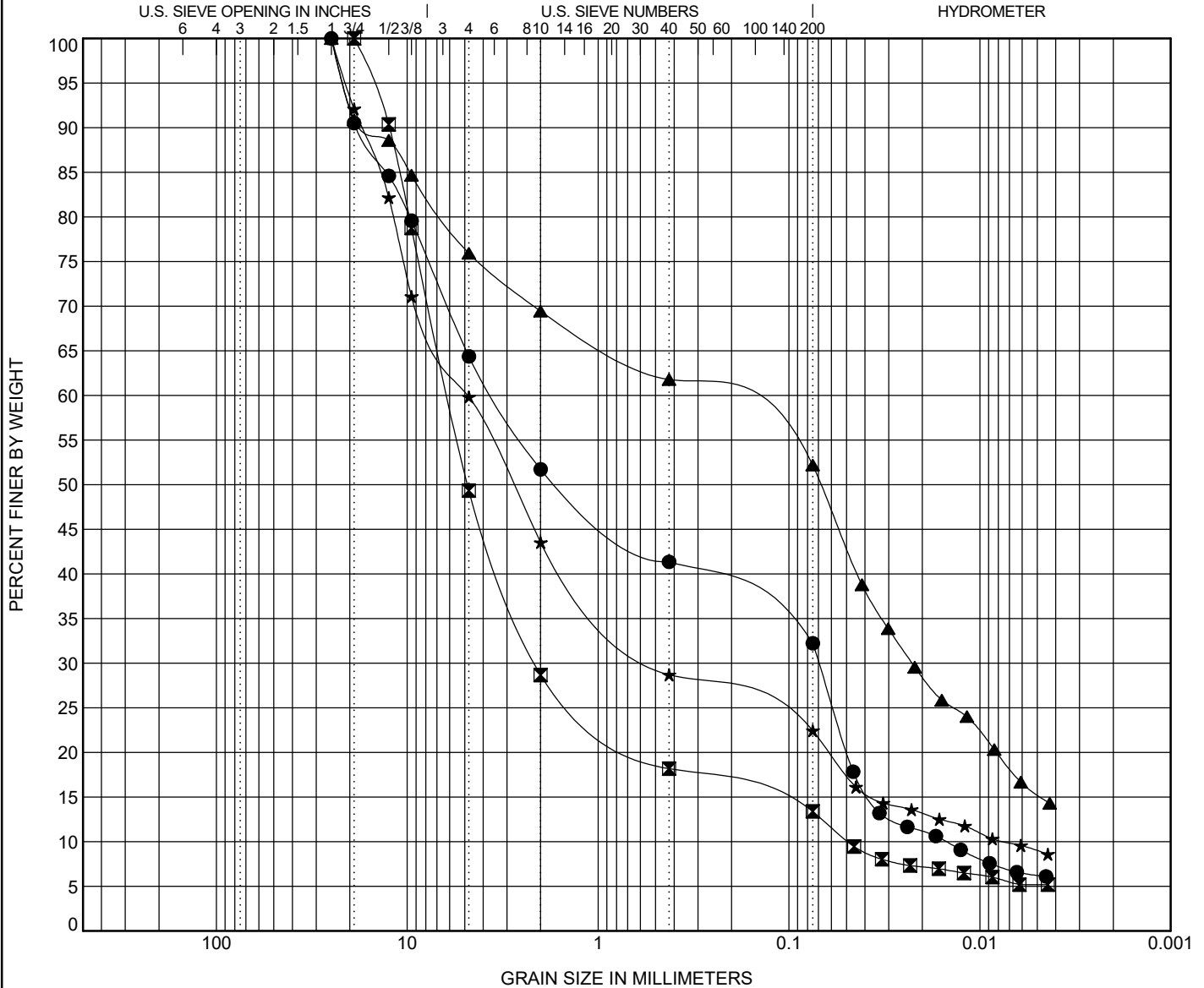
GRAIN SIZE DISTRIBUTION

PROJECT PIK-CR44-00.16

PID 115499

OGE NUMBER PIK-CR44-00.16

PROJECT TYPE ROADWAY



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Specimen Identification			ODOT (Modified AASHTO) ~ USCS Classification								LL	PL	PI
●	B-007-0-24	4.0	A-2-4 ~ SILTY GRAVEL with SAND(GM)								NP	NP	NP
▣	B-008-0-24	1.0	A-2-4 ~ CLAYEY GRAVEL with SAND(GC)								32	22	10
▲	B-009-0-24	1.0	A-6a ~ GRAVELLY LEAN CLAY with SAND(CL)								33	22	11
★	B-009-0-24	2.5	A-2-4 ~ CLAYEY GRAVEL with SAND(GC)								30	20	10
Specimen Identification			D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	B-007-0-24	4.0	18.325	1.547	0.07	0.015	49	10	9	26	6	0.09	234.24
▣	B-008-0-24	1.0	12.396	4.827	2.116	0.049	72	10	5	8	5	14.99	124.90
▲	B-009-0-24	1.0	16.204	0.068	0.023		30	8	10	37	15		
★	B-009-0-24	2.5	17.384	2.82	0.487	0.007	57	15	6	13	9	6.65	646.51

GRAIN SIZE - OH DOT.GDT - 7/26/24 08:25 - O:\PROJECT\2024\CIN-0524050010CIN_MS CONSULTANTS INC_PIK-CR44-00-16 TURKEY RUN RD BRIDGE_PEBBLE TWP PIKE CO OH\LAB AND LOGS\GINT24050010CIN.GPJ



OHIO DEPARTMENT OF TRANSPORTATION
DETERMINING SULFATE CONTENT IN SOILS
SUPPLEMENT 1122

Project C-R-S: **PIK-CR44-00.16**

PID No: **115499**

Report Date: **7/8/2024**

Consultant: **CTL Engineering, Inc.**

Technician: **RV**

Boring ID	Sample Number	Depth (feet)	Station	Offset	Latitude & Longitude (degrees)		Elevation (feet)	Soaking Time (hr)	Replicate Sample Readings						Sulfate Content (ppm)
									1		2		3		
									Dilution	Reading	Dilution	Reading	Dilution	Reading	
B-001-0-24	BS-1	1.0 - 3.0	4+46	5' LT.	39.143229	83.091818	706.5	20	20	27	20	27	20	27	540
B-002-0-24	BS-1	1.0 - 3.0	4+88	5' LT.	39.143309	83.091703	704.9	20	20	12	20	12	20	12	240
B-008-0-24	BS-1	1.0 - 3.0	10+10	5' LT.	39.144344	83.090461	681.2	20	20	< 5	20	< 5	20	< 5	< 100
B-009-0-24	BS-1	1.0 - 3.0	12+41	7' LT.	39.144949	83.090536	687.3	20	20	< 5	20	< 5	20	< 5	< 100

PROJECT NO:	24050010CIN
DATE:	8/28/2024

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE - ASTM D 7012



Method C

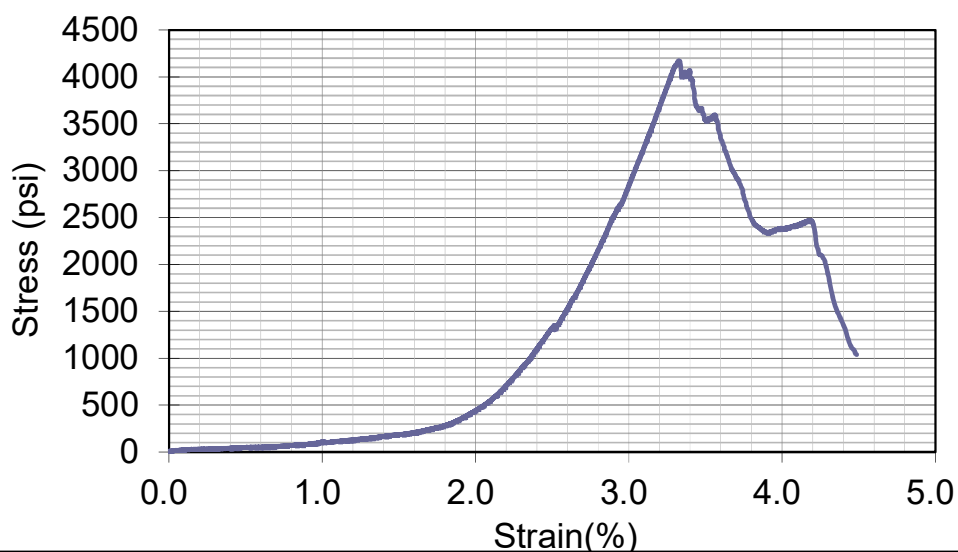
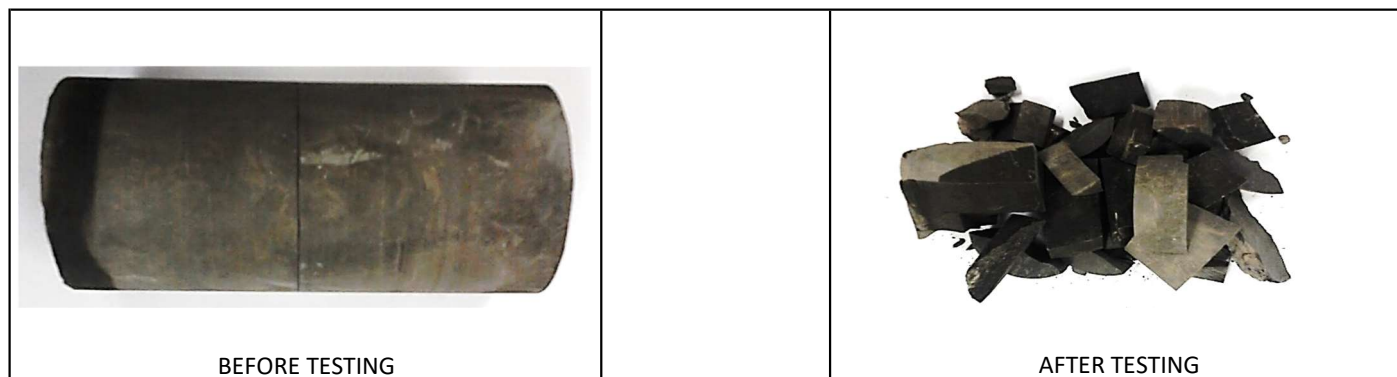
BORING NUMBER	B-004-A-24	TOP DEPTH(FT)	30.2	BOTTOM DEPTH(FT)	30.8
SAMPLE NUMBER	NQ2-2	DISTRICT	9	PID NO.	115499
COUNTY	PIK	ROUTE	CR44	SECTION	0.16

FORMATION	Ohio and Olentangy Shales Undivided
DESCRIPTION	Shale, Gray, Slightly Weathered, Moderately Strong
MOISTURE CONDITION	As Received

MEASUREMENT	LENGTH(INCHES)	DIAMETER(INCHES)
1	3.980	1.994
2	3.990	1.995
3	3.987	1.988
AVERAGE	3.986	1.992

LENGTH/DIAMETER	2.0
CORRECTION FACTOR	1
AREA(IN ²)	3.1
MASS (GRAMS)	484.2
UNIT WEIGHT(LBS/FT ³)	148.5

RATE OF LOADING (in/min)
0.11
COMPRESSIVE STRENGTH (PSI)
4,170
Equip. ID - 68897
NON-CONFORMANCES - None
TIME OF TEST (MINUTES)
1.16
LOADING DIRECTION
PERP. TO BEDDING
TECHNICIAN - MW
TEMPERATURE - Room



