REVISED DRAFT REPORT
SUBGRADE EXPLORATION REPORT
FRA-071/270-28.27/25.99A
SAFETY AND SYSTEM PRESERVATION
FRANKLIN COUNTY, OHIO
PID#: 105435

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NEAS PROJECT 21-0012

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EXECUTIVE SUMMARY

The Safety and System Preservation project (FRA-071/270-28.27/25.99A) involves increasing the capacity of I-270 Eastbound ramp to I-71 Northbound by adding a ramp lane in the City of Columbus, Franklin County, Ohio. The referenced project also includes replacement of two bridges and concrete bridge deck of ramp bridge, and resurfacing of the existing pavement within the project limits along I-270 Eastbound and I-71 Northbound.

National Engineering & Architectural Services, Inc. (NEAS) has been contracted to perform geotechnical engineering services for the project. The purpose of the geotechnical engineering services was to perform geotechnical explorations within the project limits to obtain information concerning the subsurface soil and groundwater conditions relevant to the design and construction of the project. Between April 9, 2021 and April 20, 2021, NEAS performed the site reconnaissance and exploration program for the project. The project included 27 borings drilled to a depth of 7.5 ft below ground surface (bgs) and 7 pavement cores for subgrade characterization purposes.

The subgrade conditions in the project area are relatively consistent and are generally comprised of cohesive natural overburden soils (A-4a, A-6a, A-6b, and A-7-6) and non-cohesive overburden soils (A-1-a, A-1-b, A-2-4). With respect to sulfate within the subgrade soil, based on the project laboratory testing program, two soil samples present a sulfate content value greater than 5,000 ppm within all of the project borings performed. Groundwater was not encountered during drilling and after drilling in all the project borings performed. Bedrock was not encountered in all the project borings within the subgrade depth.

Based on our evaluation of the subsurface conditions and our geotechnical engineering analyses of the proposed intersection improvement project, it is our opinion that subgrade conditions are generally satisfactory, and pavement can be designed without the need for extreme levels of remediation. Unstable subgrade conditions, including areas of weak soils and high moisture content soils, were encountered throughout 22 percent of the proposed pavement widening area along I-270 EB ramp to I-71 NB. Therefore, NEAS recommends spot stabilization be performed on the unstable subgrade which is identified by performing Item 204 Proof Rolling for the entire project. Spot stabilization should be in the form of Excavate and Replace (Item 204 with Geotextile). Excavations are estimated to extend to the depth of 12 inches, with the excavated material being replaced with material in accordance with Section F "Excavate and Replace (Item 204)" of the ODOT GB1. Stabilization limits should extend 18-inches beyond the edge of the proposed paved roadway, shoulder or median and it is recommended removing any topsoil, existing pavement materials or abandoned structure foundation materials.

High sulfate content soils were encountered at the project site. Three soil samples in Borings B-008-0-21, B-014-0-21 and B-016-0-21 present a sulfate content greater than 3,000 ppm, however, less than 5,000 ppm. Two soil samples in Borings B-009-0-21 and B-010-0-21 present a sulfate content greater than 5,000 ppm. NEAS will discuss our recommendations with the District Geotechnical Engineer.

Overall, NEAS's opinion is that the subgrade soils will provide adequate pavement support, assuming the pavement is designed and constructed in accordance with the recommendations provided within this report, as well as all applicable ODOT standards and specifications

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

1.1. General

National Engineering & Architectural Services, Inc. (NEAS) presents our Subgrade Exploration Report for the proposed FRA-071/270-28.27/25.99A Safety and System Preservation project, Franklin County, Ohio. The Safety and System Preservation project involves increasing the capacity of I-270 Eastbound (EB) ramp to I-71 Northbound (NB) by adding a ramp lane in addition to replacement of two bridges and concrete bridge deck of ramp bridge. Additionally, the project includes resurfacing of the existing pavement within the project limits along I-270 EB and I-71 NB.

This report presents a summary of the project encountered surficial and subsurface conditions and our recommendations for subgrade stabilization and pavement design parameters for I-270, I-71 and the corresponding ramps. The analysis performed as part of this report has been performed in accordance with ODOT's January 2019 revision of *Geotechnical Bulletin 1* (GB1) (ODOT [1], 2019) and *Pavement Design Manual* (PDM) (ODOT, 2020).

The exploration was conducted in general accordance with NEAS's proposal to TranSystems, dated January 8, 2021, and ODOT's January 2020 revision of *Specifications for Geotechnical Explorations* (SGE) (ODOT, 2020).

The scope of work performed by NEAS as part of the referenced project included: a review of published geotechnical information; performing 27 total test borings (all of which were utilized within this report as part of the subgrade exploration) and 7 pavement cores; laboratory testing of soil samples in accordance with the SGE; performing geotechnical engineering analysis to assess subgrade stabilization requirements and recommended pavement design parameters; and development of this summary report.

2. GEOLOGY AND OBSERVATIONS OF THE PROJECT

2.1. Geology and Physiography

The project site is located within the Columbus Lowland Till Plains, a subdivision of the Southern Ohio Loamy Till Plain. This is a moderately low relief (25 ft) lowland surrounded in all directions by relative uplands, having a broad regional slope toward the Scioto Valley, containing many larger streams. Elevations of the region range from 600 to 850 ft above mean sea level (amsl) (950 ft amsl near Powell Moraine). The geology within this region is described as Wisconsinan-age till that is high lime in the west to medium-lime in the east. The geology is also described as containing extensive outwash in Scioto Valley overlying deep Devonian- to Mississippian-age carbonate rocks, shales and siltstones (ODGS, 1998).

Based on the Bedrock Geologic Units Map of Ohio (USGS & ODGS, 2005), bedrock within the project limits is comprised of Devonian-age Ohio Shale. The Devonian-age Ohio Shale is about 359 to 385 million years old, and the sedimentary rocks mainly consist of shale and siltstone with some sandstone. The shale unit at the project site is brownish black to greenish gray, weathers brown, carbonaceous to clayey, laminated to thin bedded, and is fissile parting. This unit is carbonated and/or siderite concretions in lowermost 50 feet, with petroliferous odor and about 250 to 500+ feet thick. Based on the ODNR bedrock topography map of Ohio, bedrock elevations at the project site can be expected to range from 800 to 850 ft amsl, putting bedrock at a depth of 65 to 110 ft below ground surface (bgs).

The soils at the project site have been mapped (Web Soil Survey) by the Natural Resources Conservation Service as being gently rolling Udorthents-Urban land complex (USDA, 2015). The units of the Udorthents-Urban series account for 90% soils with none flood. The units can be classified as A-1-a, A-1-b, A-2-4, A-4a, A-6a, A-6b and A-7-6 soils according to the AASHTO method of soil classification.

2.2. Hydrology/Hydrogeology

Groundwater can be expected at an elevation consistent with that of the major local surface water bodies. A major regional hydraulic influence is the Alum Creek located about 2.0 miles to the east. The Water wells near the project site were noted to have a static water from 23 ft to 95 ft below ground surface.

Local variations in the groundwater table may exist in one of two reasons. First, if there has been extensive groundwater abstraction, water levels may be depressed by tens of feet over significantly large areas. Second, the presence of discontinuous bodies of glacial till provides the opportunity for localized pockets of perched groundwater to form.

The proposed project site is not located within a 0.2% and 1% Annual Chance Flood Hazard area based on available mapping by the Federal Emergency Management Agency's (FEMA) National Flood Hazard mapping program (FEMA, 2019).

2.3. Mining and Oil/Gas Production

No abandoned mines were noted on ODNR's Abandoned Underground Mine Locator immediately adjacent to the project's boundaries (ODNR [1], 2016).

No gas or oil wells were noted on ODNR's Ohio Oil & Gas Locator within the immediate vicinity of the project's boundaries (ODNR [2], 2016).

2.4. Historical Records and Previous Phases of Project Exploration

A historic record search was performed through ODOT's Transportation Information Management System (TIMS). Several historic projects were available for review within the limits of the FRA-071/270-28.27/25.99A project.

- FRA-270-24.47, Reconstruction and Widening, 2006
- FRA-270-15.50N, Project No. 011502,1963
- FRA-270-16.65N, Project No. 011503,1964

2.5. Field Reconnaissance

A field reconnaissance visit for the overall project area was conducted on April 9, 2021, inside the project limits. Site conditions, including the existing land conditions and pavement conditions, were noted, and photographed during the visit. Photographs of notable features and a summary of our observations by road segment are provided below.

2.5.1. Land Use and Cover

The land use of most of the project area consists of ODOT ROW (Right of Way), commercial properties (i.e., single family homes, apartments, etc.) and woodland.

2.5.2. IR-270 and Ramp from IR-270 WB to IR-71 NB

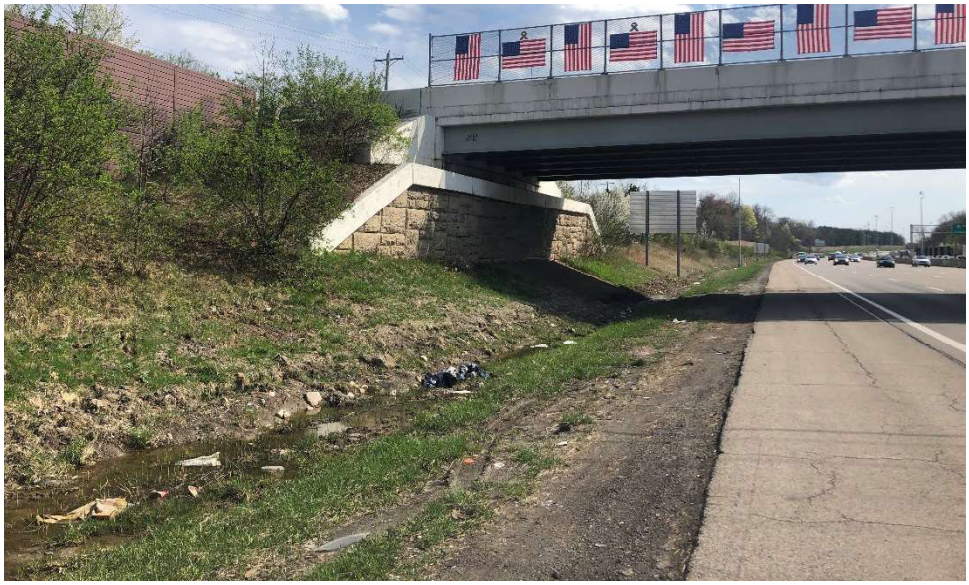
In general, the pavement condition along the exit ramp was observed to be good with signs of surface wear. The travel lanes were noted to be in markedly better condition than the shoulders along this section of roadway. Moderate severity longitudinal and transverse cracking was observed along this section as well as crack sealing deficiencies (Photograph 1). The roadway in this section sits atop a small embankment running from level with IR-270 up to the level of the ramp bridge. The embankment slopes are roughly 3H:1V (3 horizontal to one vertical). The roadway is relatively level in this section. The roadway drains to drainage ditches at the bottom of each side of the embankment (Photograph 2). The area is lightly vegetated for the most part with some signs of standing water were observed in the drainage ditches such as heavy vegetation and cattails (Photograph 3). The area appeared to be stable with no signs of geotechnical instability.

Photograph 1: Overall Pavement Condition of Exit Ramp

Photograph 2: Signs of Standing Water in Drainage Ditch

In general, the pavement condition along this section of the project was observed to be good with signs of surface wear. The travel lanes were noted to be in markedly better condition than the shoulders along this section of roadway. Moderate severity longitudinal and transverse cracking was observed along this section as well as crack sealing deficiencies (Photograph 3). The roadway in this section sits in a cut with embankment slopes rising up on either side of the highway to the level of the surrounding land. The embankment slopes are roughly 2H:1V (2 horizontal to one vertical). The roadway is relatively level in this section. The roadway drains to drainage ditches at the bottom of each side of the embankment (Photograph 4). The area is lightly vegetated for the most part with some signs of standing water were observed in the drainage ditches. The area appeared to be stable with no signs of geotechnical instability.

Photograph 3: Overall Pavement Condition of IR-71 NB



The existing bridge carrying the ramp from IR-270 EB to IR-71 NB consists of a five-span, multi-beam bridge with stub type abutments and cap and column type piers (Photograph 5). In the area of the referenced bridge, the terrain is roughly level with the surrounding area which rises very gently from north to south. Signs of instability were not observed during our site visit. The overall bridge structure appeared to be in good condition with few signs of distress observed. The spill-through slopes appeared to be at roughly 2H:1V (2 horizontal to one vertical) slopes and in good condition and protected from

erosion by rip rap. No apparent signs of distress due to geotechnical concerns were noted during our field reconnaissance visit.