Point Load Strength Index of Rock ASTM D 5731	CTL ENGINEERING, INC. 2860 Fisher Road Columbus, Ohio 43204
Sample ID: B-004-A-24, NQ2-1, 25'-29' Sample Description: Shale, Gray Avg Uncorrected Point Load Strength Index (psi): 377.21 Avg Corrected Point Load Strength Index (psi): 325.1 Estimated Uniaxial Compressive Strength S_c (psi): 3902 Point Load Strength Anisotropy Index: $I_{a(50)}$ (psi) : 2.3	Client: MS Consultants, Inc Project: PIK-CR44-00.16 Turkey Run Rd Bridge Location: Pebble Township, Pike County, OH Project No. 24050010CIN Lab Code No. 24050762COL Date Tested: 7/29/24 Reviewed by: SM

Specimen Number	Test Type	Width (W), (in)	Diameter D (in)	Effective Diameter (in)	Load lbs)	Is(psi)	F	Is(50) (psi)
1	Axial	1.987	1.147	1.703	1050	361.834	0.9002	325.736
2	Axial	1.985	0.735	1.363	744	400.731	0.7971	319.438
3	Axial	1.983	0.803	1.424	805	396.939	0.8163	324.019
4	Axial	1.986	0.858	1.473	811	373.924	0.8313	310.830
5	Axial	1.987	0.999	1.590	880	348.200	0.8667	301.775
6	Axial	1.984	1.095	1.663	1047	378.631	0.8884	336.358
7	Axial	1.995	1.072	1.650	1111	408.008	0.8846	360.924
8	Axial	1.981	1.158	1.709	1335	457.070	0.9018	412.208
9	Axial	1.986	1.250	1.778	1104	349.404	0.9216	322.024
10	Axial	1.984	1.075	1.648	549	202.197	0.8839	178.722



Point Load Strength Index of Rock ASTM D 5731	CTL ENGINEERING, INC. 2860 Fisher Road Columbus, Ohio 43204
Sample ID: B-005-0-24, NQ 2-1, 0.5'-2.5' Sample Description: Shale, Gray Avg Uncorrected Point Load Strength Index (psi): 292.48 Avg Corrected Point Load Strength Index (psi): 260.2 Estimated Uniaxial Compressive Strength S_c (psi): 3122 Point Load Strength Anisotropy Index: $I_{a(50)}$ (psi) : 2.0	Client: MS Consultants, Inc Project: PIK-CR44-00.16 Turkey Run Rd Bridge Location: Pebble Township, Pike County, OH Project No. 24050010CIN Lab Code No. 24050762COL Date Tested: 7/29/24 Reviewed by: SM

Specimen Number	Test Type	Width (W), (in)	Diameter D (in)	Effective Diameter (in)	Load lbs)	Is(psi)	F	Is(50) (psi)
1	Axial	1.968	1.254	1.773	686	218.266	0.9203	200.868
2	Axial	1.986	1.145	1.702	714	246.600	0.8997	221.861
3	Axial	1.984	0.885	1.495	689	308.197	0.8381	258.310
4	Axial	1.985	1.062	1.638	904	336.771	0.8811	296.738
5	Axial	1.981	1.147	1.701	885	305.867	0.8995	275.131
6	Axial	1.978	1.162	1.711	853	291.527	0.9023	263.042
7	Axial	1.984	1.035	1.617	657	251.135	0.8749	219.724
8	Axial	1.984	1.055	1.633	532	199.551	0.8795	175.499
9	Axial	1.984	0.805	1.426	863	424.244	0.8170	346.593
10	Axial	1.989	1.173	1.723	1133	381.446	0.9060	345.605



Point Load Strength Index of Rock ASTM D 5731	CTL ENGINEERING, INC. 2860 Fisher Road Columbus, Ohio 43204
<p>Sample ID: B-005-0-24, NQ 2-1, 4.5'-5.5'</p> <p>Sample Description: Shale, Gray</p> <p>Avg Uncorrected Point Load Strength Index (psi): 378.55</p> <p>Avg Corrected Point Load Strength Index (psi): 315.1</p> <p>Estimated Uniaxial Compressive Strength S_c (psi): 3781</p> <p>Point Load Strength Anisotropy Index: $I_{a(50)}$ (psi) : 2.3</p>	<p>Client: MS Consultants, Inc</p> <p>Project: PIK-CR44-00.16 Turkey Run Rd Bridge</p> <p>Location: Pebble Township, Pike County, OH</p> <p>Project No. 24050010CIN</p> <p>Lab Code No. 24050762COL</p> <p>Date Tested: 7/29/24</p> <p>Reviewed by: SM</p>

Specimen Number	Test Type	Width (W), (in)	Diameter D (in)	Effective Diameter (in)	Load lbs)	Is(psi)	F	Is(50) (psi)
1	Axial	1.984	1.024	1.608	519	200.702	0.8721	175.040
2	Axial	1.977	1.429	1.896	1430	397.627	0.9553	379.835
3	Axial	1.981	0.657	1.288	473	285.265	0.7735	220.647
4	Axial	1.984	1.097	1.664	1237	446.645	0.8887	396.949
5	Axial	1.981	0.935	1.535	835	354.252	0.8503	301.222
6	Axial	1.982	0.680	1.310	673	391.925	0.7807	305.976
7	Axial	1.897	0.977	1.536	872	369.418	0.8506	314.241
8	Axial	1.986	0.907	1.514	894	389.791	0.8440	328.980
9	Axial	1.981	0.650	1.281	766	467.102	0.7712	360.241
10	Axial	1.985	0.702	1.332	698	393.474	0.7875	309.858



Point Load Strength Index of Rock ASTM D 5731	CTL ENGINEERING, INC. 2860 Fisher Road Columbus, Ohio 43204
Sample ID: B-006-0-24, NQ 2-1, 5.5'-9.5' Sample Description: Shale, Gray Avg Uncorrected Point Load Strength Index (psi): 243.68 Avg Corrected Point Load Strength Index (psi): 226.4 Estimated Uniaxial Compressive Strength S_c (psi): 2717 Point Load Strength Anisotropy Index: $I_{a(50)}$ (psi) : 6.1	Client: MS Consultants, Inc Project: PIK-CR44-00.16 Turkey Run Rd Bridge Location: Pebble Township, Pike County, OH Project No. 24050010CIN Lab Code No. 24050762COL Date Tested: 7/29/24 Reviewed by: SM

Specimen Number	Test Type	Width (W), (in)	Diameter D (in)	Effective Diameter (in)	Load lbs)	Is(psi)	F	Is(50) (psi)
1	Axial	1.984	0.641	1.272	762	470.636	0.7686	361.742
2	Axial	1.986	1.436	1.905	1245	342.952	0.9577	328.459
3	Axial	1.987	1.348	1.847	691	202.653	0.9413	190.751
4	Axial	1.986	1.231	1.764	212	68.114	0.9178	62.516
5	Axial	1.993	1.328	1.836	1376	408.368	0.9382	383.122
6	Axial	1.985	1.244	1.774	654	207.920	0.9205	191.388
7	Axial	1.897	1.472	1.886	910	255.957	0.9522	243.728
8	Axial	1.988	1.089	1.660	770	279.294	0.8876	247.907
9	Diametrical	---	1.987	1.987	338	85.631	0.9802	83.935
10	Diametrical	---	1.982	1.982	655	166.690	0.9790	163.185



Point Load Strength Index of Rock ASTM D 5731	CTL ENGINEERING, INC. 2860 Fisher Road Columbus, Ohio 43204
Sample ID: B-006-0-24, NQ 2-2, 11.5'-12.2' Sample Description: Shale, Gray Avg Uncorrected Point Load Strength Index (psi): 222.02 Avg Corrected Point Load Strength Index (psi): 196.4 Estimated Uniaxial Compressive Strength S_c (psi): 2356 Point Load Strength Anisotropy Index: $I_{a(50)}$ (psi) : 3.3	Client: MS Consultants, Inc Project: PIK-CR44-00.16 Turkey Run Rd Bridge Location: Pebble Township, Pike County, OH Project No. 24050010CIN Lab Code No. 24050762COL Date Tested: 7/29/24 Reviewed by: SM

Specimen Number	Test Type	Width (W), (in)	Diameter D (in)	Effective Diameter (in)	Load lbs)	Is(psi)	F	Is(50) (psi)
1	Axial	1.979	1.433	1.900	616	170.645	0.9562	163.178
2	Axial	1.987	1.544	1.976	615	157.461	0.9773	153.892
3	Axial	1.985	0.837	1.455	433	204.545	0.8258	168.916
4	Axial	1.993	1.185	1.734	719	239.136	0.9091	217.396
5	Axial	1.990	1.169	1.721	679	229.217	0.9054	207.525
6	Axial	1.988	0.974	1.570	864	350.364	0.8609	301.616
7	Axial	1.988	1.273	1.795	519	161.140	0.9265	149.302
8	Axial	1.988	0.811	1.432	663	323.154	0.8189	264.615
9	Axial	1.977	0.919	1.521	673	290.851	0.8460	246.068
10	Diametrical	---	1.991	1.991	373	94.100	0.9813	92.344



Point Load Strength Index of Rock ASTM D 5731	CTL ENGINEERING, INC. 2860 Fisher Road Columbus, Ohio 43204
Sample ID: B-007-0-24, NQ 2-1, 7.2'-11.2' Sample Description: Shale, Gray Avg Uncorrected Point Load Strength Index (psi): 218.50 Avg Corrected Point Load Strength Index (psi): 186.5 Estimated Uniaxial Compressive Strength S_c (psi): 2237 Point Load Strength Anisotropy Index: $I_{a(50)}$ (psi) : 14.2	Client: MS Consultants, Inc Project: PIK-CR44-00.16 Turkey Run Rd Bridge Location: Pebble Township, Pike County, OH Project No. 24050010CIN Lab Code No. 24050762COL Date Tested: 7/29/24 Reviewed by: SM

Specimen Number	Test Type	Width (W), (in)	Diameter D (in)	Effective Diameter (in)	Load lbs)	Is(psi)	F	Is(50) (psi)
1	Axial	1.984	0.862	1.476	618	283.770	0.8322	236.151
2	Axial	1.904	0.935	1.506	517	227.959	0.8414	191.808
3	Axial	1.993	1.147	1.706	199	68.408	0.9008	61.625
4	Axial	1.985	1.306	1.817	846	256.319	0.9328	239.101
5	Axial	1.980	0.774	1.397	671	343.932	0.8078	277.834
6	Axial	1.887	1.006	1.554	59	24.422	0.8560	20.906
7	Axial	1.860	1.000	1.539	675	285.140	0.8513	242.741
8	Axial	1.983	0.977	1.570	853	345.934	0.8608	297.796
9	Axial	1.984	0.867	1.480	515	235.226	0.8334	196.035
10	Diametrical	---	1.989	1.989	187	47.251	0.9809	46.349



Density of Soil/Rock

ASTM D7263, Method B

Client: MS Consultants, Inc
Project: PIK-CR44-00.16-
Turkey Run Rd Bridge
Project #: 24050010CIN

Date: 7/26/2024
Tech: ZY
Reviewed by: DB
Specimen Type: Intact

Sample: B-004-A-24, NQ 2-1

Depth: 25.0'-29.0'

Avg. Height (in):	1.00	Wet Density (pcf):	140.7
Avg. Diameter (in):	1.99	Dry Density (pcf):	136.6
Weight (gms):	114.2		
Moisture Content (%):	3.01		

Sample: B-004-A-24, NQ 2-2

Depth: 30.2'-30.8'

Avg. Height (in):	3.99	Wet Density (pcf):	148.5
Avg. Diameter (in):	1.99		
Weight (gms):	484.2		

Sample: B-005-0-24, NQ 2-1

Depth: 0.5'-2.5'

Avg. Height (in):	1.65	Wet Density (pcf):	140.1
Avg. Diameter (in):	1.99	Dry Density (pcf):	135.8
Weight (gms):	188.5		
Moisture Content (%):	3.16		



Density of Soil/Rock

ASTM D7263, Method B

Client: MS Consultants, Inc
Project: PIK-CR44-00.16-
Turkey Run Rd Bridge
Project #: 24050010CIN

Date: 7/26/2024
Tech: ZY
Reviewed by: DB
Specimen Type: Intact

Sample: B-005-0-24, NQ 2-1

Depth: 4.5'-5.5'

Avg. Height (in): 1.50
Avg. Diameter (in): 1.99
Weight (gms): 173.6
Moisture Content (%): 2.84

Wet Density (pcf): 142.8
Dry Density (pcf): 138.8

Sample: B-006-0-24, NQ 2-1

Depth: 5.5'-9.5'

Avg. Height (in): 1.39
Avg. Diameter (in): 1.99
Weight (gms): 169.9
Moisture Content (%): 3.69

Wet Density (pcf): 150.2
Dry Density (pcf): 144.8

Sample: B-007-0-24, NQ 2-1

Depth: 7.2'-11.2'

Avg. Height (in): 1.21
Avg. Diameter (in): 1.99
Weight (gms): 144.4
Moisture Content (%): 3.56

Wet Density (pcf): 147.0
Dry Density (pcf): 141.9



**Slake Durability of Shales and Similar Weak Rocks
ASTM D 4644**

CTL ENGINEERING, INC.
2860 Fisher Road Columbus, Ohio 43204

Sample ID: B-004-A-24, NQ 2-1, 25'-29'

Sample Description: Shale, Gray

Slake Durability Index (%): 98.6
(second cycle)
Moisture Content (%): 3.2
Temperature Range (°C): 21.4-21.8
Temperature Average (°C): 21.5

Client: MS Consultants, Inc
Project: PIK-CR44-00.16 Turkey Run Rd Bridge

Project No. 24050010CIN
Lab Code. 24050762COL
Date Tested: 7/15/2024
Reviewed by: DB



Pre-Test Sample



Post Test Sample

Remarks:

Post Test Sample Description : Type II—Retained specimen consist of large and small fragments.



**Slake Durability of Shales and Similar Weak Rocks
ASTM D 4644**

CTL ENGINEERING, INC.
2860 Fisher Road Columbus, Ohio 43204

Sample ID: B-005-0-24, NQ 2-1, 0.5'-2.5'

Sample Description: Shale, Gray

Slake Durability Index (%): 98.6
(second cycle)
Moisture Content (%): 3.4
Temperature Range (°C): 20.6-21
Temperature Average (°C): 20.8

Client: MS Consultants, Inc
Project: PIK-CR44-00.16 Turkey Run Rd Bridge

Project No. 24050010CIN
Lab Code. 24050762COL
Date Tested: 7/15/2024
Reviewed by: DB



Pre-Test Sample



Post Test Sample

Remarks:

Post Test Sample Description : Type II—Retained specimen consist of large and small fragments.



**Slake Durability of Shales and Similar Weak Rocks
ASTM D 4644**

CTL ENGINEERING, INC.
2860 Fisher Road Columbus, Ohio 43204

Sample ID: B-006-0-24, NQ 2-1, 5.5'-7.5'

Sample Description: Shale, Gray

Slake Durability Index (%): 98.7
(second cycle)
Moisture Content (%): 3.1
Temperature Range (°C): 21.4-21.5
Temperature Average (°C): 21.5

Client: MS Consultants, Inc
Project: PIK-CR44-00.16 Turkey Run Rd Bridge

Project No. 24050010CIN
Lab Code. 24050762COL
Date Tested: 7/15/2024
Reviewed by: DB



Pre-Test Sample



Post Test Sample

Remarks:

Post Test Sample Description : Type II—Retained specimen consist of large and small fragments.



Slake Durability of Shales and Similar Weak Rocks ASTM D 4644	CTL ENGINEERING, INC. 2860 Fisher Road Columbus, Ohio 43204
<p>Sample ID: B-007-0-24, NQ 2-1, 7.2'-9.2'</p> <p>Sample Description: Shale, Gray</p> <p>Slake Durability Index (%): 97.9 (second cycle)</p> <p>Moisture Content (%): 3.3</p> <p>Temperature Range (°C): 20.5-21</p> <p>Temperature Average (°C): 20.8</p>	<p>Client: MS Consultants, Inc</p> <p>Project: PIK-CR44-00.16 Turkey Run Rd Bridge</p> <p>Project No. 24050010CIN</p> <p>Lab Code. 24050762COL</p> <p>Date Tested: 7/15/2024</p> <p>Reviewed by: DB</p>
<div>  <p>Pre-Test Sample</p> </div> <div>  <p>Post Test Sample</p> </div> <p>Remarks:</p> <p>Post Test Sample Description : Type II—Retained specimen consist of large and small fragments.</p> <div>  </div>	

APPENDIX D

ROADWAY SUBGRADE ANALYSIS



OHIO DEPARTMENT OF TRANSPORTATION**OFFICE OF GEOTECHNICAL ENGINEERING****PLAN SUBGRADES****Geotechnical Design Manual Section 600**

**PIK-CR44-00.16
115499**

PIK-CR44-00.16 consists of replacing an existing single-span bridge with a three-span bridge as well as improving the roadway horizontal and vertical alignment.

CTL ENGINEERING, INC.

Prepared By: CHRISTOPHER CAREY, E.I.
Date prepared: Tuesday, August 6, 2024

**CTL ENGINEERING, INC.
2105 SCHAPPELLE LANE
CINCINNATI, OHIO 45240
513-722-8665
WWW.CTLENG.COM
CTL@CTLENG.COM**

NO. OF BORINGS: **5**

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-24	CR44	4+46	5	LT	CME 55 TRACK	79	706.5	705.5	0.9 C
2	B-004-0-24	CR44	8+13	52	LT	CME 55 TRACK	79	699.2	691.8	7.4 C
3	B-007-0-24	CR44	9+20	18	LT	CME 55 TRACK	79	680.3	687.5	7.2 F
4	B-008-0-24	CR44	10+10	5	LT	CME 55 TRACK	79	681.2	685.6	4.4 F
5	B-009-0-24	CR44	12+41	7	LT	CME 55 TRACK	79	687.3	686.5	0.8 C



#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N ₆₀	N _{60L}		LL	PL	PI	% Silt	% Clay	P200	M _c	M _{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B 001-0 24	SS-1	1.0	2.5	0.1	1.6	24	24	4.5	29	19	10	34	16	50	12	14	A-4a	3	540					
		SS-2	2.5	4.0	1.6	3.1	22		4.5	32	20	12	48	25	73	13	15	A-6a	8						
		SS-3	4.0	5.5	3.1	4.6	22		4.5							19	14	A-6a	10						
		SS-4	5.5	7.0	4.6	6.1	36		4							22	14	A-6a	10						
2	B 004-0 24	SS-5	7.0	8.5	-0.4	1.1	38	30	4.5	41	24	17	51	42	93	20	21	A-7-6	11						
		SS-6	8.5	10.0	1.1	2.6	41		4	49	24	25	16	16	32	17	10	A-2-7	3		Mc				
		SS-7	10.0	11.5	2.6	4.1	30								15	10	A-2-6	4							
		SS-8	11.5	13.0	4.1	5.6	53			36	20	16	10	11	21	19	10	A-2-6	0						
4	B 008-0 24	SS-1	1.0	2.5	5.4	6.9	15	15		32	22	10	8	5	13	10	10	A-2-4		99					
		SS-2	3.5	5.0	7.9	9.4	21								11	10	A-2-4								
		SS-3	6.0	6.9	10.4	11.3	50/5"								18	0	Rock								
		SS-4	8.5	8.8	12.9	13.2	50/3"								11	0	Rock								
5	B 009-0 24	SS-1	1.0	2.5	0.2	1.7	16	16	3	33	22	11	37	15	52	16	17	A-6a	4	99					
		SS-2	2.5	4.0	1.7	3.2	24			30	20	10	13	9	22	12	10	A-2-4	0						
		SS-3	4.0	5.5	3.2	4.7	32								11	10	A-2-4	0							
		SS-4	5.5	7.0	4.7	6.2	56								11	10	A-2-4	0							

PID: 115499

County-Route-Section: PIK-CR44-00.16

No. of Borings: 5

Geotechnical Consultant: CTL ENGINEERING, INC.

Prepared By: CHRISTOPHER CAREY, E.I.

Date prepared: 8/6/2024

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

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

Design CBR	8
-----------------------	----------

% Samples within 3 feet of subgrade			
$N_{60} \leq 5$	0%	$HP \leq 0.5$	0%
$N_{60} < 12$	0%	$0.5 < HP \leq 1$	0%
$12 \leq N_{60} < 15$	0%	$1 < HP \leq 2$	0%
$N_{60} \geq 20$	54%	$HP > 2$	46%
M+	8%		
Rock	0%		
Unsuitable Soil	100%		

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

% Proposed Subgrade Surface	
Unstable & Unsuitable	14%
Unstable	14%
Unsuitable (Soil & Rock)	0%

	N ₆₀	N _{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M _C	M _{OPT}	GI
Average	31	21	4.14	35	21	14	27	17	45	15	11	4
Maximum	56	30	4.50	49	24	25	51	42	93	22	21	11
Minimum	15	15	3.00	29	19	10	8	5	13	10	0	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	2	0	0	5	0	2	1	0	0	1	0	0	4	0	0	1	0	0	16	
Percent	0%	13%	0%	0%	31%	0%	13%	6%	0%	0%	6%	0%	0%	25%	0%	0%	6%	0%	0%	100%	
% Rock Granular Cohesive	0%	13%	56%									31%									100%
Surface Class Count	0	0	0	0	1	0	1	1	0	0	1	0	0	2	0	0	1	0	0	7	
Surface Class Percent	0%	0%	0%	0%	14%	0%	14%	14%	0%	0%	14%	0%	0%	29%	0%	0%	14%	0%	0%	100%	