The bridge deck and concrete wearing course was observed to be in good condition with minor severity pop-outs being common (Photograph 6). With respect to drainage, the bridge deck and adjacent pavement appeared to be well drained, with no signs of ponding or drainage issues observed during our field visit. The adjacent ramp appeared to drain to drainage ditches that runs parallel to the roadway. The bridge deck drained off of the north side of the bridge at either end of the bridge where the concrete guard rail terminates.

Photograph 5: Cap and Column Bridge Piers

Photograph 6: Bridge Deck Wearing Course

3. GEOTECHNICAL EXPLORATION

3.1. Roadway Exploration Program

The subsurface exploration for the project was conducted by NEAS between April 14, 2021 and April 20, 2021 and included 27 borings drilled to a depth 7.5 ft bgs. The boring locations were selected by NEAS in general accordance with the guidelines contained in the SGE with the intent to evaluate subsurface soil and groundwater conditions. Borings were typically located either within existing pavement areas that are planned to undergo full-depth replacement or within areas where widening is planned. Target boring locations were located in the field by NEAS prior to drilling utilizing handheld GPS equipment and the boring locations were drilled in areas that were not restricted by underground utilities or dictated by terrain (i.e. steep embankment slopes). Each as-drilled project boring location and corresponding ground surface elevation was surveyed in the field following drilling. Each individual project boring log (included within Appendix B) includes the recorded boring latitude and longitude location (based on the surveyed Ohio State Plane South, NAD83, location) and the corresponding ground surface elevation, as summarized in Table 1.

Table 1: Project Boring Summary

Boring Number	Latitude	Longitude	Elevation (NAVD 88) (ft)	Alignment	Station	Offset	Depth (ft)	Substructure
B-001-0-21	40.110037	-82.977651	913.0	I-71	130+13	34' RT.	7.5	Subgrade
B-002-0-21	40.111052	-82.976900	914.1	I-71	134+39	49' RT.	7.5	Subgrade
B-003-0-21	40.112010	-82.976279	913.7	I-71	138+27	46' RT.	7.5	Subgrade
B-004-0-21	40.112998	-82.975669	911.1	I-71	142+24	49' RT.	7.5	Subgrade
B-005-0-21	40.113975	-82.975211	908.2	I-71	146+00	27' RT.	7.5	Subgrade
B-006-0-21	40.115133	-82.974503	903.0	I-71	150+64	59' RT.	7.5	Subgrade
B-007-0-21	40.116108	-82.974071	899.4	I-71	154+37	56' RT.	7.5	Subgrade
B-008-0-21	40.117174	-82.973656	895.2	I-71	158+41	50' RT.	7.5	Subgrade
B-009-0-21	40.118246	-82.973248	891.0	I-71	162+45	56' RT.	7.5	Subgrade
B-010-0-21	40.119281	-82.972942	887.8	I-71	166+31	50' RT.	7.5	Subgrade
B-011-0-21	40.120386	-82.972642	885.9	I-71	170+40	49' RT.	7.5	Subgrade
B-012-0-21	40.121451	-82.972399	886.8	I-71	174+32	49' RT.	7.5	Subgrade
B-013-0-21	40.122537	-82.972200	889.2	I-71	178+31	48' RT.	7.5	Subgrade
B-014-0-21	40.123658	-82.972045	891.6	I-71	182+40	46' RT.	7.5	Subgrade
B-015-0-21	40.124754	-82.971942	894.1	I-71	186+38	45' RT.	7.5	Subgrade
B-016-0-21	40.125854	-82.971865	896.6	I-71	190+40	44' RT.	7.5	Subgrade
B-017-0-21	40.126945	-82.971739	898.8	I-71	194+38	56' RT.	7.5	Subgrade
B-018-0-21	40.110560	-82.989002	921.6	Ramp M	84+55	17' RT.	7.5	Subgrade
B-019-0-21	40.110619	-82.987640	920.4	Ramp M	88+34	26' LT	7.5	Subgrade
B-020-0-21	40.110342	-82.986326	917.4	Ramp M	92+14	25' RT.	7.5	Subgrade
B-021-0-21	40.109798	-82.985064	918.6	Ramp M	96+33	44' RT.	7.5	Subgrade
B-022-0-21	40.109199	-82.984109	920.6	Ramp M	99+81	43' RT.	7.5	Subgrade
B-023-0-21	40.108675	-82.982948	923.6	Ramp M	103+52	22' LT	7.5	Subgrade
B-024-0-21	40.107974	-82.981926	925.6	Ramp M	107+35	10' LT	7.5	Subgrade
B-025-0-21	40.107701	-82.980661	935.5	Ramp P	1010+99	0' LT	7.5	Subgrade
B-026-0-21	40.108377	-82.978429	928.1	Ramp P	1018+06	17' LT	7.5	Subgrade
B-027-0-21	40.109351	-82.977947	913.7	Ramp P	1022+01	52' LT	7.5	Subgrade

Borings were drilled using a CME 45B truck-mounted or track-mounted drilling rig utilizing 3.25-inch (inner diameter) hollow stem augers. Soil samples for subgrade borings were typically recovered

continuously to a depth of 7.5 ft bgs, each using an 18-inch split spoon sampler (AASHTO T-206 "Standard Method for Penetration Test and Split Barrel Sampling of Soils."). The soil samples obtained from the exploration program were visually observed in the field by the NEAS field representative and preserved for review by a Geologist for possible laboratory testing. Standard penetration tests (SPT) were conducted using CME auto hammer that has been calibrated to be 81.7% efficient (depending on the specific rig used and the calibration date of the hammer) as indicated on the boring logs (Appendix B).

Field boring logs were prepared by drilling personnel and included pavement description (where present), lithological description, SPT results recorded as blows per 6-inch increment of penetration and estimated unconfined shear strength values on specimens exhibiting cohesion (using a hand-penetrometer). Groundwater level observations were recorded both during and after the completion of drilling. These groundwater level observations are included on the individual boring logs (provided in Appendix B). After completing the borings, the boreholes were backfilled with either auger cuttings, bentonite chips, or a combination of these materials and patched accordingly with the cold patch asphalt and/or cement when drilling through the roadway.

3.2. Pavement Coring Exploration Program

The pavement coring investigation program for the project was conducted by NEAS concurrently with the subgrade exploration on April 21, 2021 and included a total of seven (7) pavement cores. As described in Section 3.1. of this report, the indicated target boring locations were located in the field by NEAS prior to drilling utilizing handheld GPS equipment in areas that were not restricted by maintenance of traffic efforts or utilities. Measurements, location information, photographs and other details of each core sample can be found in the Pavement Core Logs included within Appendix B, and are summarized in Table 2 below. The approximate location for each core is depicted on the Boring Location Plan provided in Appendix A.

Cores were drilled using a portable, truck-mounted, electric powered coring drill with a 4-inch (outer diameter) diamond tipped drill bit and utilizing water as the circulating fluid. Asphalt and concrete thicknesses were measured in the field after the cores were extracted and down-hole measurements were made. Each core sample was then photographed, logged, and placed in a core box for transportation to NEAS's laboratory. Following field documentation, photographs and borehole completion, the core hole was backfilled to existing grade with either asphalt patch or quick-set concrete (where appropriate). Once in the laboratory the cores were: 1) re-measured for thickness verification and photographed; 2) checked for composition; and, 3) reviewed for individual layer identification and subsequent measurements.

Table 2: Pavement Core Summary

Pavement Core Number	Latitude	Longitude	Elevation (NAVD 88) (ft)	Alignment	Station	Offset	Length (in)
X-001-0-21	40.107653	-82.979486	912.3	Ramp P	1014+17	46' RT.	18.75
X-002-0-21	40.113628	-82.975595	909.1	I-71	144+42	23' LT.	16.75
X-003-0-21	40.120010	-82.973021	886.2	I-71	168+85	28' LT.	16.50
X-004-0-21	40.125285	-82.972180	895.0	I-71	188+28	33' LT.	17.00
X-005-0-21	40.111052	-82.976900	914.1	I-71	134+39	49' RT.	16.50
X-006-0-21	40.118246	-82.973248	891.0	I-71	162+45	56' RT.	18.00
X-007-0-21	40.125854	-82.971865	896.6	I-71	190+40	44' RT.	14.75

3.3. Laboratory Testing Program

The laboratory testing program consisted of classification testing, moisture content determinations and sulfate content testing. Data from the laboratory testing program were incorporated onto the boring logs (Appendix B). Soil samples are retained at the laboratory for 60 days following report submittal, after which time they will be discarded.

3.3.1. Classification Testing

Representative soil samples were selected for index property (Atterberg Limits) and gradation testing for classification purposes on approximately 50% of the samples. At each boring location, the upper two samples obtained below the proposed top of subgrade elevation were generally tested while additional samples were selected for testing with the intent of properly classifying the subsurface soil and groundwater conditions within the planned project limits. Soils not selected for testing were compared to laboratory tested samples/strata and classified visually. Moisture content testing was conducted on all samples. The laboratory testing was performed in general accordance with applicable AASHTO specifications and ODOT Supplements.

Final classification of soil strata in accordance with AASHTO M-145 "Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes," as modified by ODOT "Classification of Soils" was made once laboratory test results became available. The results of the soil classification are presented on the boring logs in Appendix B.

3.3.2. Standard Penetration Test Results

Standard Penetration Tests (SPT) and split-barrel (commonly known as split-spoon) sampling of soils were performed continuously in the project borings performed. To account for the high efficiency (automatic) hammers used during SPT sampling, field SPT N-values were converted based on the calibrated efficiency (energy ratio) of the specific drill rig's hammer. Field N-values were converted to an equivalent rod energy of 60% (N_{60}) for use in analysis or for correlation purposes. The resulting N_{60} values are shown on the boring logs provided in Appendix B.

3.3.3. Sulfate Testing

Sulfate testing was generally performed on one sample for each subgrade or roadway boring performed for pavement/subgrade design purposes. The selected samples were tested in accordance with ODOT Supplement 1122, "Determining Sulfate Content in Soils" dated July 17, 2015. In general, the upper most sample (within 3 ft of the proposed subgrade elevation) from each boring was tested when feasible. Testing results are summarized in ODOT Sulfate Supplement 1122 Table within Appendix C.

4. FINDINGS

The subsurface conditions encountered during NEAS's explorations are described in the following subsections and/or on each boring log presented in Appendix B. The boring logs represent NEAS's interpretation of the subsurface conditions encountered at each boring location based on our site observations, field logs, visual review of the soil samples by NEAS's geologist, and laboratory test results. The lines designating the interfaces between various soil strata on the boring logs represent the approximate interface location; the actual transition between strata may be gradual and indistinct. The subsurface soil and groundwater characterizations included herein, including summary test data, are based

on the subsurface findings from the geotechnical explorations performed by NEAS as part of the referenced project. At the time of the composition of this report, pavement grade information has been assumed to be consistent with project profile basemap provided by TranSystems dated July 12, 2021. It should be noted that for the purposes of this report and our analysis the term 'subgrade' has been assumed to represent soils and/or soil conditions from 1.5 ft below proposed final pavement grades to a depth of 7.5 ft below the proposed pavement grades.

4.1. Existing Pavement

The pavement section thickness in terms of asphalt, concrete, and granular base was measured at representative subgrade borings and pavement cores. Pavement section thicknesses were measured during the subsurface exploration and are recorded on the test boring log and pavement core provided in Appendix B. A summary of these measurements is provided in Table 3 and 4 below.