APPENDIX E

GLOBAL STABILITY ANALYSIS



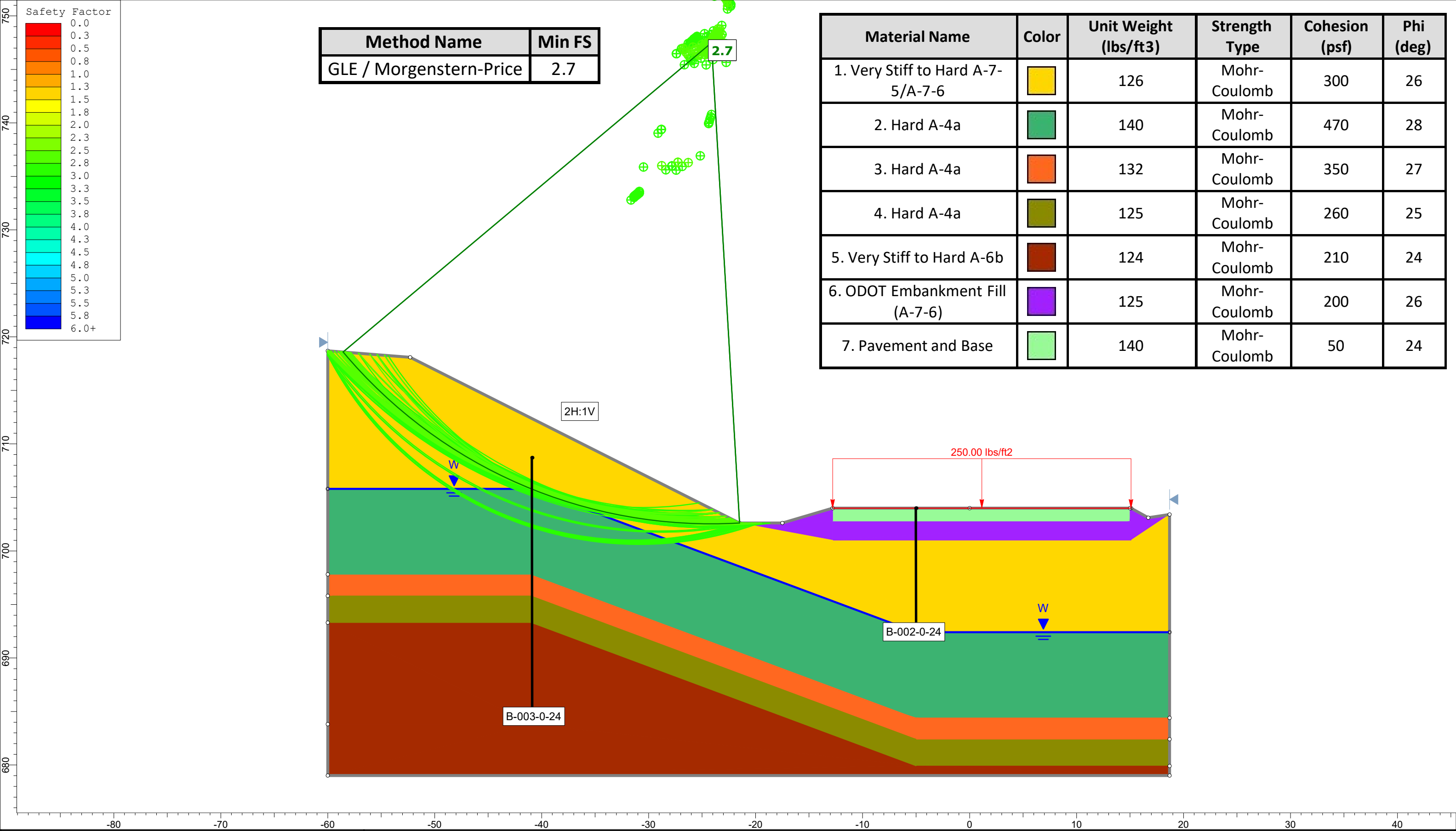
Slope Stability Parameters

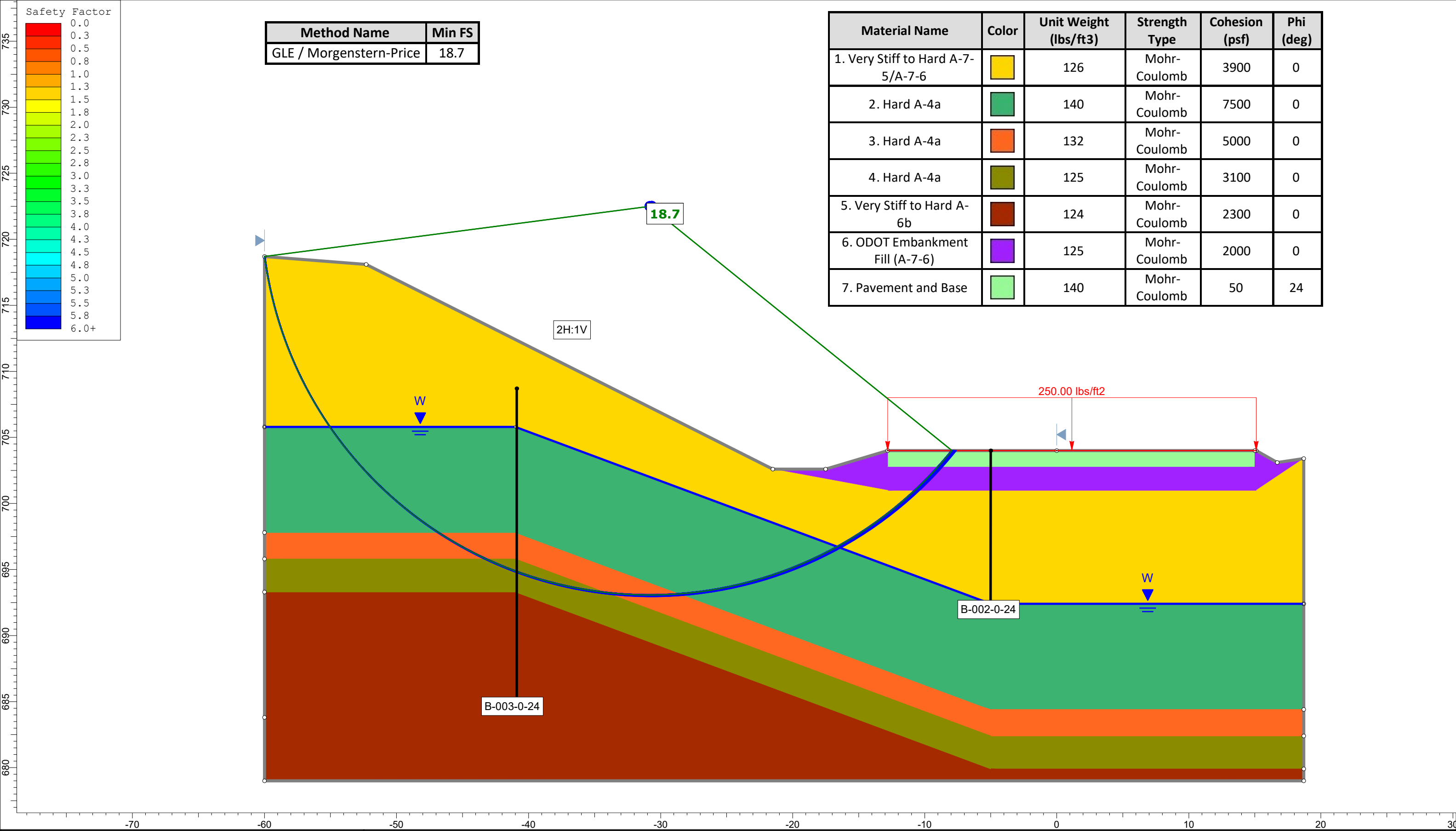
Project: PIK-CR44-00.16
 PID No.: 115499
 CTL Project No.: 24050010CIN
 Boring No.: B-002-0-24 & B-003-0-24
 Location: Pebble Township, Pike County, Ohio
 Station: 5+00
 Date: 8/8/2024

Layer No.	Consistency	ODOT Soil Type	Total Weight (pcf)	Total Stress		Effective Stress		Reference
				Cohesion (psf)	Friction Angle (degrees)	Cohesion (psf)	Friction Angle (degrees)	
1	Very Stiff to Hard	A-7-5 A-7-6	126	3900	0	300	26	1, 2, 3
2	Hard	A-4a	140	7500	0	470	28	1, 2, 3
3	Hard	A-4a	132	5000	0	350	27	1, 2, 3
4	Hard	A-4a	125	3100	0	260	25	1, 2, 3
5	Very Stiff to Hard	A-6b	124	2300	0	210	24	1, 2, 3
6	ODOT Embankment Material (A-7-6)		125	2000	0	200	26	4
7	Pavement and Base		140	50	0	50	24	-

Reference Key

- 1 Total stress and effective stress cohesion estimated according to ODOT GDM Section 404.1
- 2 Total stress friction angle of cohesive soils estimated to be 0
- 3 Effective stress friction angle for cohesive soils estimated using GB7 Table 2
- 4 Unit weight, cohesion, and friction angle obtained from ODOT GDM Table 500-2





APPENDIX F

GEOTECHNICAL DESIGN CHECKLIST





Ohio Department of Transportation Geotechnical Engineering Design Checklists



Version 6.0
January 20, 2023

Preface

Geotechnical design features that arise in the development of roadway projects vary both in type and complexity. Cuts, embankments, wetlands, mine issues, and rock slopes are just some geotechnical issues encountered on transportation projects. Consistent and comprehensive reconnaissance, analysis, and plan preparation are necessary to ensure that all possible geotechnical issues that may occur on a project will be adequately identified and accounted for on the final plans.

A set of topical review checklists, a reference list, and a technical publications list have been developed to aid the project development personnel in their production of geotechnically sound project plans. All projects that contain geotechnical related issues will benefit from the use of this document. Although it is expected that the District Geotechnical Engineer will be one of the main users of these checklists, any personnel responsible for a geotechnical aspect of the project plan development will use this document. Possible users of this checklist include, but are not limited to, design and geotechnical Consultants and District and Central Office reviewers and project engineers.

The design checklists are provided to assist the project development personnel in:

- Developing a comprehensive geotechnical scope of services
- Developing and reviewing geotechnical reports and assimilating information
- Analyzing, designing, and reviewing geotechnical related aspects of a transportation project, including needs assessment, plans, and specifications
- Recognizing cost-saving opportunities
- Identifying deficiencies due to inadequate geotechnical exploration, analysis, or design
- Recognizing when to request additional technical assistance from a geotechnical specialist
- Defining areas of needed training

At first glance, the design checklist will seem to be inordinately lengthy. One, however, should not avoid using the checklist because of this. Only on major and complex projects will it be necessary to complete most of the checklist. Just those checklists that pertain to a specific geotechnical feature encountered on the project should be completed. Therefore, for most projects, only a small portion of the checklist will need to be completed.

Since several entities may be involved in the geotechnical development of a transportation project, it is possible that there may be more than one set of checklists completed for a specific project, or different entities may fill out different sections of the checklist. It is anticipated that all completed checklists will be included with the project file in District or Central Office.

To utilize the checklists,

- First fill out the project information on the Checklist Cover tab. The project information in the headings of the rest of the checklists will autopopulate. Also indicate which checklists will be utilized.
- Complete only the checklists that apply to the project by using the dropdown boxes.
- Submit the checklist cover along with all completed checklists with the report and plan submission

Additional topics and questions may be added as the development of these checklists continues and input is received from the users. All additional updates and design guidance will be issued from the Office of Geotechnical Engineering (OGE) and available on the internet at the Design Reference Resource Center and the OGE website. The OGE Administrator will be the point of contact regarding the checklist, and any questions, recommendations, and training requests should be directed to the Office Administrator.

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	Preface
I.	Checklist Cover
II.	Reconnaissance and Planning Checklist
III.	General Earthwork Design Checklists
	A. Centerline Cuts (Soil Cuts, Rock Slopes)
	B. Embankments (Settlements, Stability, Sidehill Fills, Special)
	C. Subgrade
IV.	Structural Design Checklists
	A. Foundations of Structures (Soil and Bedrock Strength Data, Spread Footing, Pile Structures, Drilled Shafts)
	B. Retaining Wall (Soil Data and Preliminary Calculations, Design, Plans and Contract Documents)
V.	Geologic Hazard Design Checklists
	A. Landslide Remediation (Exploration, Analysis, Design, Plans and Contract Documents)
	B. Rockfall Remediation (Exploration, Analysis, Design, Plans and Contract Documents)
	C. Wetland or Peat Remediation (Exploration, Analysis, Design, Plans and Contract Documents)
	D. Underground Mine Remediation (Exploration, Analysis, Design, Plans and Contract Documents)
	E. Surface Mine Remediation (Exploration, Analysis, Design, Plans and Contract Documents)
	F. Karst Remediation (Exploration, Analysis, Design, Plans and Contract Documents)
VI.	Submission Requirements Checklists
	A. Geotechnical Profile (General Presentation, Cover Sheet, Lab Data Sheets, Plan and Profile, Boring Logs)
	B. Geotechnical Reports (General Presentation)
VII.	References

Symbols and Abbreviations

Y	Yes
N	No
X	Not Applicable (Reason should be explained in the "Notes" area of the checklist)
✓	Selected item utilized
AASHTO	American Association of State Highway and Transportation Officials
AML	Abandoned Mine Land Reclamation Program, DMRM, ODNR
AUMIRA	Manual for Abandoned Underground Mine Inventory and Risk Assessment, ODOT
BDM	Bridge Design Manual, ODOT
CBR	California Bearing Ratio
C&MS	Construction and Material Specifications, ODOT
DGE	District Geotechnical Engineer, ODOT District
DGS	Division of Geological Survey, ODNR
DMRM	Division of Mineral Resources Management, ODNR
DSWC	Division of Soil and Water Conservation, ODA
EPA	Ohio Environmental Protection Agency
FHWA	Federal Highway Administration
F.S.	Factor of Safety
GDM	Geotechnical Design Manual, ODOT
L&D1	Location & Design Manual, Volume 1, ODOT
L&D3	Location & Design Manual, Volume 3, ODOT
LRFD	Load and Resistance Factor Design
N ₆₀	Standard Penetration Value, normalized to 60 percent of drill rod energy ratio
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
OGE	Office of Geotechnical Engineering, ODOT
OSMRE	Office of Surface Mining Reclamation and Enforcement, U.S. Dept. of the Interior
ROW	Right of Way
RQD	Rock Quality Designation
SDI	Slake Durability Index
SGE	Specifications for Geotechnical Explorations, ODOT
SPT	Standard Penetration Test
TIMS	Transportation Information Mapping System
UBV	Ultimate Bearing Value
USGS	U.S. Geological Survey
WEAP	Wave Equation Analysis of Pile Driving (Software)

I. Geotechnical Design Checklists	
Project: PIK-CR44-00.16	PDP Path:
PID: 115499	Review Stage:

Checklist	Included in This Submission
II. Reconnaissance and Planning	✓
III. A. Centerline Cuts	✓
III. B. Embankments	
III. C. Subgrade	
IV. A. Foundations of Structures	✓
IV. B. Retaining Wall	
V. A. Landslide Remediation	
V. B. Rockfall Remediation	
V. C. Wetland or Peat Remediation	
V. D. Underground Mine Remediation	
V. E. Surface Mine Remediation	
V. F. Karst Remediation	
VI. A. Geotechnical Profile	✓
VI. D. Geotechnical Reports	✓

II. Reconnaissance and Planning Checklist

C-R-S:	PIK-CR44-00.16	PID:	115499	Reviewer:		Date:	
Reconnaissance		(Y/N/X)	Notes:				
1	Based on Section 302.1 in the SGE, have the necessary plans been developed in the following areas prior to the commencement of the subsurface exploration reconnaissance:						
	Roadway plans	✓					
	Structures plans	✓					
	Geohazards plans						
2	Have the resources listed in Section 302.2.1 of the SGE been reviewed as part of the office reconnaissance?	Y					
3	Have all the features listed in Section 302.3 of the SGE been observed and evaluated during the field reconnaissance?	Y					
4	If notable features were discovered in the field reconnaissance, were the GPS coordinates of these features recorded?	X					
Planning - General		(Y/N/X)	Notes:				
5	In planning the geotechnical exploration program for the project, have the specific geologic conditions, the proposed work, and historic subsurface exploration work been considered?	Y					
6	Has the ODOT Transportation Information Mapping System (TIMS) been accessed to find all available historic boring information and inventoried geohazards?	Y					
7	Have the borings been located to develop the maximum subsurface information while using a minimum number of borings, utilizing historic geotechnical explorations to the fullest extent possible?	Y					
8	Have the topography, geologic origin of materials, surface manifestation of soil conditions, and any other special design considerations been utilized in determining the spacing and depth of borings?	Y					
9	Have the borings been located so as to provide adequate overhead clearance for the equipment, clearance of underground utilities, minimize damage to private property, and minimize disruption of traffic, without compromising the quality of the exploration?	Y					

II. Reconnaissance and Planning Checklist

Planning - General		(Y/N/X)	Notes:
10	Have the scaled boring plans, showing all project and historic borings, and a schedule of borings in tabular format, been submitted to the District Geotechnical Engineer?	X	
The schedule of borings should present the following information for each boring:			
a.	exploration identification number		
b.	location by station and offset		
c.	estimated amount of rock and soil, including the total for each for the entire program.		
Planning – Exploration Number		(Y/N/X)	Notes:
11	Have the coordinates, stations and offsets of all explorations (borings, soundings, test pits, etc.) been identified?	Y	
12	Has each exploration been assigned a unique identification number, in the following format X-XXX-W-YY, as per Section 303.2 of the SGE?	Y	
13	When referring to historic explorations that did not use the identification scheme in 12 above, have the historic explorations been assigned identification numbers according to Section 303.2 of the SGE?	X	

II. Reconnaissance and Planning Checklist

Planning – Boring Types		(Y/N/X)	Notes:
14	Based on Sections 303.3 to 303.7.6 of the SGE, have the location, depth, and sampling requirements for the following boring types been determined for the project?	Y	B-001-0-24: A B-002-0-24: B3 B-003-0-24: B3 B-004-0-24: A/E1 B-005-0-24: E1 B-006-0-24: E1 B-007-0-24: A/E1 B-008-0-24: B1 B-009-0-24: A
	Check all boring types utilized for this project:		
	Existing Subgrades (Type A)	✓	
	Roadway Borings (Type B)		
	Embankment Foundations (Type B1)	✓	
	Cut Sections (Type B2)		
	Sidehill Cut Sections (Type B3)	✓	
	Sidehill Cut-Fill Sections (Type B4)		
	Sidehill Fill Sections on Unstable Slopes (Type B5)		
	Geohazard Borings (Type C)		
	Lakes, Ponds, and Low-Lying Areas (Type C1)		
	Peat Deposits, Compressible Soils, and Low Strength Soils (Type C2)		
	Uncontrolled Fills, Waste Pits, and Reclaimed Surface Mines (Type C3)		
	Underground Mines (C4)		
	Landslides (Type C5)		
	Rock Slope (Type C6)		
	Karst (Type C7)		
	Proposed Underground Utilities (Type D)		
	Structure Borings (Type E)		
	Bridges (Type E1)	✓	
	Culverts (Type E2 a,b,c)		
	Retaining Walls (Type E3 a and b)		
	Noise Barrier (Type E4)		
	CCTV & High Mast Lighting Towers (Type E5)		
	Buildings and Salt Domes (Type E6)		

III.A. Centerline Cuts Checklist

C-R-S:	PIK-CR44-00.16	PID:	115499	Reviewer:		Date:	
<p><i>If you do not have a centerline cut on the project, you do not have to fill out this checklist.</i></p>							
Soil Cuts		(Y/N/X)	Notes:				
1	Does drilling provide continuous stratigraphic sections for the range of elevations that represent proposed cut slope areas?	Y					
2	Do the cut slopes have a minimum stability F.S. of 1.30 and are not steeper than 2:1? Indicate which program and which analysis method (Spencer, Bishop, etc) was used.	Y					
3	If there is a "red bed" or other historically unstable soil or rock layer through the cut slopes, was this layer considered as a possible failure zone?	N					
4	Have erosion protection measures been addressed for backslopes, side slopes, and ditches (including riprap recommendations or special slope treatments)?	X					
5	Have issues related to any special usage of excavated soils been addressed?	X					
6	If the cut is not completely above the water table,	X					
a.	Did the design consider the construction or long term ramifications of cutting below the water table?						
b.	Did the design consider additional drainage in the cut slope (springs / seeps) and roadway base?						
Rock Slopes		(Y/N/X)	Notes:				
<p><i>For rockfall and additional design considerations, see the "Rockfall Remediation Checklist."</i></p>							
7	Has the subsurface exploration adequately characterized the rock in accordance with GDM Section 1000?	X					
8	Have the slope angles, benching scheme, rockfall catchment design, and drainage controls been determined as prescribed in GDM Section 1000?	X					
9	In accordance with GDM Section 1000, are the rock cut slopes, benches, and catchment areas indicated on all appropriate cross-sections?	X					
10	In accordance with GDM Section 1000, has the rockfall catchment software analysis output and the cost analysis comparing catchment configurations been provided?	X					

III.B. Embankments Checklist

C-R-S:	PIK-CR44-00.16	PID:	115499	Reviewer:		Date:	
<p><i>Use this checklist in conjunction with the Embankment Design Guidance in GDM Section 500</i></p> <p><i>If you do not have an embankment on the project, you do not have to fill out this checklist.</i></p>							
Settlement				(Y/N/X)	Notes:		
1	If soil conditions and project requirements warrant, have settlement issues been addressed? If not applicable (X), go to Question 14			X			
2	Have consolidation properties of the foundation soils been determined? Check methods used:						
	laboratory consolidation tests						
	empirical correlations with moisture content and Atterberg values						
	other (describe other methods)						
3	Have calculations been performed to estimate the total expected embankment settlement and the time of consolidation? Indicate method used.						
4	If differing foundation soil and/or loading conditions occur throughout the embankment area, have sufficient analyses been completed to evaluate consolidation at locations representative of the most critical conditions?						
5	Have the total settlement and the time of consolidation analyses indicated acceptable values at all locations for the scope of the embankment work?						
6	If total settlement or time of consolidation is unacceptable, have the stations and lateral extent of the problem areas been defined?						
7	Has a method been chosen as a solution to the settlement issues? Check the method(s) used:						
	waiting periods with monitoring						
	drainage blanket and wick drains						
	surcharge (preloading)						
	removal and replacement of weak soil						
	lowering proposed grade / change alignment						
	lightweight fill						
	other (describe other methods)						

III.B. Embankments Checklist

Settlement		(Y/N/X)	Notes:
8	Based on accepted design practices, and where applicable, adhering to published guidelines and design recommendations from FHWA, have calculations been performed to evaluate the effectiveness of the chosen solution(s)?		
9	Has an economic analysis been performed to evaluate the cost benefits of the recommended solution compared to others?		
10	Have all necessary notes, specifications, and details for the chosen solution been determined?		
11	Have the need, locations, type, plan notes, and reading schedule for settlement platforms or cells been determined?		
12	Have the effects of the predicted settlement and the chosen solution been determined and accounted for on the construction schedule?		
13	Has the effect of any foundation soil consolidation (including differential settlement) been evaluated with regard to adjacent structures (e.g., bridges, buildings, culverts, utilities) which will also undergo settlement and be subject to stresses induced by the consolidation of the surrounding soil?		
Stability		(Y/N/X)	Notes:
14	If soil conditions and project requirements warrant, have stability issues been addressed? If not applicable (X), go to Question 29	Y	
15	Has the total (short term) and effective (long term) shear strength of the foundation soils been determined?	Y	
	Check method used:		
	laboratory shear tests		
	estimation from SPT or field tests	✓	
16	Have the values of shear strength for proposed embankment fill material, as determined from GDM Section 500, been used in the stability analyses?	Y	

III.B. Embankments Checklist

Stability	(Y/N/X)	Notes:
17 Have calculations been performed to determine the F.S. for stability? Indicate which program and which analysis method (Spencer, Bishop, etc) was used.	Y	GLE/Morgenstern-Price
18 Have the following F.S. been met or exceeded, as determined by the calculations, for the given stability conditions:	Y	
a. 1.30 for short term (undrained) condition	Y	
b. 1.30 for long term (drained) condition	Y	
c. 1.10 for rapid drawdown, flood condition	X	
d. 1.50 for embankment containing or supporting a structural element	X	
19 When differing soil or loading conditions occur throughout the embankment area, have sufficient analyses been completed to evaluate the stability at locations representative of the most critical conditions?	X	
20 If the F.S. was not met or exceeded, have the stations and lateral extent of the problem areas been defined?	X	
21 Has a method been chosen as a solution to the stability issues?	X	
Check the method(s) used:		
flattening slopes		
counter berm		
lightweight embankment		
reinforced soil slope		
soil nailing		
drainage blanket and wick drains		
removal of soft soil, adding shear key		
reduced grade / change alignment		
staged construction		
controlled rate of fill placement		
drilled shaft slope stabilization		
other (describe other methods)		
22 Based on accepted design practices, and where applicable, adhering to published guidelines and design recommendations from FHWA, have calculations been performed to evaluate the effectiveness of the chosen solution(s)?	X	
23 Has an economic analysis been performed to evaluate the cost benefits of the recommended solution compared to others?	X	