Table 3: Measured Pavement Thicknesses Based on Subgrade Borings

Boring ID	Alignment	Asphalt Thickness (in)	Concrete Thickness (in)	Base thickness (in)	Total thickness (in)
B-001-0-21	I-71	17.0	-	7.0	24.0
B-002-0-21	I-71	16.0	-	8.0	24.0
B-003-0-21	I-71	16.0	-	8.0	24.0
B-004-0-21	I-71	17.0	-	7.0	24.0
B-005-0-21	I-71	17.0	-	7.0	24.0
B-006-0-21	I-71	19.0	-	7.0	26.0
B-007-0-21	I-71	17.0	-	7.0	24.0
B-008-0-21	I-71	16.0	-	7.0	23.0
B-009-0-21	I-71	18.0	-	7.0	25.0
B-010-0-21	I-71	18.0	-	7.0	25.0
B-011-0-21	I-71	18.0	-	18.0	36.0
B-012-0-21	I-71	18.0	-	6.0	24.0
B-013-0-21	I-71	15.0	-	7.0	22.0
B-014-0-21	I-71	14.0	-	6.0	20.0
B-015-0-21	I-71	15.0	-	7.0	22.0
B-016-0-21	I-71	15.0	-	6.0	21.0
B-017-0-21	I-71	14.5	-	6.0	20.5
B-018-0-21	Ramp M	17.0	-	6.0	23.0
B-019-0-21	Ramp M	16.0	-	7.0	23.0
B-020-0-21	Ramp M	16.0	-	6.0	22.0
B-021-0-21	Ramp M	18.0	-	6.0	24.0
B-022-0-21	Ramp M	18.0	-	7.0	25.0
B-023-0-21	Ramp M	18.0	-	5.0	23.0
B-024-0-21	Ramp M	18.0	-	7.0	25.0
B-025-0-21	Ramp P	17.0	-	8.0	25.0
B-026-0-21	Ramp P	16.0	-	9.0	25.0
B-027-0-21	Ramp P	16.0	-	8.0	24.0

Table 4: Measured Pavement Thicknesses Based on Pavement Cores

Core ID	Proposed Alignment	Top Layer Asphalt Thickness (in)	Second Layer Asphalt Thickness (in)	Third Layer Asphalt Thickness (in)	Fourth Layer Asphalt Thickness (in)	Total Asphalt Thickness (in)
X-001-0-21	Ramp P	10.00	8.75	-	-	18.75
X-002-0-21	I-71	3.50	3.00	10.25	-	16.75
X-003-0-21	I-71	1.50	15.00	-	-	16.50
X-004-0-21	I-71	3.50	5.00	8.50	-	17.00
X-005-0-21	I-71	1.50	15.00	-	-	16.50
X-006-0-21	I-71	2.00	3.25	4.25	8.50	18.00
X-007-0-21	I-71	3.50	4.50	6.75	-	14.75

4.2. Subgrade Conditions

The subgrade conditions in the project area are relatively consistent and are generally comprised of cohesive natural overburden soils (A-4a, A-6a, A-6b, and A-7-6) and non-cohesive overburden soils (A-1-a, A-1-b, A-2-4). With respect to sulfate within the subgrade soil, based on the project laboratory testing program, two soil samples present a sulfate content value larger than 5,000 ppm within all the project borings performed.

The following subsections present a brief summary of the subsurface conditions by ramp/roadway segment with problem areas highlighted where present.

4.2.1. I-71

The subgrade soils encountered along I-71 consisted of 81% cohesive materials and 19% granular materials. Those cohesive materials are: 1) Sandy Silt (A-4a, 50%); 2) Silt and Clay (A-6a, 24% of samples); 3) Silty Clay (A-6b, 4% of samples); and 4) Clay (A-7-6, 3% of samples). With respect to the consistency of the fine-grained soils, the descriptions varied from stiff to hard correlating to N_{60} values between 5 and 41 bpf. Natural moisture contents ranged from 5 to 28 percent. Based on Atterberg Limit tests performed on representative samples of the fine-grained subgrade soils obtained within these pavement widening limits, the liquid and plastic limits ranged from 22 to 39 percent and from 14 to 25 percent, respectively.

Nineteen percent (19%) of the samples taken along the I-71 were classified as non-cohesive soils and were comprised of: 1) Gravel and Stone Fragments with Sand (A-1-b, 13% of samples); 2) Stone Fragments (A-1-a, 4% of samples); and 3) Stone Fragments with Sand and Silt (A-2-4, 3% of samples). With respect to the relative compactness of the coarse-grained soils, the descriptions varied from loose to very dense correlating to converted SPT-N values (N_{60}) values between 7 and 109 blows per foot (bpf). Natural moisture content ranged from 4 to 24 percent.

4.2.2. Ramp M

The subgrade soils encountered along Ramp M consisted of 89% cohesive materials and 11% granular materials. Those cohesive materials are: 1) Silt and Clay (A-6a, 36% of samples); 2) Silty Clay (A-6b, 29% of samples); 3) Clay (A-7-6, 11% of samples) and 4) Sandy Silt (A-4a, 14%). With respect to the consistency of the fine-grained soils, the descriptions varied from stiff to hard correlating to N_{60} values between 10 and 34 bpf. Natural moisture contents ranged from 9 to 27 percent. Based on Atterberg Limit tests performed on representative samples of the fine-grained subgrade soils obtained within these

pavement widening limits, the liquid and plastic limits ranged from 25 to 50 percent and from 16 to 22 percent, respectively.

Twelve percent (11%) of the samples taken along Ramp M were classified as non-cohesive soils and were comprised of: 1) Gravel and Stone Fragments with Sand (A-1-b, 7% of samples); and 2) Stone Fragments (A-1-a, 4% of samples). With respect to the relative compactness of the coarse-grained soils, the descriptions varied from loose to medium dense correlating to converted SPT-N values (N_{60}) values between 10 and 16 blows per foot (bpf). Natural moisture content ranged from 6 to 11 percent.

4.2.1. Ramp P

The subgrade soils encountered along Ramp P consisted of 85% cohesive materials and 15% granular materials. Those cohesive materials are: 1) Sandy Silt (A-4a, 26%); 2) Silt and Clay (A-6a, 30% of samples); and 3) Silty Clay (A-6b, 30% of samples). With respect to the consistency of the fine-grained soils, the descriptions varied from stiff to hard correlating to N_{60} values between 5 and 35 bpf. Natural moisture contents ranged from 10 to 19 percent. Based on Atterberg Limit tests performed on representative samples of the fine-grained subgrade soils obtained within these pavement widening limits, the liquid and plastic limits ranged from 24 to 39 percent and from 15 to 20 percent, respectively.

Six percent (15%) of the samples taken along Ramp P were classified as non-cohesive soils and were comprised of: 1) Stone Fragments with Sand and Silt (A-2-4, 4% of samples); 2) Gravel and Stone Fragments with Sand (A-1-b, 7% of samples); and 3) Stone Fragments (A-1-a, 4% of samples). With respect to the relative compactness of the coarse-grained soils, the description was loose correlating to converted SPT-N values (N_{60}) value between 7 and 16 blows per foot (bpf).. Natural moisture content ranged from 6 to 11 percent.

4.2.2. Groundwater

Groundwater was not encountered during drilling and after drilling in all the project borings performed as part of the referenced project. It should be noted that groundwater is affected by many hydrologic characteristics in the area and may vary from those measured at the time of the exploration.

4.2.3. Bedrock

Bedrock was not encountered in all the project borings within the subgrade depth.

5. ANALYSES AND RECOMMENDATIONS

We understand that the project FRA-071/270-28.27/25.99A consists of adding a ramp lane along I-270 EB to I-71 NB ramp in addition to replacement of two bridges and concrete bridge deck of ramp bridge. Additionally, the project includes resurfacing of the existing pavement within the project limits along I-270 EB and I-71 NB. For this purpose, a roadway exploration and subsequent analysis was completed for the referenced project. The analysis completed for the proposed project included a subgrade (GB1) analysis. The subgrade analysis was performed in accordance with ODOT's GB1 criteria utilizing the ODOT provided *GB1: Subgrade Analysis Spreadsheet* (GB1_SubgradeAnalysis.xls, Version 14.5 dated January 18, 2019). Input information for the spreadsheet was based on the soil characteristics gathered during NEAS's subgrade exploration (i.e., SPT results, laboratory test results, etc.). A GB1 analysis was performed for each of the referenced pavement widening areas individually.

Based on our evaluation of the subsurface conditions and our geotechnical engineering analyses of the proposed project, it is our opinion that the subgrade conditions encountered are generally satisfactory and pavement can be designed without the need for extreme levels of remediation, especially with the use of global stabilization per the GB1. In general, the subgrade soils throughout the project will be globally stabilized by either Excavate and Replace (Item 204 with Geotextile) or chemical stabilization. The following sections provide further detail about the analysis performed and the recommended remediation.

5.1. Subgrade Analysis

A GB1 analysis was performed to identify the method, location, and dimensions (including depth) of required subgrade stabilization for the project. In addition to identifying stabilization recommendations, pavement design parameters are also determined to aid in pavement section design. The subsections below present the results of our GB1 analysis including pavement design parameters and unsuitable and/or unstable subgrade conditions if any are identified within the project limits. A GB1 analysis spreadsheet is provided in Appendix C.

5.1.1. Pavement Design Recommendations

A GB1 analysis was performed using the subgrade soil data obtained during our field exploration program to evaluate the soil characteristics and develop pavement parameters for use in pavement design. The subgrade analysis parameters recommended for use in pavement design are presented in Table 5 below. Provided in the table are ranges of maximum, minimum and average N_{60L} values for the indicated segments as well as the design CBR value recommended for use in pavement design.

Table 5: Pavement Design Values

Section	Maximum N_{60L}	Minimum N_{60L}	Average N_{60L}	Average PI Values	Design CBR
Entire Project	25	5	15	11	7
I-71	25	7	16	10	7
Ramp M	22	10	14	14	6
Ramp P	22	5	12	14	7

5.1.2. Unsuitable Subgrade

Per ODOT's GB1, the presence of select subgrade conditions (i.e., unsuitable) are prohibited within the subgrade zone for new pavement construction. These unsuitable subgrade conditions generally include the presence of rock and specific soil types. With respect to the planned roadways, these subgrade conditions are further discussed in the following subsections.

5.1.2.1. Rock

Rock was not encountered in any of the borings performed within the project roadway limits.

5.1.2.2. Prohibited Soils

Unsuitable soil types per the GB1, which include A-4b, A-2-5, A-5, A-7-5, A-8a, A-8b, and soils with liquid limits greater than 65, were not encountered within the subgrade of the referenced project roadway segments.

5.1.3. Unstable Subgrade

The unstable subgrade conditions generally include the presence of weak soil conditions and overly moist soil conditions. With respect to the planned roadway sections, these subgrade conditions are further discussed in the following subsections.

5.1.3.1. Weak Soils

Soils for which the lowest N_{60} (N_{60L}) at the referenced boring location is less than 12 bpf and in some cases less than 15 bpf (i.e., where moisture content is greater than optimum plus 3 percent), or in which the lowest HP reading at the referenced boring location is less than 1.5 and, in some cases, less than 1.875 (i.e., where moisture content is greater than optimum plus 3 percent), subgrade stabilization depths are recommended per *Figure B - Subgrade Stabilization* within the GB1.

It should be noted that for the purposes of this report the term "weak soils" has been assumed to represent subgrade soils of these conditions. A summary of the boring locations where unstable soils were encountered and determined to have a potential impact on subgrade performance are shown in Table 6 below, per the roadway segment for which they were encountered. Also included is the associated GB1 recommended remediation depth with the method of either excavation and replacement or chemical treatment within the project limits.

Table 6: Unstable Soil Locations Summary

Boring ID	N_{60L}	Subgrade Depth (ft)	Remediation Depth (inches)		
			Excavate and Replace (Item 204 w/ Geotextile)	Excavate and Replace (Item 204 w/ Geogrid - SS 861)	Chemical Stabilization (Item 206)
I-71					
B-002-0-21	11	3.9 - 5.4	12	N/A	12
B-007-0-21	10	2.4 - 5.4	12	N/A	14
B-012-0-21	14	3.9 - 5.4	12	N/A	12
B-013-0-21	12	3.9 - 5.4	12	N/A	12
B-015-0-21	11	2.4 - 5.4	12	N/A	12
B-027-0-21	7	(-)0.6 - 0.9	15	N/A	14
Ramp M					
B-018-0-21	10	3.0 - 6.0	12	N/A	14
B-020-0-21	10	2.6 - 5.6	12	N/A	14
B-022-0-21	10	2.5 - 5.5	12	N/A	14
Ramp P					
B-022-0-21	10	2.9 - 5.9	12	N/A	14
B-025-0-21	5	0.6 - 5.1	21	15	14
B-026-0-21	5	(-)0.6 - 5.4	21	15	14
B-027-0-21	7	(-)0.2 - 1.3	15	N/A	14
Note: N/A, Not Applicable based on GB1- Figure B - Subgrade Stabilization					

It should be noted that *Figure B - Subgrade Stabilization* does not apply to soil types A-1-a, A-1-b, A-3, or A-3a, nor to soils with N_{60L} values of 15 or more. Per GB1 guidance, *these soils should be reworked to stabilize the subgrade.*

5.1.3.2. High Moisture Content Soils

High moisture content soils are defined by the GB1 as soils that exceed the estimated optimum moisture content (per *Figure A - Optimum Moisture Content* within the GB1) for a given classification by 3 percent or more. Per the GB1, soils determined to be above the identified moisture content levels are a likely indication of the presence of an unstable subgrade and may require some form of subgrade stabilization. High moisture content soils were encountered along I-71 NB and I-270 EB within 3 ft of proposed finished grade of roadway segment. Therefore, remediation is needed for the high moisture content soils encountered at these roadway alignments. Summaries of the boring locations where high moisture content conditions were encountered within the limits of each proposed alignment are shown in Table 7 below.