III.B. Embankments Checklist

Stability	(Y/N/X)	Notes:
24 Have all necessary notes, specifications, and details for the chosen solution been determined?	X	
25 Have the need, location, type, plan notes, and reading schedule for piezometers and inclinometers been determined?	X	
26 If piezometers will be used, has the critical pressure value been determined and the appropriate information included in the plans?	X	
27 Have the effects of the stability solution been determined and accounted for on the construction schedule?	X	
28 Has the effect of the stability solution been evaluated with regard to structures (e.g., bridges, buildings, culverts, utilities) which may be subject to unusual stresses or require special construction considerations?	X	
Sidehill Fills	(Y/N/X)	Notes:
29 If soil conditions and project requirements warrant, have sidehill fill issues been addressed? If not applicable (X), go to Question 34	X	
30 In accordance with GDM Section 800, have sidehill fills been evaluated to determine if special benching or shear keys are needed?		
31 In accordance with GDM Section 800, if special benching or shear keys are required,		
a. has Plan Note G109 from L&D3 been included in the General Notes?		
b. have quantities for both excavation and embankment been calculated for the benched areas and added to the plan General Quantities?		
c. have the special benching or shear keys been indicated on the appropriate cross sections?		
32 Have water bearing zones been identified and their impact addressed?		
33 Have subsurface drainage controls been adequately addressed?		

III.B. Embankments Checklist

Special	(Y/N/X)	Notes:
34 Have all of the environmental factors, including wetlands, stream mitigation, and landfills, been considered and incorporated prior to design and analysis of embankment settlement and stability, including EPA or other government agencies' involvement, mitigation, or special design or construction considerations?	X	
35 If an embankment is to be placed through standing water or over weak, wet soils (with or without a fabric separator), the fill should be placed by the method of end dumping to a given height above the standing water or until compaction is achievable over the soft soil. If end dumping is to be specified,	X	
a. has the material type for the fill to be end dumped been specified?		
b. has the need for a fabric separator or filter layer been determined?		
c. has the height of fill to be end dumped been determined?		
d. have all notes and specifications for end dumping been developed?		

III.C. Subgrade Checklist

C-R-S:	PIK-CR44-00.16	PID:	115499	Reviewer:		Date:	
<p><i>Use this Checklist in conjunction with the Subgrade design guidance in GDM Section 600</i></p> <p><i>If you do not have any subgrade work on the project, you do not have to fill out this checklist.</i></p>							
Subgrade		(Y/N/X)		Notes:			
1	Has the subsurface exploration adequately characterized the soil or rock according to GDM Section 600?	Y					
a.	Has each sample been visually classified and inspected for the presence of gypsum? Has a moisture content been performed on each sample?	Y					
b.	Has mechanical classification (Plastic Limit (PL), Liquid Limit (LL), and gradation testing) been done on at least two samples from each boring within six feet of the proposed subgrade?	Y					
c.	Has the sulfate content of at least one sample from each boring within 3 feet of the proposed subgrade been determined, per Supplement 1122, Determining Sulfate Content in Soils?	Y					
d.	Has the sulfate content of all samples that exhibit gypsum crystals been determined?	Y					
e.	Have A-2-5, A-4b, A-5, A-7-5, A-8a, or A-8b soils within the top 3 feet of the proposed subgrade been mechanically classified?	Y					
2	If soils classified as A-2-5, A-4b, A-5, A-7-5, A-8a, or A-8b, or having a LL>65, are present at the proposed subgrade (geotechnical profile), do the plans specify that these materials need to be removed and replaced or chemically stabilized?	X					
a.	If these materials are to be removed and replaced, have the station limits, depth, and lateral limits for the planned removal been provided?						
3	If there is any rock, shale, or coal present at the proposed subgrade (C&MS 204.05), do the plans specify the removal of the material?	X					
a.	If removal of any rock, shale, or coal is required, have the station limits, depth, and lateral limits for the planned removal of the material at proposed subgrade been provided?						

III.C. Subgrade Checklist

Subgrade	(Y/N/X)	Notes:						
4 In accordance with GDM Section 600, do the SPT (N_{60})/HP values and existing moisture contents for the proposed subgrade soils indicate the need for subgrade stabilization?	N							
a. If removal and replacement is applicable, has the detail of subgrade removal been shown on the plans, including depth of removal, station limits, lateral extent, replacement material, and plan notes (Item 204 - Subgrade Compaction and Proof Rolling)?								
b. If chemical stabilization is applicable, has the detail of this treatment been shown on the plans, including depth, percentage of chemical, station limits, lateral extent, and plan notes? <table border="1" data-bbox="188 793 933 911"> <tr> <td data-bbox="188 793 782 831">Indicate type of chemical stabilization specified:</td> <td data-bbox="782 793 933 831"></td> </tr> <tr> <td data-bbox="188 831 782 869">cement stabilization</td> <td data-bbox="782 831 933 869"></td> </tr> <tr> <td data-bbox="188 869 782 911">lime stabilization</td> <td data-bbox="782 869 933 911"></td> </tr> </table>	Indicate type of chemical stabilization specified:		cement stabilization		lime stabilization			
Indicate type of chemical stabilization specified:								
cement stabilization								
lime stabilization								
5 If removal and replacement has been specified, do the plans include Plan Note G121 from L&D3?	X							
6 If drainage or groundwater is an issue with the proposed subgrade, has an appropriate drainage system (e.g., pipe, underdrains) been provided?	X							
7 Has an appropriate quantity of Proof Rolling (C&MS 204.06) and has Plan Note G111 from L&D3 been included in the plans?	X							
8 Has a design CBR value been provided?	Y	CBR = 8						

IV.A Foundations of Structures Checklist

C-R-S:	PIK-CR44-00.16	PID:	115499	Reviewer:		Date:	
<p>Use this Checklist in conjunction with the bridge foundation design guidance in GDM Section 1300 If you do not have such a foundation or structure on the project, you do not have to fill out this checklist.</p>							
Soil and Bedrock Strength Data				(Y/N/X)	Notes:		
1	Has the shear strength of the foundation soils been determined?			Y			
	Check method used:						
	laboratory shear tests						
	estimation from SPT or field tests			✓			
2	Have sufficient soil shear strength, consolidation, and other parameters been determined so that the required allowable loads for the foundation/structure can be designed?			Y			
3	Has the shear strength of the foundation bedrock been determined?			Y	Lab Testing on Rock Core Samples include: - Uniaxial Compressive Strength of Intact Rock Core (ASTM D7012) - Point Load Strength Index of Rock (ASTM D5731)		
	Check method used:						
	laboratory shear tests			✓			
	other (describe other methods)						
Spread Footings				(Y/N/X)	Notes:		
4	Are there spread footings on the project? If no, go to Question 11			N			
5	Have the recommended bottom of footing elevation and reason for this recommendation been provided?			X			
a.	Has the recommended bottom of footing elevation taken scour from streams or other water flow into account?						
6	Were representative sections analyzed for the entire length of the structure for the following:			X			
a.	factored bearing resistance?						
b.	factored sliding resistance?						
c.	eccentric load limitations (overturning)?						
d.	predicted settlement?						
e.	overall (global) stability?						
7	Has the need for a shear key been evaluated?			X			
a.	If needed, have the details been included in the plans?						
8	If special conditions exist (e.g. geometry, sloping rock, varying soil conditions), was the bottom of footing "stepped" to accommodate them?			X			
9	Have the Service I and Maximum Strength Limit States for bearing pressure on soil or rock been provided?			X			

IV.A Foundations of Structures Checklist

Spread Footings		(Y/N/X)	Notes:
10	If weak soil is present at the proposed foundation level, has the removal / treatment of this soil been developed and included in the plans?	X	
a.	Have the procedure and quantities related to this removal / treatment been included in the plans?		
Pile Structures		(Y/N/X)	Notes:
11	Are there piles on the project? If no, go to Question 17	Y	
12	Has an appropriate pile type been selected?		Stage 2 Plans indicate that H-Piles (HP10x42 and HP 12x53) will be used at the abutments and piers.
	Check the type selected:		
	H-pile (driven)		
	H-pile (prebored)	✓	
	Cast In-place Reinforced Concrete Pipe		
	Micropile		
	Continuous Flight Auger (CFA)		
	other (describe other types)		
13	Have the estimated pile length or tip elevation and section (diameter) based on either the Ultimate Bearing Value (UBV) or the depth to top of bedrock been specified? Indicate method used.	Y	
14	If scour is predicted, has pile resistance in the scour zone been neglected?	✓	
15	Has a wave equation drivability analysis been performed as per BDM 305.3.1.2 to determine whether the pile can be driven to either the UBV, the pile tip elevation, or refusal on bedrock without overstressing the pile?	N	
16	If required for design, have sufficient soil parameters been provided and calculations performed to evaluate the:	X	H-Piles will be prebored into Bedrock
a.	Nominal unit tip resistance and maximum settlement of the piles?		
b.	Nominal unit side resistance for each contributing soil layer and maximum deflection of the piles?		
c.	Downdrag load on piles driven through new embankment or compressible soil layers, as per BDM 305.3.2.2?		
d.	Potential for and impact of lateral squeeze from soft foundation soils?		

IV.A Foundations of Structures Checklist

Pile Structures		(Y/N/X)	Notes:
17	If piles are to be driven to strong bedrock ($Q_u > 7.5$ ksi) or through very dense granular soils or overburden containing boulders, have "pile points" been recommended in order to protect the tips of the steel piling, as per BDM 305.3.5.6?	X	
18	If subsurface obstacles exist, has preboring been recommended to avoid these obstructions?	Y	
19	If piles will be driven through 15 feet or more of new embankment, has preboring been specified as per BDM 305.3.5.7?	X	

IV.A Foundations of Structures Checklist

Drilled Shafts		(Y/N/X)	Notes:
20	Are there drilled shafts on the project? If no, go to the next checklist.	Y	Stage 2 plans show H-Piles being used, but CTL recommends drilled shafts.
21	Have the drilled shaft diameter and embedment length been specified?	N	Embedment length has been specified. Not diameter.
22	Have the recommended drilled shaft diameter and embedment been developed based on the nominal unit side resistance and nominal unit tip resistance for vertical loading situations?	N	
23	For shafts undergoing lateral loading, have the following been determined:	X	
	a. total factored lateral shear?		
	b. total factored bending moment?		
	c. maximum deflection?		
	d. reinforcement design?		
24	If a bedrock socket is required, has a minimum rock socket length equal to 1.5 times the rock socket diameter been used, as per BDM 305.4.2?	X	Diameter has not been determined.
25	Generally, bedrock sockets are 6" smaller in diameter than the soil embedment section of the drilled shaft. Has this factor been accounted for in the drilled shaft design?	X	
26	If scour is predicted, has shaft resistance in the scour zone been neglected?	✓	
27	Has the site been assessed for groundwater influence?	N	
	a. If yes, and if artesian flow is a potential concern, does the design address control of groundwater flow during construction?		
28	Have all the proper items been included in the plans for integrity testing?	X	
29	If special construction features (e.g., slurry, casing, load tests) are required, have all the proper items been included in the plans?	X	
30	If necessary, have wet construction methods been specified?	X	
General		(Y/N/X)	Notes:
31	Has the need for load testing of the foundations been evaluated?	X	
	a. If needed, have details and plan notes for load testing been included in the plans?		

VI.A. Geotechnical Profile Checklist

C-R-S:	PIK-CR44-00.16	PID:	115499	Reviewer:		Date:	
General Presentation				(Y/N/X)	Notes:		
1	Has an electronic copy of all geotechnical submissions been provided to the District Geotechnical Engineer (DGE)?			Y			
2	Have the cadd files been prepared using the appropriate version of the ODOT CADD standards?			Y			
3	Has the geotechnical specification (title and date) under which the work was performed been clearly identified on every submission (reports, plans, etc.)?			Y			
4	Has the first complete version of all documents being submitted been labeled as 'Draft'?			Y			
5	Subsequent to ODOT's review and approval, has the complete version of the revised documents being submitted been labeled as 'Final'?			X			
a.	Have the C-R-S, PID number, and product title been included in the folder name?			X			
6	If the project includes structures, have all structure explorations been presented together under the same cover sheet? (Do not create separate Geotechnical Profile - Bridge Sheets)			Y			
7	Has a scale of 1"=1' been used for cover sheets, laboratory test data sheets, and boring log sheets, if applicable?			Y			
8	Based on the project length, has the correct horizontal scale been used to plot the project data?			Y			
Check scale used:							
1" = 5', 10', 20', 25', 40', or 50' for projects 1500' or less (use largest scale appropriate to present entire plan on one sheet)			✓				
1" = 50' projects greater than 1500'							
9	Has a scale of 1" = 10' been utilized for the vertical scale of the project data?			Y			
10	If the project includes structures, has the plan and profile view been shown at the same scale as the Site Plan for the proposed structure(s), when possible?			Y			

VI.A. Geotechnical Profile Checklist

General Presentation		(Y/N/X)	Notes:
11	If the project includes culverts, have the plan and profile been presented along the flowline of the culvert?	X	
12	Have the cross-sections been plotted at a scale of 1" = 10' (preferred) or 1" = 20' (for higher or wider slopes)?	X	
Cover Sheet		(Y/N/X)	Notes:
13	Has the following general information been provided on the cover sheet:	Y	
a.	Brief description of the project, including the bridge number of each bridge involved in the plan set, if any?	Y	
b.	Brief description of historic geotechnical explorations referenced in this exploration? State if no historic records are available.	Y	
c.	Generalized information about the geology of the project area, including terrain, soil origin, bedrock types, and age?	Y	
d.	Brief presentation of geological and topographical information derived from the field reconnaissance? Include comments on structure and pavement conditions.	Y	
e.	Brief presentation of test boring and sampling methods? Include date of last calibration and drill rod energy ratio as a percent for the hammer systems used.	Y	
f.	Summary of general soil, bedrock, and groundwater conditions, including a generalized interpretation of findings?	Y	
g.	A statement of which version (date) of the SGE specification the exploration was performed in accordance with?	Y	
h.	Statement of where geotechnical reports are available for review?	Y	
i.	Initials of personnel and dates they performed field reconnaissance, subsurface exploration and preparation of the geotechnical profile?	Y	

VI.A. Geotechnical Profile Checklist

Cover Sheet		(Y/N/X)	Notes:
14	Has a Legend been provided?	Y	
15	Have the following items been included in the Legend:	Y	
a.	Symbols and usual descriptions for only the soil and bedrock types presented in the Geotechnical Profile, as per the Soil and Rock Symbology Chart in Appendix D of the SGE?	Y	
b.	All miscellaneous symbols and acronyms, used on any of the sheets, defined?	Y	
c.	The number of soil samples for each classification that were mechanically classified and visually described in the current exploration?	Y	
16	Has a Location Map, showing the beginning and end stations for the project, been shown on the cover sheet, sized per the L&D3 Manual?	Y	
17	Have the station limits for each plan and profile sheet for projects with multiple alignments, or greater than 1500', been identified in a table?	Y	
18	Have the station limits for any cross section sheets been identified in the same table?	Y	
19	Has a list of any structures for which structure foundation explorations been performed been identified in the same table?	Y	
20	If sampling and testing for a scour analysis was performed, has this data been shown in tabular form?	Y	
21	Has a summary table of test data for all roadway and subgrade boring samples been shown?	Y	
22	If borings from previous subsurface explorations are being used, has that data been shown in a separate table?	X	
23	In the summary table, has the data been displayed by roadway and subgrade boring in ascending stationing order for each roadway?	Y	
24	Have the centerline or baseline station, offset, and exploration identification number been provided for each boring presented in the table?	Y	

VI.A. Geotechnical Profile Checklist

Cover Sheet		(Y/N/X)	Notes:
25	For each sample, has the following information been provided in the summary table:	Y	
a.	Sample depth interval?	Y	
b.	Sample number and type?	Y	
c.	N ₆₀ ?	Y	
d.	Percent recovery?	Y	
e.	Hand Penetrometer?	Y	
f.	Percentage of aggregate, coarse sand, fine sand, silt, and clay size particles?	Y	
g.	Liquid limit, plastic limit, plasticity index, and water content, all rounded to the nearest percent or whole number?	Y	
h.	ODOT classification and Group Index?	Y	
i.	Visual description of samples not mechanically classified, including water content, and estimated ODOT classification with 'Visual' in parentheses?	Y	
j.	Sulfate Content test results?	Y	
26	Have all undisturbed test results been displayed in graphical format on the sheet prior to the plan and profile sheets?	X	
Surface Data		(Y/N/X)	Notes:
27	Has the following information been shown on each roadway plan drawing:	Y	
a.	Existing surface features described in Section 702.5.1?	Y	
b.	Proposed construction items, as described in Section 702.5.2?	X	
c.	Project and historic boring locations, with appropriate exploration targets and exploration identification numbers?	Y	
d.	Notes regarding observations not readily shown by drawings?	X	
28	Have the existing ground surface contours been presented?	Y	
29	If cross sections are to be developed for stationing covered on a plan sheet, has an index for the appropriate cross section sheets been included on the plan sheet?	Y	

VI.A. Geotechnical Profile Checklist

Subsurface Data		(Y/N/X)	Notes:
30	Has all the subsurface data been presented in the form of a profile along the centerline or baseline, and on cross sections where applicable?	Y	
31	Have the graphical boring logs been correctly shown, as follows:	Y	
a.	Location and depth of boring indicated by a heavy dashed vertical line?	Y	
b.	Exploration identification number above the boring?	Y	
c.	Logs indicate soil and bedrock layers with symbols 0.4" wide and centered on the heavy dashed vertical line where possible?	Y	
d.	Bedrock exposures with 0.4" wide symbols, but without a heavy dashed vertical line?	Y	
e.	Soil and bedrock symbols as per ODOT Soil and Rock Symbolology chart (SGE - Appendix D)?	Y	
f.	Historical borings shown in same manner with the exploration identification number above the boring?	X	
32	Have the proposed groundline and existing groundline been shown on the profile view, according to ODOT CADD standards?	Y	
33	Have the locations of the proposed structure foundation elements been shown on the profile view?	Y	
34	Have the offsets from centerline or baseline been indicated above the borings in the profile view?	Y	
35	Have borings located immediately adjacent to the centerline or baseline and considered representative of centerline or baseline subsurface conditions been referenced directly to the centerline or baseline?	X	
36	Have offset borings in or near the same elevation interval of a centerline or baseline boring been plotted either on a cross section or immediately above or below the centerline boring in a box containing an elevation scale?	X	
37	Have cross-sections been developed to show subsurface conditions disclosed by a series of borings drilled transverse to centerline or baseline?	X	

VI.A. Geotechnical Profile Checklist

Subsurface Data		(Y/N/X)	Notes:
38	Have the existing and proposed groundlines been displayed on cross section sheets according to ODOT CADD standards?	Y	
39	Have bedrock exposures shown on the cross sections been plotted along the contour of the cross section?	X	
40	Has the following information been provided adjacent to the graphical logs or bedrock exposure:	Y	
a.	Thickness, to the nearest inch, of sod/topsoil or other shallow surface material written above the boring (with corresponding symbology at top of log)?	Y	
b.	Moisture content, to nearest whole percent, with the bottom of the text aligned with the bottom of the sample? Label this column as 'WC' at bottom of the boring.	Y	
c.	N ₆₀ , aligned with the bottom of sample? Label column as 'N ₆₀ ' at bottom of boring.	Y	
d.	Free water indicated by a horizontal line with a 'w' attached, and water level at the end of drilling indicated by an open equilateral triangle, point down?	Y	
e.	Complete geologic description of each bedrock unit, including unit core loss, unit RQD, SDI, and compressive strength test results? (Do not present geologic descriptions for structure borings for which this information is presented on the boring logs as described in 703.3)	Y	
f.	Visual description of any uncontrolled fill or interval not adequately defined by a graphical symbol?	X	
g.	Organic content with modifiers, per 603.5?	X	
h.	Designate a plastic soil with moisture content equal to or greater than the liquid limit minus three with a 1/8" solid black circle adjacent to the moisture content?	Y	
i.	Designate a non-plastic soil with moisture content exceeding 25% or exceeding 19% but appearing wet initially, with a 1/8" open circle with a horizontal line through it adjacent to the moisture content?	Y	
j.	The reason for discontinuing a boring prior to reaching the planned depth indicated immediately below the boring?	X	

VI.A. Geotechnical Profile Checklist

Boring Logs	(Y/N/X)	Notes:
41 Have the boring logs of all structure borings, all geohazard borings, and any roadway borings drilled in the vicinity of the structures or geohazard been shown on the boring log sheets following the plan and profile sheets? (Create the logs in accordance with 703.3)	Y	
42 Have the boring logs been developed by integrating the driller's field logs, laboratory test data, and visual descriptions?	Y	
43 Has the following boring information been included in the heading of each boring log:	Y	
a. Exploration identification number?	Y	
b. Project designation (C-R-S) and PID?	Y	
c. Structure File Number (if applicable) and project type?	Y	
d. Centerline or baseline name, station, offset, and surface elevation?	Y	
e. Coordinates?	Y	
f. Method of drilling?	Y	
g. Date started and date completed?	Y	
h. Method and material (including quantity) used for backfilling or sealing, including type of instrumentation, if any (reported in the footer)?	Y	
i. Date of last calibration and drill rod energy ratio (ER) in percent for the hammer system(s) used, not to exceed 90%?	Y	
44 Has the following boring information been included in each boring log:	Y	
a. A depth and elevation scale?	Y	
b. Indication of stratum change?	Y	
c. Description of material in each stratum?	Y	
d. Depth of bottom of boring?	Y	
e. Depth of boulders or cobbles, if encountered?	Y	
f. Caving depth?	Y	
g. Water level observations?	Y	
h. Artesian water level and height of rise?	X	
i. Heaving sand?	X	
j. Cavities or other unusual conditions?	X	
k. Depth interval represented by sample?	Y	
l. Sample number and type?	Y	
m. Percent recovery for each sample?	Y	
n. Measured blow counts for each 6 inches of drive for split spoon samples, not to exceed 18 inches total?	Y	
o. N_{60} to the nearest whole number?	Y	

VI.A. Geotechnical Profile Checklist

p. Hand penetrometer?	Y	
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VI.A. Geotechnical Profile Checklist

Boring Logs	(Y/N/X)	Notes:
q. Particle-size analysis?	Y	
r. Liquid limit, plastic limit, plasticity index?	Y	
s. Water content?	Y	
t. ODOT soil classifications, with "V" in parentheses for those samples that are not mechanically classified?	Y	
u. Top of bedrock and bedrock descriptions?	Y	
v. Rock core run percent recovery?	Y	
w. Run RQD?	Y	
x. Unit rock core percent recovery?	Y	
y. Unit RQD?	Y	
z. SDI, if applicable?	Y	
aa. Rock compressive strength test results, if applicable?	Y	