Table 7: High Moisture Content Soils Location Summary

Boring ID	High MC Soil Type	Moisture Content (%)	Optimum Moisture Content (%)	Subgrade Depth (ft)
I-71				
B-001-0-21	A-6b	21	16	0.9 - 2.4
B-003-0-21	A-1-a	9	6	(-)0.6 - 0.9
B-004-0-21	A-1-b	9	6	(-)0.6 - 0.9
	A-6a	17	14	0.9 - 2.4
B-012-0-21	A-1-b	10	6	(-)0.6 - 0.9
B-013-0-21	A-1-b	24	6	(-)0.6 - 0.9
B-014-0-21	A-4a	13	10	0.9 - 2.4
B-015-0-21	A-1-b	12	6	(-)0.6 - 0.9
B-016-0-21	A-4a	14	6	(-)0.6 - 0.9
Ramp M				
B-018-0-21	A-7-6	25	19	1.5 - 3.0
Ramp P				
B-025-0-21	A-4a	13	10	0.6 - 2.1
B-026-0-21	A-6a	17	14	(-)0.6 - 0.9
		19	14	0.9 - 2.4

5.1.4. High Sulfate Content Soils

High sulfate content soils are defined as soils that exceed 3,000 ppm. Where high sulfate content soils are encountered, the GB1 prohibits the use of chemical stabilization without prior consultation with the District Geotechnical Engineer. Three soil samples in borings B-008-0-21, B-014-0-21 and B-016-0-21 present a sulfate content greater than 3,000 ppm, however, less than 5,000 ppm. Two soil samples in borings B-009-0-21 and B-010-0-21 present a sulfate content greater than 5,000 ppm.

5.2. Stabilization Recommendations

5.2.1. Subgrade Stabilization

Guidance from ODOT's GB1 states that *"For all other roadways, if it is determined that 30 percent or more of the subgrade area must be stabilized, consideration should be given to stabilizing the entire project (global stabilization)"*. Chemical Stabilization is generally more economical when stabilizing large areas (approximately greater than 1 mile of roadway) per ODOT's GB1. Unstable subgrade conditions, including areas of weak soils and high moisture content soils, were encountered throughout 22 percent of the proposed pavement widening area along I-270 EB ramp to I-71 NB. Therefore, NEAS recommends spot stabilization be performed on the unstable subgrade which is identified by performing Item 204 Proof Rolling for the entire project. Spot stabilization should be in the form of Excavate and Replace (Item 204 with Geotextile). Excavations are estimated to extend to the depth of 12 inches, with the excavated material being replaced with material in accordance with Section F "Excavate and Replace (Item 204)" of the ODOT GB1, specifically, Item 204 Granular Material Type B or C. Stabilization limits should extend 18-inches beyond the edge of the proposed paved roadway, shoulder or median and it is recommended removing any topsoil, existing pavement materials or abandoned structure foundation materials.

However, the guidance from ODOT's GB1 states that *" Where it is determined that soil is present where a majority of sulfate content values are found to be greater than 3,000 parts per million (ppm), or individual soil samples with sulfate contents greater than 5,000 ppm are present,* ***contact the District Geotechnical Engineer to discuss options including stabilization as needed using excavate and replace methods."*** NEAS will discuss our recommendations with the District Geotechnical Engineer.

6. QUALIFICATIONS

This investigation was performed in accordance with accepted geotechnical engineering practice for the purpose of characterizing the subsurface conditions along the referenced portions of roadways. This report has been prepared for TranSystems and ODOT to be used solely in evaluating the subgrade soils within the project limits and presenting geotechnical engineering recommendations specific to this project. The assessment of general site environmental conditions or the presence of pollutants in the soil, rock and groundwater of the site was beyond the scope of this geotechnical exploration. Our recommendations are based on the results of our field explorations, laboratory test results from representative soil samples, and geotechnical engineering analyses. The results of the field explorations and laboratory tests, which form the basis of our recommendations, are presented in the appendices as noted. This report does not reflect any variations that may occur between the borings or elsewhere on the site, or variations whose nature and extent may not become evident until a later stage of construction. In the event that any changes occur in the nature, design or location of the proposed improvement work, the conclusions and recommendations contained in this report should not be considered valid until they are reviewed and have been modified or verified in writing by a geotechnical engineer.

It has been a pleasure to be of service to TranSystems in performing this geotechnical exploration for the FRA-071/270-28.27/25.99A Safety and System Preservation project. Please call if there are any questions, or if we can be of further service.

Respectfully Submitted,

Zhao Mankoci, Ph.D., P.E.
Geotechnical Engineer

Melina He, Ph.D., P.E.
Project Geotechnical Engineer

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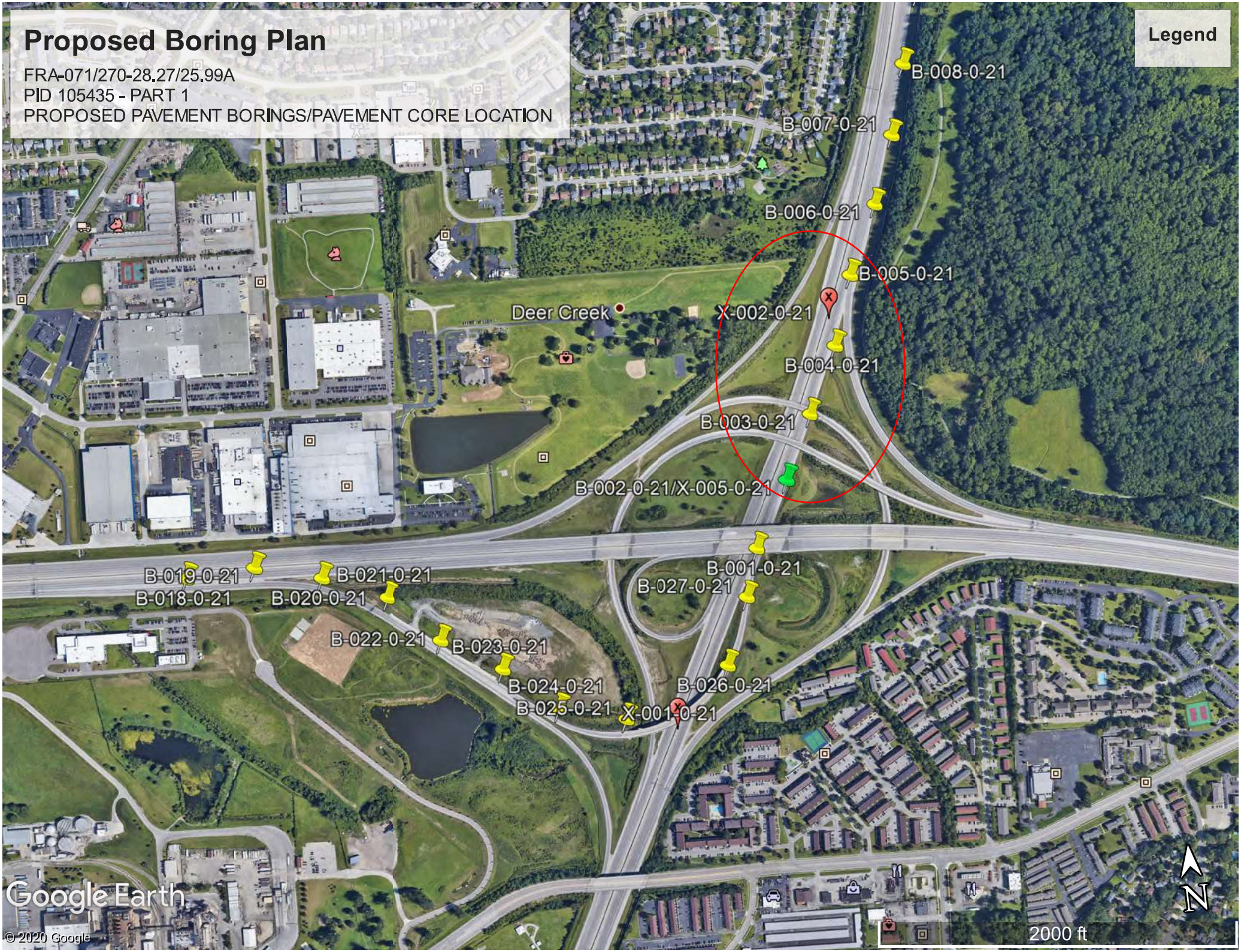
APPENDIX A

SOIL BORING LOCATION PLAN


Proposed Boring Plan
FRA-071/270-28.27/25.99A
PID 105435 - PART 1
PROPOSED PAVEMENT BORINGS/PAVEMENT CORE LOCATION
Legend
B-008-0-21
B-007-0-21
B-006-0-21
B-005-0-21
X-002-0-21
Deer Creek
B-004-0-21
B-003-0-21
B-002-0-21/X-005-0-21
B-001-0-21
B-027-0-21
B-019-0-21
B-021-0-21
B-018-0-21
B-020-0-21
B-022-0-21
B-023-0-21
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B-025-0-21
X-001-0-21
B-026-0-21
Google Earth
© 2020 Google
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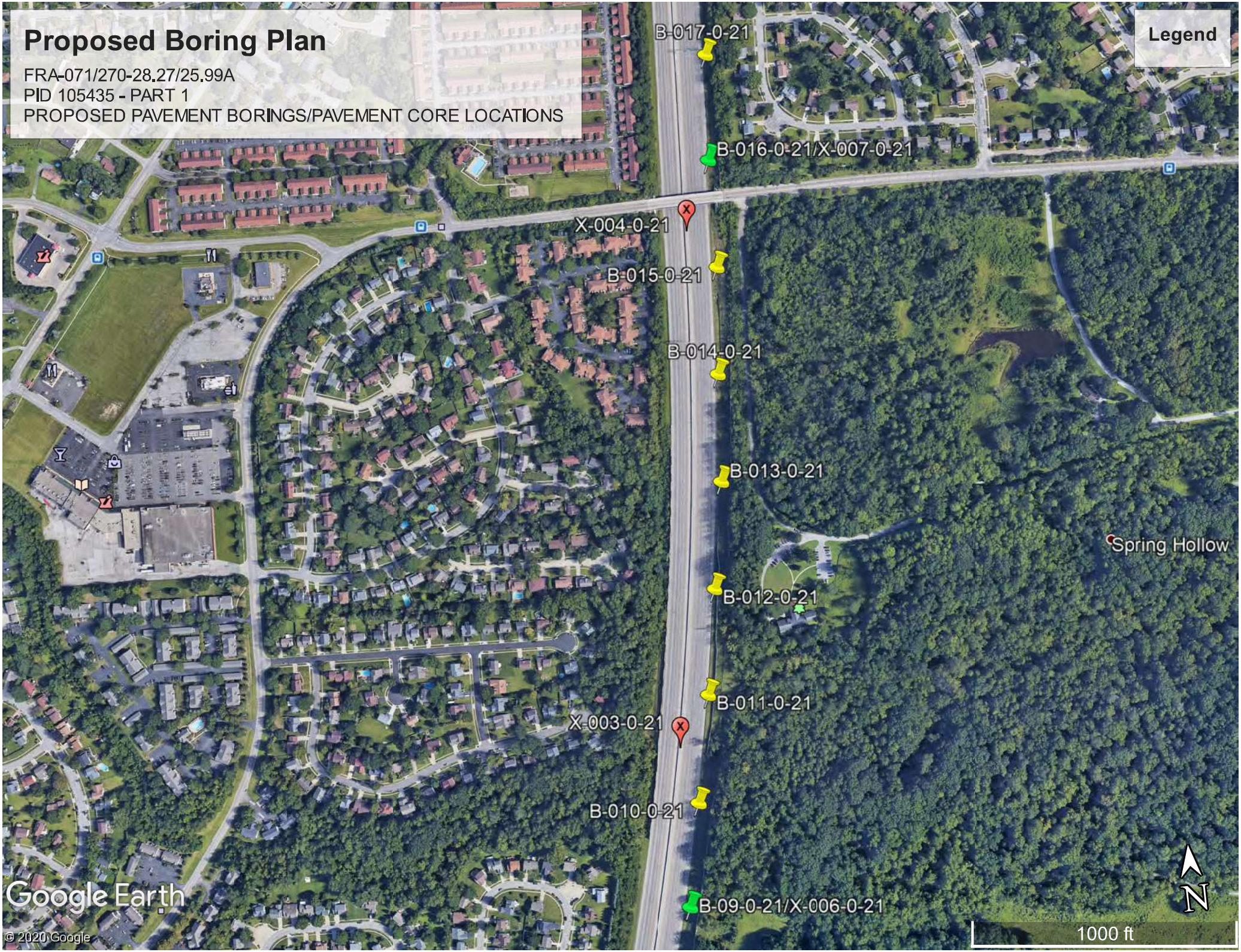
2000 ft


Proposed Boring Plan
FRA-071/270-28.27/25.99A
PID 105435 - PART 1
PROPOSED PAVEMENT BORINGS/PAVEMENT CORE LOCATIONS
Legend
B-017-0-21
B-016-0-21/X-007-0-21
X-004-0-21
B-015-0-21
B-014-0-21
B-013-0-21
Spring Hollow
B-012-0-21
B-011-0-21
X-003-0-21
B-010-0-21
B-09-0-21/X-006-0-21
N
1000 ft
Google Earth
© 2020 Google

APPENDIX B

BORING LOGS

NEAS Inc.
National Engineering & Architectural Services Inc.

LEGEND

SYMBOL	DESCRIPTION	ODOT CLASSIFICATION
	Gravel and/or Stone Fragments	A-1-a
	Gravel and/or Stone Fragments with Sand	A-1-b
F.S.	Fine Sand	A-3
	Coarse and Fine Sand	A-3a
	Gravel and/or Stone Fragments with Sand and Silt	A-2-4 A-2-5
	Gravel and/or Stone Fragments with Sand, Silt and Clay	A-2-6 A-2-7
	Sandy Silt	A-4a
	Silt	A-4b
	Elastic Silt and Clay	A-5
	Silt and Clay	A-6a
	Silty Clay	A-6b
	Elastic Clay	A-7-5
	Clay	A-7-6
	Organic Silt	A-8a
	Organic Clay	A-8b

SYMBOL	DESCRIPTION	ODOT CLASSIFICATION
	Shale	Visual
	Weathered Shale	Visual
	Sandstone	Visual

GRADATION (%)

GR Gravel
CS Coarse Sand
MS Medium Sand
FS Fine Sand
SI Silt
CL Clay (<5 micron)

SAMPLER SYMBOLS

Shelby Tube

Rock Core

Split Spoon Sample (SS)

* Indicates a Sample Taken Within 3 ft of Proposed Grade

ABBREVIATIONS

LL	LIQUID LIMIT (%)	HP	HAND PENETROMETER
PI	PLASTIC INDEX (%0	PID	PHOTOIONIZATION DETECTOR
WC	MOISTURE CONTENT (%)	UC	UNCONFINED COMPRESSION
SPT	STANDARD PENETRATION TEST	ppm	PARTS PER MILLION
NP	NON PLASTIC	$\mathcal{W}$	WATER FIRST ENCOUNTERED
-200	PERCENT PASSING NO. 200 SIEVE	▼	WATER LEVEL UPON COMPLETION
N_{60}	ADJUSTED SPT RESULT		
EOB	END OF BORING		

MATERIAL CLASSIFIED BY VISUAL INSPECTION

Sod and Topsoil
Pavement or Base
Concrete

Uncontrolled Fill (Describe)

Bouldery Zone

Peat, S-Sedimentary
W-Woody F-Fibrous
L-Loamy & etc

PROJECT: FRA-071/270-28.27/25.99A	DRILLING FIRM / OPERATOR: NEAS / J. LONG	DRILL RIG: CME 45B	STATION / OFFSET: 130+13, 34' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / J. LONG	HAMMER: CME AUTOMATIC	ALIGNMENT: I-71
PID: 105435 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 12/5/19	ELEVATION: 913.0 (MSL) EOB: 7.5 ft.
START: 4/19/21 END: 4/19/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.7	LAT / LONG: 40.110037, 40.110037

EXPLORATION ID B-001-0-21

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 913.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
17.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	911.0	1																	
MEDIUM DENSE, BROWN, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, DAMP	910.0	2	5 7 7	19	67	SS-1	-	33	16	12	24	15	NP	NP	NP	10	A-4a (1)	-	
VERY STIFF TO HARD, BROWNISH GRAY AND ORANGISH BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, CONTAINS IRON STAINING, DAMP TO MOIST		3	6 7 8	20	100	SS-2	4.50	1	4	11	43	41	39	19	20	21	A-6b (12)	233	
		4																	
		5	6 9 12	29	33	SS-3	4.50	-	-	-	-	-	-	-	-	18	A-6b (V)	-	
		6																	
	905.5	7	6 8 11	26	39	SS-4	3.75	-	-	-	-	-	-	-	-	25	A-6b (V)	-	
		EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/20/21 END: 4/20/21

DRILLING FIRM / OPERATOR: NEAS / J. LONG
SAMPLING FIRM / LOGGER: NEAS / J. LONG
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 134+39, 49' RT.
ALIGNMENT: I-71
ELEVATION: 914.1 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.111052, 40.111052

EXPLORATION ID B-002-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
16.0" ASPHALT AND 8.0" BASE (DRILLERS DESCRIPTION)	914.1																		
HARD, BROWNISH GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP **(FILL)**	912.1	1–2	13 12 8	27	72	SS-1	4.50	6	11	17	39	27	27	17	10	13	A-4a (6)	400	
HARD, BROWNISH GRAY WITH TRACE BLACK MOTTLES, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP TO MOIST **(FILL)**	911.1	2–3	4 7 7	19	67	SS-2	4.50	16	14	13	35	22	28	17	11	11	A-6a (5)	-	
VERY STIFF, BROWN WITH TRACE GRAY MOTTLES, **CLAY**, SOME SILT, LITTLE SAND, LITTLE GRAVEL, CONTAINS IRON STAINING AND BRICK FRAGMENTS, DAMP **(FILL)**	908.1	4–5	3 6 5	15	67	SS-3	4.50	-	-	-	-	-	-	-	-	19	A-6a (V)	-	
	906.6	6–7	3 3 5	11	56	SS-4	2.75	-	-	-	-	-	-	-	-	21	A-7-6 (V)	-	
		EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/20/21 END: 4/20/21

DRILLING FIRM / OPERATOR: NEAS / J. LONG
SAMPLING FIRM / LOGGER: NEAS / J. LONG
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 138+27, 46' RT.
ALIGNMENT: I-71
ELEVATION: 913.7 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.112010, 40.112010

EXPLORATION ID B-003-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV. 913.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
16.0" ASPHALT AND 8.0" BASE (DRILLERS DESCRIPTION)	911.7	1																	
MEDIUM DENSE TO DENSE, GRAY, **STONE FRAGMENTS**, LITTLE SAND, TRACE SILT, TRACE CLAY, RESEMBLES GRANULAR BASE, DAMP **(FILL)**	909.2	2	9 14 12	35	56	SS-1	-	-	-	-	-	-	-	-	-	9	A-1-a (V)	-	
		3	9 10 12	30	44	SS-2	-	77	10	5	6	2	NP	NP	NP	4	A-1-a (0)	-	
VERY STIFF, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP TO MOIST		4	5 6 7	18	67	SS-3	2.75	14	8	15	34	29	32	18	14	18	A-6a (7)	100	
	906.2	5	6 7 9	22	33	SS-4	2.25	-	-	-	-	-	-	-	-	21	A-6a (V)	-	
		EOB																	
		6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/20/21 END: 4/20/21

DRILLING FIRM / OPERATOR: NEAS / J. LONG
SAMPLING FIRM / LOGGER: NEAS / J. LONG
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 142+24, 49' RT.
ALIGNMENT: I-71
ELEVATION: 911.1 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.112998, 40.112998

EXPLORATION ID B-004-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
17.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	911.1																		
VERY DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, RESEMBLES GRANULAR BASE, DAMP **(FILL)**	909.1	1	43 25 19	60	56	SS-1	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	-	
VERY STIFF TO HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, SS-2 CONTAINS IRON STAINING, DAMP	908.1	2	12 12 14	35	89	SS-2	4.50	5	8	14	40	33	34	19	15	17	A-6a (10)	20	
VERY STIFF, BROWN AND GRAY, **CLAY**, SOME SILT, SOME SAND, TRACE GRAVEL, DAMP	905.1	3	9 10 11	29	100	SS-3	3.50	8	10	14	36	32	32	17	15	16	A-6a (9)	-	
	903.6	4	8 8 10	25	44	SS-4	3.50	-	-	-	-	-	-	-	-	24	A-7-6 (V)	-	
		5																	
		6																	
		7 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A	DRILLING FIRM / OPERATOR: NEAS / J. LONG	DRILL RIG: CME 45B	STATION / OFFSET: 146+00, 27' RT.	EXPLORATION ID B-005-0-21
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / J. LONG	HAMMER: CME AUTOMATIC	ALIGNMENT: I-71	
PID: 105435 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 12/5/19	ELEVATION: 908.2 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 4/20/21 END: 4/20/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.7	LAT / LONG: 40.113975, 40.113975	

MATERIAL DESCRIPTION AND NOTES	ELEV. 908.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
17.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)																			
DENSE, GRAY, **STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, RESEMBLES GRANULAR BASE, DAMP **(FILL)**	906.2	1	45 15 11	35	100	SS-1	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	-	
VERY STIFF TO HARD, BROWN AND GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, SS-3 CONTAINS 1.5" STONE FRAGMENTS, DAMP	905.2	2	9 8 9	23	56	SS-2	4.50	14	13	17	34	22	26	17	9	14	A-4a (4)	260	
		3	8 7 8	20	22	SS-3	4.00	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		4	10 8 9	23	22	SS-4	4.25	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
	900.7	5 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/14/21 END: 4/14/21

DRILLING FIRM / OPERATOR: NEAS / J. HODGES
SAMPLING FIRM / LOGGER: NEAS / J. HODGES
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 150+64, 59' RT.
ALIGNMENT: I-71
ELEVATION: 903.0 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.115133, 40.115133

EXPLORATION ID B-006-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
19.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	903.0																		
HARD, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO SOME GRAVEL, DAMP	900.8	1	8 7 6	18	100	SS-1	4.50	10	13	18	35	24	24	16	8	13	A-4a (5)	580	
		2																	
		3	10 4 18	30	67	SS-2	4.50	27	13	16	27	17	25	16	9	9	A-4a (2)	-	
	898.5	4																	
DENSE, GRAY, **STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, DAMP	897.0	5	12 12 15	37	44	SS-3	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	-	
HARD, GRAY, **SANDY SILT**, SOME CLAY, SOME GRAVEL, DAMP	895.5	6	10 14 16	41	39	SS-4	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
		7 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/14/21 END: 4/14/21

DRILLING FIRM / OPERATOR: NEAS / J. HODGES
SAMPLING FIRM / LOGGER: NEAS / J. HODGES
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 154+37, 56' RT.
ALIGNMENT: I-71
ELEVATION: 899.4 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.116108, 40.116108

EXPLORATION ID B-007-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV. 899.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
17.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	897.4	1																	
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, TRACE CLAY, RESEMBLES GRANULAR BASE, DAMP **(FILL)**	896.4	2	9 11 9	27	67	SS-1	-	-	-	-	-	-	-	-	-	5	A-1-b (V)	1147	
VERY STIFF TO HARD, BROWN AND GRAY, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, DAMP		3	3 7 8	20	83	SS-2	4.50	29	14	15	27	15	23	16	7	9	A-4a (1)	-	
		4	2 3 5	11	100	SS-3	4.25	21	13	16	31	19	23	15	8	11	A-4a (3)	-	
	891.9	5	3 3 4	10	50	SS-4	2.25	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
	EOB	6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/25/21 07:36 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\FRA-071-270-28.27-25.99 A\GINT FILES\FRA-071-270-28.27-25.99