VI.B. Geotechnical Reports

C-R-S:	PIK-CR44-00.16	PID:	115499	Reviewer:		Date:	
General		(Y/N/X)	Notes:				
1	Has an electronic copy of all geotechnical submissions been provided to the District Geotechnical Engineer (DGE)?	N					
2	Has the first complete version of a geotechnical report being submitted been labeled as 'Draft'?	Y					
3	Subsequent to ODOT's review and approval, has the complete version of the revised geotechnical report being submitted been labeled 'Final'?	X					
4	Has the boring data been submitted in a native format that is DIGGS (Data Interchange for Geotechnical and Geoenvironmental) compatible? gINT files meet this demand?	X					
5	Does the report cover format follow ODOT's Brand and Identity Guidelines Report Standards found at http://www.dot.state.oh.us/brand/Pages/default.aspx ?	Y					
6	Have all geotechnical reports being submitted been titled correctly as prescribed in Section 706.1 of the SGE?	Y					
Report Body		(Y/N/X)	Notes:				
7	Do all geotechnical reports being submitted contain the following:	Y					
a.	an Executive Summary as described in Section 706.2 of the SGE?	Y					
b.	an Introduction as described in Section 706.3 of the SGE?	Y					
c.	a section titled "Geology and Observations of the Project," as described in Section 706.4 of the SGE?	Y					
d.	a section titled "Exploration," as described in Section 706.5 of the SGE?	Y					
e.	a section titled "Findings," as described in Section 706.6 of the SGE?	Y					
f.	a section titled "Analyses and Recommendations," as described in Section 706.7 of the SGE?	Y					
Appendices		(Y/N/X)	Notes:				
8	Do all geotechnical reports being submitted contain all applicable Appendices as described in Section 706.8 of the SGE?	Y					
9	Do the Appendices present a site Boring Plan showing all boring locations as described in Section 706.8.1 of the SGE?	Y					

VI.B. Geotechnical Reports

Appendices	(Y/N/X)	Notes:
10 Do the Appendices include boring logs and color pictures of rock, if applicable, as described in Section 706.8.2 of the SGE?	Y	
11 Do the Appendices include reports of undisturbed test data as described in Section 706.8.3 of the SGE?	X	
12 Do the Appendices include calculations in a logical format to support recommendations as described in Section 706.8.4 of the SGE?	Y	

APPENDIX G

SCOUR CALCULATIONS



Critical Shear Stress Analyses for Scour Evaluation

Client:	MS Consultants	Project:	PIK-CR44-00.16 (PID: 115499); Turkey Run Road Bridge over Pee Creek
CTL Project No.:	24050010CIN	Location:	Pebble Township, Pike County, Ohio
Engineer:	C. Carey / D. Batt	Boring/Fnd:	Rear Abutment (B-004-0-24), Pier 1 (B-005-0-24), Pier 2 (B-006-0-24), Forward Abutment (B-007-0-24)
Date:	12/12/2024	Criteria/Details:	Rock Parameters are Est. Values based on Visual Assessment of Rock Core.

Sample Data Input				Soil Data Input						Calculated Findings			
Boring No.	Sample No.	Sample Elevation (ft.)	Soil/Rock Type	Mean Particle Grain Size, D_{50} (mm)	Water Content, w (%)	Fraction of Fine Particles, F (%)	Plasticity Index, PI	Unconfined Compressive Str., q_u (Ksf)	Unconfined Compressive Str., q_u (kPa)	Equivalent Particle Grain Size, D_{50eq} (mm)	Critical Shear Stress, τ_c (Pa)	Critical Shear Stress, τ_c (psf)	Erosion Category, EC
B-004-0-24	SS-11	683.2 - 681.7	A-2-6	2.6184	15	27	18	2.00	95.8	3.4267	3.4267	0.0716	3.6124
B-004-0-24	SS-12	681.7 - 680.2	A-4a	0.5704	13	39	4	2.00	95.8	0.5704	0.5704	0.0119	1.9074
B-004-0-24	SS-13	680.2 - 678.7	A-2-4	3.5212	13	23	8	2.00	95.8	3.5212	3.5212	0.0735	2.8560
B-004-0-24	SS-14	678.7 - 677.2	A-2-4	2.1063	27	31	9	2.00	95.8	2.1063	2.1063	0.0440	2.5882
B-005-0-24	SS-1	675.6 - 675.2	Rock	--	--	--	--	--	--	36.6623	36.6623	0.7659	3.4000
B-005-0-24	NQ2-1	675.1 - 673.1	Rock	--	--	--	--	--	--	6101.9273	6101.9273	127.4693	3.4000
B-006-0-24	SS-3	673.1 - 672.8	Rock	--	--	--	--	--	--	47.9391	47.9391	1.0014	3.4000
B-006-0-24	NQ2-1	671.6 - 667.6	Rock	--	--	--	--	--	--	3747.1964	3747.1964	78.2789	3.4000
B-007-0-24	SS-1	679.3 - 677.8	A-1-b	9.5418	8	17	NP	2.00	95.8	9.5418	9.5418	0.1993	3.3756
B-007-0-24	SS-2	677.8 - 676.3	A-1-b	2.4228	10	25	NP	2.00	95.8	2.4228	2.4228	0.0506	2.6612
B-007-0-24	SS-3	676.3 - 674.8	A-1-b	1.5466	15	32	NP	2.00	95.8	1.5466	1.5466	0.0323	2.4272

Sample Data Input				Rock Data Input									
Boring No.	Sample No.	Sample Elevation (ft.)	Soil/Rock Type	Spacing btwn Horiz. Discont., Sv (mm)	Rock Quality Designation, RQD (%)	Rock Joint Set No., Jn	Joint Roughness No., Jr	Joint Alteration No., Ja	Relative Joint Orientation Parameter, Js	Intact Rock Mass Strength Parameter, Ms	Block Size Parameter, Kb	Shear Strength Parameter, Kd	Erodibility Index, K
B-004-0-24	SS-11	683.2 - 681.7	A-2-6	--	--	--	--	--	--	--	--	--	--
B-004-0-24	SS-12	681.7 - 680.2	A-4a	--	--	--	--	--	--	--	--	--	--
B-004-0-24	SS-13	680.2 - 678.7	A-2-4	--	--	--	--	--	--	--	--	--	--
B-004-0-24	SS-14	678.7 - 677.2	A-2-4	--	--	--	--	--	--	--	--	--	--
B-005-0-24	SS-1	675.6 - 675.2	Rock	25.0	0	2.00	2.00	3.00	0.90	0.35	0.10	0.67	0.02
B-005-0-24	NQ2-1	675.1 - 673.1	Rock	25.0	60	2.00	2.00	2.00	0.90	21.53	30.00	1.00	581.19
B-006-0-24	SS-3	673.1 - 672.8	Rock	25.0	0	2.00	2.00	3.00	0.90	0.60	0.10	0.67	0.04
B-006-0-24	NQ2-1	671.6 - 667.6	Rock	25.0	26	2.00	2.00	2.00	0.90	18.73	13.00	1.00	219.18
B-007-0-24	SS-1	679.3 - 677.8	A-1-b	--	--	--	--	--	--	--	--	--	--
B-007-0-24	SS-2	677.8 - 676.3	A-1-b	--	--	--	--	--	--	--	--	--	--
B-007-0-24	SS-3	676.3 - 674.8	A-1-b	--	--	--	--	--	--	--	--	--	--

Reference: FHWA-HIF-12-003, Hydraulic Engineering Circular 18 (HEC 18), Evaluating Scour at Bridges, 2012
 ODOT GDM Section 1302
 ODOT BDM Section 305.2.1.b

<p>Where D_{50}= Mean Particle Grain Size, mm</p> <p>w= Water content, percent</p> <p>F= Fraction of fine particles ($< 75\mu\text{m}$) by mass, percent</p> <p>PI= Plasticity index, dimensionless</p> <p>q_u= Unconfined compressive strength, psf</p> <p>α= Unit conversion constant, 0.01 in U.S. customary units and 0.1 in S.I.</p> <p>τ_c= Critical shear stress, psf</p> <p>EC= Erosion Category</p> <p>RQD= Rock Quality Designation, percent</p>	<p>S_v= Average Vertical Spacing between Horizontal Discontinuities, mm</p> <p>J_n= Rock Joint Set Number</p> <p>J_r= Joint Roughness Numer</p> <p>J_a= Joint Alteration Number</p> <p>J_s= Relative Orientation Number</p> <p>M_s= Rock Mass Strength Parameter</p> <p>K_b= Block Size Parameter</p> <p>K_d= Shear Strength Parameter</p> <p>K= Erodibility Index</p>
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APPENDIX H

CTL DISPOSITION STAGE 3 PLAN REVIEW





December 9, 2024

MS Consultants
2221 Schrock Road
Columbus, Ohio 43229

Attn: Mr. Sean Jenq, P.E. – Bridge Manager

Subject: **CTL Geotechnical Disposition –
Stage 3 & Compliance R/W Submission
PIK-CR44-0.16, Turkey Run Road
PID No. 115499
CTL Project No. 24050010CIN**

Dear Mr. Jenq:

In response to your request, we are providing CTL Engineering's (CTL) disposition to the geotechnical engineering relayed comments provided by ODOT District 9 in their letter to you dated December 2, 2024.

1. *General Comments:*

- a. *The draft Geotechnical Report was not provided with the submission. Please provide for review ASAP.*

CTL Response: *CTL provided the Roadway Exploration Draft Report dated August 28, 2024. Updated geotechnical drawings (Appendix A) were provided to MS Consultants on October 24, 2024.*

2. *Stage 1 Plans:*

- a. *Sheets 38 – 48 (Geotechnical Profile – Bridge)*
 - i. *Plot sheets the same size as construction plans.*

CTL Response: *CTL will plot the sheets to the size as requested.*

1. *SFE:*

CTL Response: *The ODOT D9 comments are based on the CTL report dated August 28, 2024. The page numbers provided by ODOT refer to the PDF file page.*

- a. *Pp. 14*
 - i. *Provide clarifying sentence of OGE spreadsheet and version number used for the CBR calculation.*

CTL Response: *CTL will provide the information as requested on page 11 of the report under section VI.B Roadway Subgrade Considerations .*

b. Pp. 16

- i. Reference basis for the minimum FS of 1.3 from Section 305.1 of the BDM.

CTL Response: CTL will provide the requested reference for the minimum factor of safety for roadway embankment stability as shown on page 13, Table 7 Results of Global Stability Analyses, of the report. The ODOT Geotechnical Design Manual (GDM), under Section 502 Embankment Stability, provides Table 500-1: Minimum Embankment Factor of Safety for short term undrained condition and the long term drained condition.

c. Pp. 17

- i. Summary of geotechnical scour parameters (used in the hydraulic scour calculations) is provided in the Geotechnical Report and also the Geotechnical Profile Sheet 2 (page 39). The geotech consultant should still show their work for these calculations for both rock and soil analyses, especially for the rock portion, and include as appendix to geotechnical report.

1. This would include interpretation of rock core parameters from rock core photos (such as Jr, Ja, etc.) as basis for the calculation.

CTL Response: CTL will provide the calculations for the geotechnical scour parameters including the interpretation of the rock core parameters used in the scour calculations as shown on page 14, Table 8 Summary of Scour Parameters, of the report. The geotechnical scour parameter calculations will be provided in the report appendix.

If you have any questions or need further information, please feel free to contact our office.

Respectfully Submitted,

CTL ENGINEERING, INC.



Doug R. Batt, P.E.
Project Manager