PROJECT: FRA-071/270-28.27/25.99A	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 45B	STATION / OFFSET: 158+41, 50' RT.	EXPLORATION ID B-008-0-21
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: I-71	
PID: 105435 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 12/5/19	ELEVATION: 895.2 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 4/14/21 END: 4/14/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.7	LAT / LONG: 40.117174, 40.117174	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
16.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	895.2																		
VERY STIFF TO HARD, BROWNISH GRAY AND GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL AND STONE FRAGMENTS, DAMP	893.3	1	19 15 15	41	100	SS-1	4.50	13	13	18	34	22	23	16	7	9	A-4a (4)	4267	
		2																	
		3	9 7 7	19	56	SS-2	4.50	12	13	17	36	22	23	15	8	10	A-4a (5)	-	
		4																	
		5	4 5 9	19	89	SS-3	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		6																	
	887.7	7 EOB	7 7 9	22	100	SS-4	4.25	-	-	-	-	-	-	-	-	11	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 45B	STATION / OFFSET: 162+45, 56' RT.	EXPLORATION ID B-009-0-21
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: I-71	
PID: 105435 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 12/5/19	ELEVATION: 891.0 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 4/14/21 END: 4/14/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.7	LAT / LONG: 40.118246, 40.118246	

MATERIAL DESCRIPTION AND NOTES	ELEV. 891.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
18.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	888.9	1																	
HARD, BROWNISH GRAY BECOMING GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP		2	12 12 12	33	100	SS-1	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	8000	
		3	4 9 9	25	100	SS-2	4.50	11	11	18	37	23	24	14	10	9	A-4a (5)	-	
		4																	
		5	2 4 5	12	100	SS-3	4.50	12	13	17	37	21	22	15	7	11	A-4a (5)	-	
@6.0'; SS-4 BECOMES STIFF		6	4 5 6	15	89	SS-4	1.75	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
	883.5	7 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/14/21 END: 4/14/21

DRILLING FIRM / OPERATOR: NEAS / J. HODGES
SAMPLING FIRM / LOGGER: NEAS / J. HODGES
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 166+31, 50' RT.
ALIGNMENT: I-71
ELEVATION: 887.8 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.119281, 40.119281

EXPLORATION ID B-010-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
18.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	887.8																		
VERY DENSE, BLACK AND BROWN, **STONE FRAGMENTS**, SOME SAND, TRACE SILT, TRACE CLAY, CONTAINS ASPHALT FRAGMENTS, DAMP **(FILL)**	885.7	1	13 10 28	52	33	SS-1	-	-	-	-	-	-	-	-	-	5	A-1-a (V)	-	
HARD, BROWN, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, CONTAINS TRACE IRON STAINING, DAMP	884.8	2	6 9 6	20	56	SS-2	4.50	16	16	19	35	14	33	25	8	21	A-4a (3)	5767	
VERY STIFF, BROWN AND BROWNISH GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, MOIST	881.8	3	6 8 12	27	44	SS-3	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
	880.3	4	5 6 13	26	72	SS-4	3.50	4	7	15	43	31	33	19	14	20	A-6a (9)	-	
	EOB	5																	
		6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/14/21 END: 4/14/21

DRILLING FIRM / OPERATOR: NEAS / J. HODGES
SAMPLING FIRM / LOGGER: NEAS / J. HODGES
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 170+40, 49' RT.
ALIGNMENT: I-71
ELEVATION: 885.9 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.120386, 40.120386

EXPLORATION ID B-011-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
18.0" ASPHALT AND 18.0" BASE (DRILLERS DESCRIPTION) @1.5' TO 3.0'; SS-1 IS GRANULAR BASE	885.9																		
	882.9	1	20 25 32	78	67	SS-1	-	-	-	-	-	-	-	-	-	5	A-1-b (V)	-	
HARD, BROWNISH GRAY AND BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP	881.4	2 3 4	3 6 7	18	56	SS-2	4.50	8	11	14	37	30	26	16	10	12	A-4a (6)	440	
STIFF TO HARD, BROWNISH GRAY AND BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP TO WET	878.4	5 6 7	5 7 5	16	78	SS-3	4.50	14	11	13	35	27	28	17	11	13	A-6a (6)	-	
		EOB	6 6 7	18	100	SS-4	1.50	-	-	-	-	-	-	-	-	28	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/15/21 END: 4/15/21

DRILLING FIRM / OPERATOR: NEAS / J. HODGES
SAMPLING FIRM / LOGGER: NEAS / J. HODGES
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 174+32, 49' RT.
ALIGNMENT: I-71
ELEVATION: 886.8 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.121451, 40.121451

EXPLORATION ID B-012-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV. 886.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
18.0" ASPHALT AND 6.0" BASE (DRILLERS DESCRIPTION)	884.8	1																	
VERY DENSE, GRAY, **STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, RESEMBLES GRANULAR BASE, DAMP **(FILL)**	883.8	2	31 18 20	52	39	SS-1	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	-	
HARD, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP	882.3	3 4	3 5 6	15	89	SS-2	4.50	5	13	17	36	29	28	17	11	14	A-6a (6)	220	
HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP	880.8	5 6	5 5 6	15	78	SS-3	4.50	8	14	18	36	24	26	16	10	13	A-4a (5)	-	
VERY STIFF, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, MOIST	879.3	7 EOB	4 5 5	14	100	SS-4	2.50	-	-	-	-	-	-	-	-	22	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 45B	STATION / OFFSET: 178+31, 48' RT.	EXPLORATION ID B-013-0-21
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: I-71	
PID: 105435 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 12/5/19	ELEVATION: 889.2 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 4/15/21 END: 4/15/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.7	LAT / LONG: 40.122537, 40.122537	

MATERIAL DESCRIPTION AND NOTES	ELEV. 889.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
15.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	887.4	1																	
VERY DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, RESEMBLES GRANULAR BASE, WET **(FILL)**	886.2	2	10 43 16	80	44	SS-1	-	-	-	-	-	-	-	-	-	24	A-1-b (V)	-	
STIFF TO VERY STIFF, BROWN AND BROWNISH GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT**, LITTLE CLAY, NO INTACT SOIL FOR HP READINGS, DAMP	884.7	3 4 5	4 9 15	33	100	SS-2	-	28	23	15	21	13	24	17	7	9	A-2-4 (0)	1433	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP TO MOIST	881.7	6 7 EOB	6 5 5	14	100	SS-3	4.25	9	11	13	38	29	24	14	10	12	A-4a (6)	-	
			5 5 4	12	100	SS-4	2.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/15/21 END: 4/15/21

DRILLING FIRM / OPERATOR: NEAS / J. HODGES
SAMPLING FIRM / LOGGER: NEAS / J. HODGES
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 182+40, 46' RT.
ALIGNMENT: I-71
ELEVATION: 891.6 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.123658, 40.123658

EXPLORATION ID B-014-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV. 891.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
14.0" ASPHALT AND 6.0" BASE (DRILLERS DESCRIPTION)	889.9																		
HARD, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE GRAVEL AND STONE FRAGMENTS, CONTAINS TRACE IRON STAINING, DRY TO DAMP		1 2 3 4 5 6 7	14 11 14	34	100	SS-1	4.50	14	15	16	31	24	27	17	10	5	A-4a (4)	4767	
			5 7 8	20	100	SS-2	4.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
			9 8 7	20	100	SS-3	4.50	14	26	19	25	16	24	16	8	11	A-4a (1)	-	
	884.1	EOB	8 8 9	23	100	SS-4	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/15/21 END: 4/15/21

DRILLING FIRM / OPERATOR: NEAS / J. HODGES
SAMPLING FIRM / LOGGER: NEAS / J. HODGES
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 186+38, 45' RT.
ALIGNMENT: I-71
ELEVATION: 894.1 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.124754, 40.124754

EXPLORATION ID B-015-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
15.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	894.1																		
VERY DENSE, GRAY, **STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, RESEMBLES GRANULAR BASE, DAMP **(FILL)**	892.3		20 36 44	109	33	SS-1	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	-	
VERY STIFF TO HARD, BROWNISH GRAY BECOMING GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE GRAVEL, DAMP	891.1		17 6 5	15	72	SS-2	4.50	15	17	19	31	18	28	18	10	12	A-4a (3)	2300	
			4 3 5	11	100	SS-3	3.25	18	14	14	32	22	25	16	9	11	A-4a (4)	-	
	886.6	EOB	5 5 4	12	100	SS-4	3.25	-	-	-	-	-	-	-	-	13	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/15/21 END: 4/15/21

DRILLING FIRM / OPERATOR: NEAS / J. HODGES
SAMPLING FIRM / LOGGER: NEAS / J. HODGES
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 190+40, 44' RT.
ALIGNMENT: I-71
ELEVATION: 896.6 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.125854, 40.125854

EXPLORATION ID B-016-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV. 896.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
15.0" ASPHALT AND 6.0" BASE (DRILLERS DESCRIPTION)	894.8																		
DENSE, BROWNISH GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, RESEMBLES GRANULAR BASE, MOIST **(FILL)**	893.6	1	6 15 22	50	44	SS-1	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	-	
HARD, BROWNISH GRAY AND GRAY, **SANDY SILT**, SOME CLAY, TRACE TO LITTLE GRAVEL, DAMP		2	6 6 7	18	100	SS-2	4.50	10	14	16	36	24	25	16	9	11	A-4a (5)	3767	
		3	10 10 8	25	100	SS-3	4.50	15	12	15	34	24	25	16	9	12	A-4a (5)	-	
		4	9 11 7	25	100	SS-4	4.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
	889.1	5 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/15/21 END: 4/15/21

DRILLING FIRM / OPERATOR: NEAS / J. HODGES
SAMPLING FIRM / LOGGER: NEAS / J. HODGES
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 194+38, 56' RT.
ALIGNMENT: I-71
ELEVATION: 898.8 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.126945, 40.126945

EXPLORATION ID B-017-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV. 898.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
14.5" ASPHALT AND 6.0" BASE (DRILLERS DESCRIPTION)	897.1	1																	
HARD, BROWN AND BROWNISH GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	895.8	2	11 5 12	23	100	SS-1	4.50	15	12	16	33	24	32	19	13	13	A-6a (6)	193	
HARD, BROWNISH GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP	894.3	3 4	9 9 12	29	100	SS-2	4.50	12	12	18	35	23	26	17	9	11	A-4a (5)	-	
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, LITTLE SAND, LITTLE GRAVEL, DAMP		5	8 8 7	20	100	SS-3	4.50	-	-	-	-	-	-	-	-	11	A-6a (V)	-	
	891.3	6 7 EOB	7 6 6	16	100	SS-4	3.75	-	-	-	-	-	-	-	-	11	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/19/21 END: 4/19/21

DRILLING FIRM / OPERATOR: NEAS / J. LONG
SAMPLING FIRM / LOGGER: NEAS / J. LONG
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 84+55, 17' RT.
ALIGNMENT: RAMP M
ELEVATION: 921.6 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.110560, 40.110560

EXPLORATION ID B-018-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV. 921.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
17.0" ASPHALT AND 6.0" BASE (DRILLERS DESCRIPTION)	919.7	1																	
HARD, GRAY AND BROWN, **SILTY CLAY**, SOME STONE FRAGMENTS, SOME SAND, STONE FRAGMENTS ARE WEAK SHALE, DAMP	918.6	2	4 8 7	20	100	SS-1	4.50	24	13	8	29	26	36	20	16	12	A-6b (6)	213	
STIFF TO VERY STIFF, BROWN WITH TRACE GRAY MOTTLES, **CLAY**, SOME SILT, SOME SAND, TRACE GRAVEL, MOIST TO DAMP		3	5 5 6	15	100	SS-2	2.25	5	6	16	33	40	50	22	28	25	A-7-6 (17)	-	
		4	3 3 4	10	100	SS-3	1.75	-	-	-	-	-	-	-	-	27	A-7-6 (V)	-	
	914.1	5	4 4 5	12	100	SS-4	1.50	-	-	-	-	-	-	-	-	22	A-7-6 (V)	-	
		EOB 6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A	DRILLING FIRM / OPERATOR: NEAS / J. LONG	DRILL RIG: CME 45B	STATION / OFFSET: 88+34, 26' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / J. LONG	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP M
PID: 105435 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 12/5/19	ELEVATION: 920.4 (MSL) EOB: 7.5 ft.
START: 4/19/21 END: 4/19/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.7	LAT / LONG: 40.110619, 40.110619

EXPLORATION ID B-019-0-21

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 920.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
16.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	918.5	1																	
HARD, BROWN AND BROWNISH GRAY, **SILT AND CLAY**, SOME SAND, TRACE TO LITTLE GRAVEL, DAMP		2	9 8 6	19	100	SS-1	4.50	18	8	13	36	25	31	17	14	13	A-6a (7)	633	
		3	7 6 8	19	100	SS-2	4.50	8	11	17	38	26	28	17	11	14	A-6a (6)	-	
		4	4 5 6	15	22	SS-3	4.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		5	5 5 6	15	22	SS-4	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
	912.9	6 EOB																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. BORING OFFSET 25.0' SOUTH.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/19/21 END: 4/19/21

DRILLING FIRM / OPERATOR: NEAS / J. LONG
SAMPLING FIRM / LOGGER: NEAS / J. LONG
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 92+14, 25' RT.
ALIGNMENT: RAMP M
ELEVATION: 917.4 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.110342, 40.110342

EXPLORATION ID B-020-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
16.0" ASPHALT AND 6.0" BASE (DRILLERS DESCRIPTION)	917.4																		
HARD, BROWN AND BROWNISH GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, CONTAINS IRON STAINING, DAMP	915.6	1	15 10 11	29	100	SS-1	4.50	9	14	17	35	25	26	17	9	12	A-4a (5)	393	
HARD, BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, CONTAINS A 2.0" STONE FRAGMENT, DAMP	914.4	2	9 9 8	23	56	SS-2	4.50	12	14	15	34	25	27	16	11	12	A-6a (5)	-	
VERY STIFF, GRAY, **SILTY CLAY**, LITTLE TO SOME SAND, LITTLE GRAVEL, DAMP	912.9	3	3 3 4	10	44	SS-3	3.75	-	-	-	-	-	-	-	-	13	A-6b (V)	-	
	909.9	4	2 3 5	11	56	SS-4	2.25	-	-	-	-	-	-	-	-	14	A-6b (V)	-	
	EOB	5																	
		6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/19/21 END: 4/19/21

DRILLING FIRM / OPERATOR: NEAS / J. LONG
SAMPLING FIRM / LOGGER: NEAS / J. LONG
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 96+33, 44' RT.
ALIGNMENT: RAMP M
ELEVATION: 918.6 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.109798, 40.109798

EXPLORATION ID B-021-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV. 918.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
18.0" ASPHALT AND 6.0" BASE (DRILLERS DESCRIPTION)	916.6																		
HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP		1	8 5 10	20	100	SS-1	4.50	8	10	16	36	30	32	18	14	13	A-6a (8)	293	
		2	8 7 10	23	100	SS-2	4.50	9	9	17	37	28	29	18	11	14	A-6a (6)	-	
		3	7 7 8	20	100	SS-3	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
		4	8 5 7	16	100	SS-4	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
	911.1	5 EOB																	
		6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/25/21 07:37 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\FRA-071-270-28.27-25.99 AIGINT FILES\FRA-071-270-28.27-25.99

PROJECT: FRA-071/270-28.27/25.99A	DRILLING FIRM / OPERATOR: NEAS / J. LONG	DRILL RIG: CME 45B	STATION / OFFSET: 99+81, 43' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / J. LONG	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP M
PID: 105435 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 12/5/19	ELEVATION: 920.6 (MSL) EOB: 7.5 ft.
START: 4/19/21 END: 4/19/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.7	LAT / LONG: 40.109199, 40.109199

EXPLORATION ID B-022-0-21

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 920.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
18.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	918.5	1																	
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, RESEMBLES GRANULAR BASE, DAMP **(FILL)**	916.1	2	4 6 6	16	78	SS-1	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	-	
		3	5 5 4	12	89	SS-2	-	54	20	8	14	4	NP	NP	NP	6	A-1-b (0)	-	
HARD, BROWN AND GRAY, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, DAMP	914.6	4	3 4 4	11	50	SS-3	4.25	3	8	14	39	36	38	19	19	18	A-6b (12)	240	
		5																	
LOOSE, GRAY, **STONE FRAGMENTS**, TRACE SAND, TRACE SILT, TRACE CLAY, MOIST	913.1	6	4 4 3	10	17	SS-4	-	-	-	-	-	-	-	-	-	11	A-1-a (V)	-	
		EOB 7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. BORING OFFSET 25.0' NORTH.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/19/21 END: 4/19/21

DRILLING FIRM / OPERATOR: NEAS / J. LONG
SAMPLING FIRM / LOGGER: NEAS / J. LONG
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 103+52, 22' LT.
ALIGNMENT: RAMP M
ELEVATION: 923.6 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.108675, 40.108675

EXPLORATION ID B-023-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV. 923.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
18.0" ASPHALT AND 5.0" BASE (DRILLERS DESCRIPTION)	921.7	1																	
HARD, BROWN AND GRAY, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL AND STONE FRAGMENTS, CONTAINS TRACE IRON STAINING, DAMP		2	6 7 8	20	89	SS-1	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	533	
		3	10 7 6	18	100	SS-2	4.50	13	16	13	31	27	35	19	16	16	A-6b (7)	-	
	917.6	4																	
		5	8 10 12	30	67	SS-3	4.25	-	-	-	-	-	-	-	-	11	A-6b (V)	-	
VERY STIFF, GRAY AND BROWN, **SILT AND CLAY**, "AND" STONE FRAGMENTS, SOME SAND, CONTAINS NO INTACT SOIL FOR HP READINGS, DAMP	916.1	6	8 9 16	34	44	SS-4	-	40	15	7	22	16	32	18	14	9	A-6a (2)	-	
		7 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/19/21 END: 4/19/21

DRILLING FIRM / OPERATOR: NEAS / J. LONG
SAMPLING FIRM / LOGGER: NEAS / J. LONG
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 107+35, 10' LT.
ALIGNMENT: RAMP M
ELEVATION: 925.6 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.107974, 40.107974

EXPLORATION ID B-024-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV. 925.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
18.0" ASPHALT AND 7.0" BASE (DRILLERS DESCRIPTION)	923.5	1																	
HARD, BROWN AND GRAY, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	922.6	2	15 6 10	22	100	SS-1	4.50	-	-	-	-	-	-	-	-	16	A-6b (V)	-	
HARD, GRAY AND BROWNISH GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP		3	7 8 11	26	100	SS-2	4.50	11	11	16	37	25	26	16	10	11	A-4a (5)	1967	
		4																	
		5	13 10 11	29	100	SS-3	4.50	12	12	16	38	22	25	16	9	10	A-4a (5)	-	
		6																	
	918.1	7	12 12 14	35	100	SS-4	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
		EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A
TYPE: SUBGRADE
PID: 105435 SFN:
START: 4/19/21 END: 4/19/21

DRILLING FIRM / OPERATOR: NEAS / J. LONG
SAMPLING FIRM / LOGGER: NEAS / J. LONG
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 12/5/19
ENERGY RATIO (%): 81.7

STATION / OFFSET: 1010+99, LT.
ALIGNMENT: RAMP P
ELEVATION: 935.5 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.107701, 40.107701

EXPLORATION ID B-025-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV. 935.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
17.0" ASPHALT AND 8.0" BASE (DRILLERS DESCRIPTION)	933.4	1																	
VERY STIFF TO HARD, BROWNISH GRAY BECOMING GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP		2	6 7 3	14	100	SS-1	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
		3	2 2 2	5	72	SS-2	2.50	10	11	17	39	23	25	15	10	13	A-4a (5)	1227	
		4	2 3 3	8	44	SS-3	3.75	8	13	17	38	24	24	15	9	13	A-4a (5)	-	
	928.0	5 6 7 EOB	2 3 4	10	39	SS-4	4.00	-	-	-	-	-	-	-	-	13	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A	DRILLING FIRM / OPERATOR: NEAS / J. LONG	DRILL RIG: CME 45B	STATION / OFFSET: 1018+06, 17' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / J. LONG	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP P
PID: 105435 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 12/5/19	ELEVATION: 928.1 (MSL) EOB: 7.5 ft.
START: 4/19/21 END: 4/19/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.7	LAT / LONG: 40.108377, 40.108377

EXPLORATION ID B-026-0-21

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 928.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
16.0" ASPHALT AND 9.0" BASE (DRILLERS DESCRIPTION)	926.0																		
VERY STIFF, BROWN AND BROWNISH GRAY, **SILT AND CLAY**, SOME SAND, TRACE TO LITTLE GRAVEL, DAMP		1	9 3 3	8	83	SS-1	3.00	6	9	16	37	32	32	17	15	17	A-6a (9)	673	
		2	4 3 4	10	89	SS-2	3.75	6	9	14	38	33	33	19	14	19	A-6a (9)	-	
		3	3 2 2	5	39	SS-3	3.50	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
		4	4 2 2	5	44	SS-4	2.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
	920.6	5																	
		6																	
		7 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: FRA-071/270-28.27/25.99A	DRILLING FIRM / OPERATOR: NEAS / J. LONG	DRILL RIG: CME 45B	STATION / OFFSET: 1022+01, 52' LT.	EXPLORATION ID B-027-0-21
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / J. LONG	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP P	
PID: 105435 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 12/5/19	ELEVATION: 913.7 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 4/19/21 END: 4/19/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.7	LAT / LONG: 40.109351, 40.109351	

MATERIAL DESCRIPTION AND NOTES	ELEV. 913.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
16.0" ASPHALT AND 8.0" BASE (DRILLERS DESCRIPTION)	911.7	1																	
LOOSE, GRAY, **STONE FRAGMENTS WITH SAND AND SILT**, LITTLE CLAY, CONTAINS ASPHALT FRAGMENTS, DAMP **(FILL)**	910.7	2	6 3 2	7	28	SS-1	-	45	14	8	19	14	NP	NP	NP	10	A-2-4 (0)	-	
		3	3 7 7	19	100	SS-2	-	30	14	8	27	21	34	20	14	12	A-6a (4)	807	
STIFF, GRAY, **SILT AND CLAY**, SOME TO "AND" STONE FRAGMENTS, SOME SAND, CONTAINS NO INTACT SOIL FOR HP READINGS, DAMP		4																	
		5	7 5 8	18	78	SS-3	-	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		6	6 6 7	18	56	SS-4	-	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	906.2	7 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

OHIO DEPARTMENT OF TRANSPORTATION

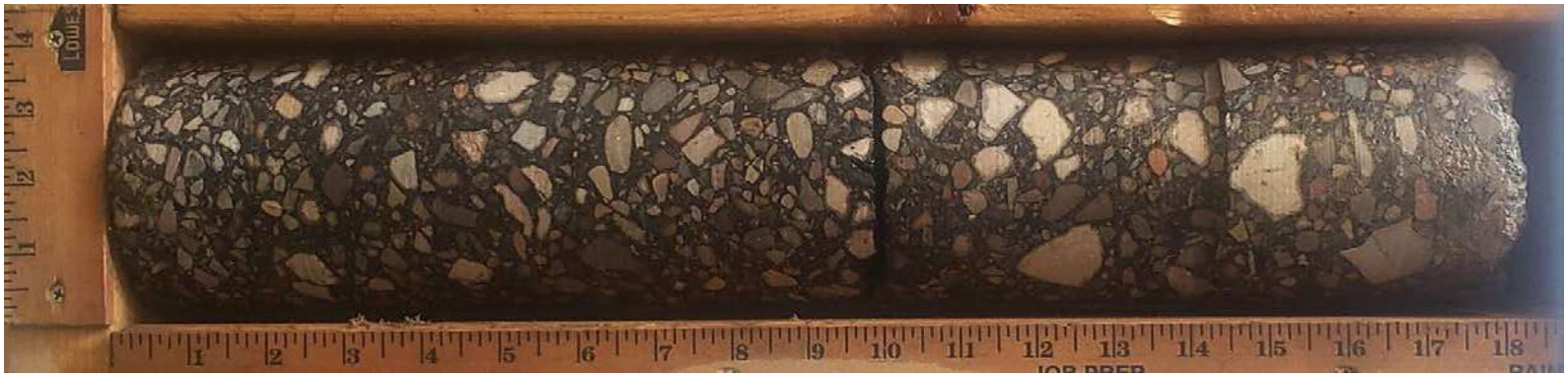
DETERMINING SULFATE CONTENT IN SOILS **SUPPLEMENT 1122**

Project C-R-S:	FRA-071/270-28.27
PID No:	105435
Report Date:	5/12/2021
Consultant:	NEAS Inc.
Technician:	L. Rosenbeck

Boring ID & Sample #	Station	Offset	Latitude & Longitude or State Plane Coordinates		Elevation	Soaking Time (hr)	Replicate Sample Readings						Sulfate Content (ppm)
							1		2		3		
							Dilution	Reading	Dilution	Reading	Dilution	Reading	
B-001-0-21 SS-2	130+13.45	33.64' RT.	40.110037	-82.977651	913.02	17.1	20	11	20	12	20	12	**233**
B-002-0-21 SS-1	134+38.61	48.74' RT.	40.111052	-82.976900	914.113	17.1	20	19	20	21	20	20	**400**
B-003-0-21 SS-3	138+27.06	46.29' RT	40.112010	-82.976279	913.661	17.1	20	5	20	5	20	5	**100**
B-004-0-21 SS-2	142+23.72	49.14' RT	40.112998	-82.975669	911.111	17.1	20	1	20	1	20	1	**20**
B-005-0-21 SS-2	146+00.36	27.13' RT	40.113975	-82.975211	908.243	17.1	20	12	20	14	20	13	**260**
B-006-0-21 SS-1	150+63.61	59.05' RT	40.115133	-82.974503	902.988	18.1	20	32	20	29	20	26	**580**
B-007-0-21 SS-1	154+37.05	56.17' RT	40.116108	-82.974071	899.363	18.2	20	52	20	58	20	62	**1147**
B-008-0-21 SS-1	158+40.65	50.43' RT	40.117174	-82.973656	895.22	18.1	100	46	100	42	100	40	**4267**
B-009-0-21 SS-1	162+45.49	55.74' RT	40.118246	-82.973248	890.984	16.3	100	>80	100	>80	100	>80	**>8000**
B-010-0-21 SS-2	166+30.55	49.53' RT	40.119281	-82.972942	887.8	16.3	100	61	100	56	100	56	**5767**
B-011-0-21 SS-2	170+40.03	48.88' RT	40.120386	-82.972642	885.897	16.3	20	22	20	22	20	22	**440**
B-012-0-21 SS-2	174+32.33	48.74' RT	40.121451	-82.972399	886.806	16.3	20	9	20	14	20	10	**220**
B-013-0-21 SS-2	178+30.59	47.78' RT	40.122537	-82.972200	889.171	16.3	100	14	100	15	100	14	**1433**
B-014-0-21 SS-1	182+39.72	46.26' RT	40.123658	-82.972045	891.613	21.25	100	53	100	45	100	45	**4767**
B-015-0-21 SS-2	186+38.44	44.65' RT	40.124754	-82.971942	894.132	21.25	100	27	100	22	100	20	**2300**
B-016-0-21 SS-2	190+39.61	43.68' RT	40.125854	-82.971865	896.565	21.25	100	39	100	35	100	39	**3767**
B-017-0-21 SS-1	194+38.28	56.43' RT	40.126945	-82.971739	898.808	21.25	20	11	20	10	20	8	**193**
B-018-0-21 SS-1	84+54.58	16.59' RT	40.110560	-82.989002	921.592	21.25	20	10	20	11	20	11	**213**
B-019-0-21 SS-1	88+33.68	26.22' LT	40.110619	-82.987640	920.357	21.25	20	28	20	32	20	35	**633**
B-020-0-21 SS-1	92+14.25	24.92' RT	40.110342	-82.986326	917.375	16.4	20	19	20	20	20	20	**393**
B-021-0-21 SS-1	96+33.42	43.71' RT	40.109798	-82.985064	918.563	16.4	20	14	20	15	20	15	**293**

B-022-0-21 SS-3	99+80.90	42.93' RT	40.109199	-82.984109	920.637	16.4	20	12	20	12	20	12	**240**
B-023-0-21 SS-1	103+52.16	22.33' LT	40.108675	-82.982948	923.572	16.4	20	26	20	27	20	27	**533**
B-024-0-21 SS-2	107+35.10	9.60' LT	40.107974	-82.981926	925.586	16.3	100	23	100	16	100	20	**1967**
B-025-0-21 SS-2	1010+98.56	CL	40.107701	-82.980661	935.545	16.4	40	30	40	31	40	31	**1227**
B-026-0-21 SS-1	1018+05.87	16.63' LT	40.108377	-82.978429	928.067	16.4	20	35	20	33	20	33	**673**
B-027-0-21 SS-2	1022+01.45	52.46' LT	40.109351	-82.977947	913.74	16.4	20	38	20	46	20	37	**807**

Core Photo: X-001-0-21



Core Information				
Core Diameter (in):			**4**	
Core Total Length (in):			**18.75**	
Layers	Core Composition & Thickness (in)			Remarks
	Asphalt	Concrete	Brick	
1	10			
2	8.75			
3				
4				
Rebar Encountered	N/A			

Latitude: 40.107653
Longitude -82.979486

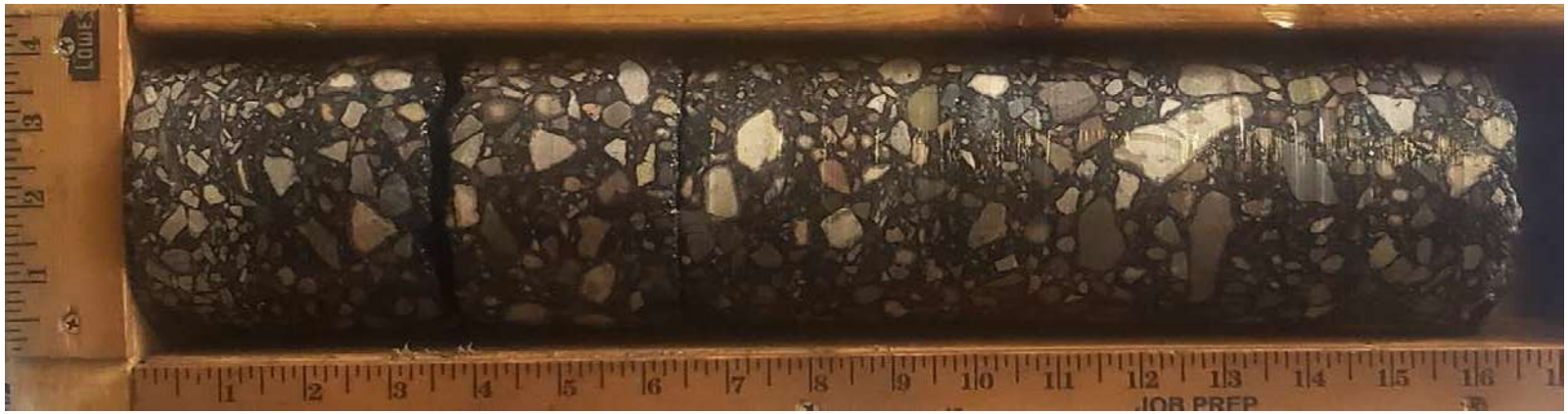
Pavement & Core Photo Log

Roadway Project
FRA-71/270

National Engineering & Architectural Services Inc.

NEAS Project No.: 105435
Date: 4/21/2021
Taken By: MJ
Scale: N/A

Core Photo: X-002-0-21



Core Information				
Core Diameter (in):			**4**	
Core Total Length (in):			**16.75**	
Layers	Core Composition & Thickness (in)			Remarks
	Asphalt	Concrete	Brick	
1	3.5			
2	3			
3	10.25			
4				
Rebar Encountered	N/A			

Latitude: 40.113628
Longitude -82.975595

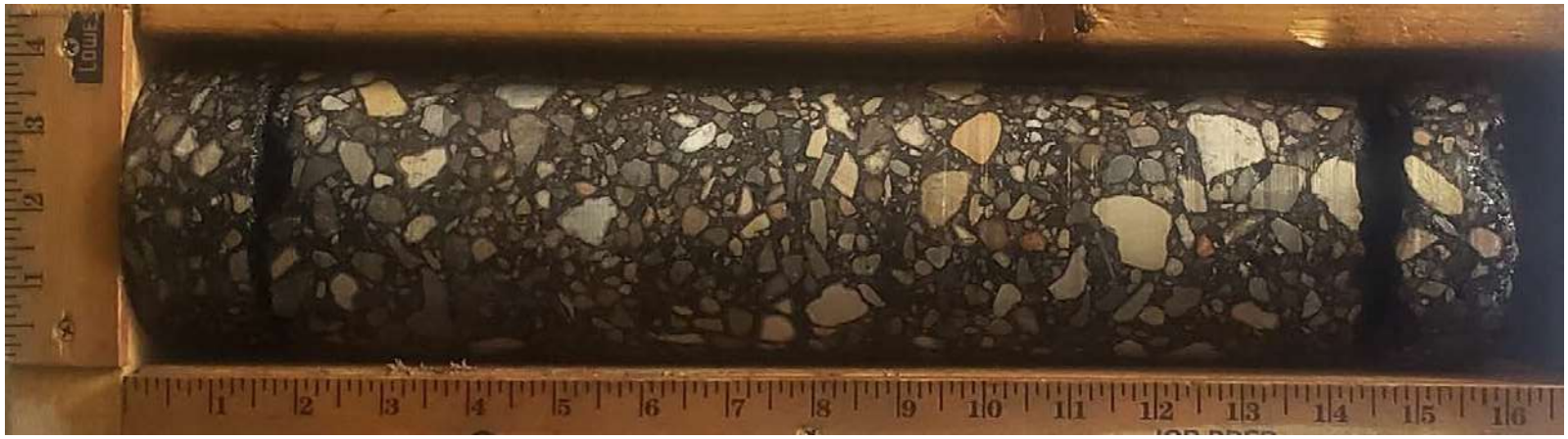
Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project
FRA-71/270

NEAS Project No.: 105435
Date: 4/21/2021
Taken By: MJ
Scale: N/A

Core Photo: X-003-0-21



Core Information				
Core Diameter (in):			**4**	
Core Total Length (in):			**16.5**	
Layers	Core Composition & Thickness (in)			Remarks
	Asphalt	Concrete	Brick	
1	1.5			
2	15			
3				
4				
Rebar Encountered	N/A			

Latitude: 40.120010
Longitude -82.973021

Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project
FRA-71/270

NEAS Project No.: 105435
Date: 4/21/2021
Taken By: MJ
Scale: N/A

Core Photo: X-004-0-21

Core Information				
Core Diameter (in):			**4**	
Core Total Length (in):			**17**	
Layers	Core Composition & Thickness (in)			Remarks
	Asphalt	Concrete	Brick	
1	3.5			
2	5			
3	8.5			
4				
Rebar Encountered	N/A			

Latitude: 40.125285
Longitude -82.972180

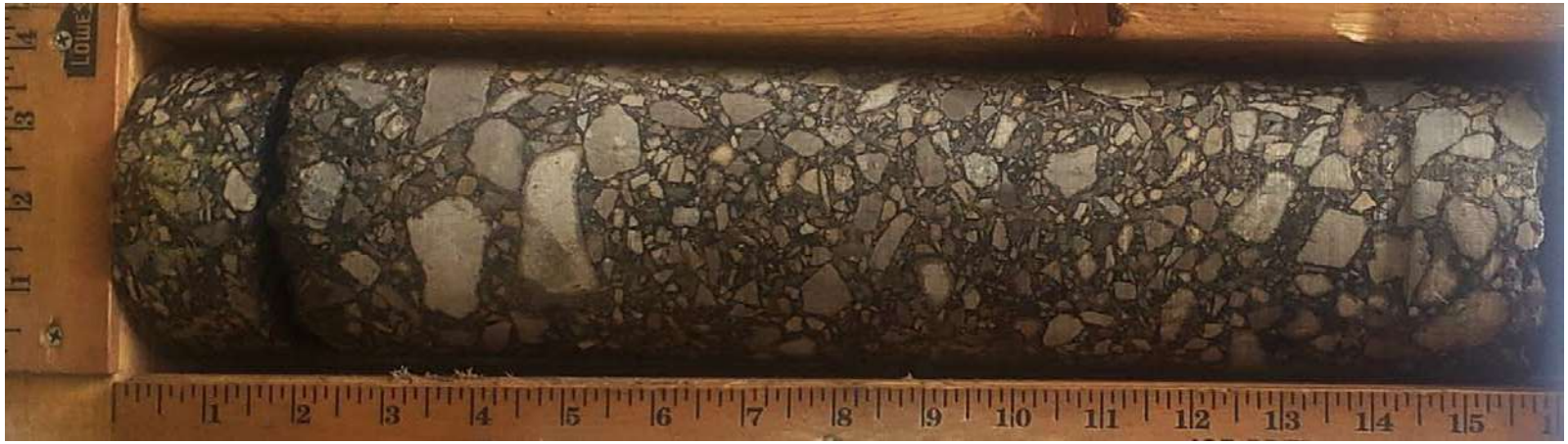
Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project
FRA-71/270

NEAS Project No.: 105435
Date: 4/21/2021
Taken By: MJ
Scale: N/A

Core Photo: X-005-0-21



Core Information				
Core Diameter (in):			**4**	
Core Total Length (in):			**16.5**	
Layers	Core Composition & Thickness (in)			Remarks
	Asphalt	Concrete	Brick	
1	1.5			
2	15			
3				
4				
Rebar Encountered	N/A			

Latitude: 40.111052
Longitude -82.976900

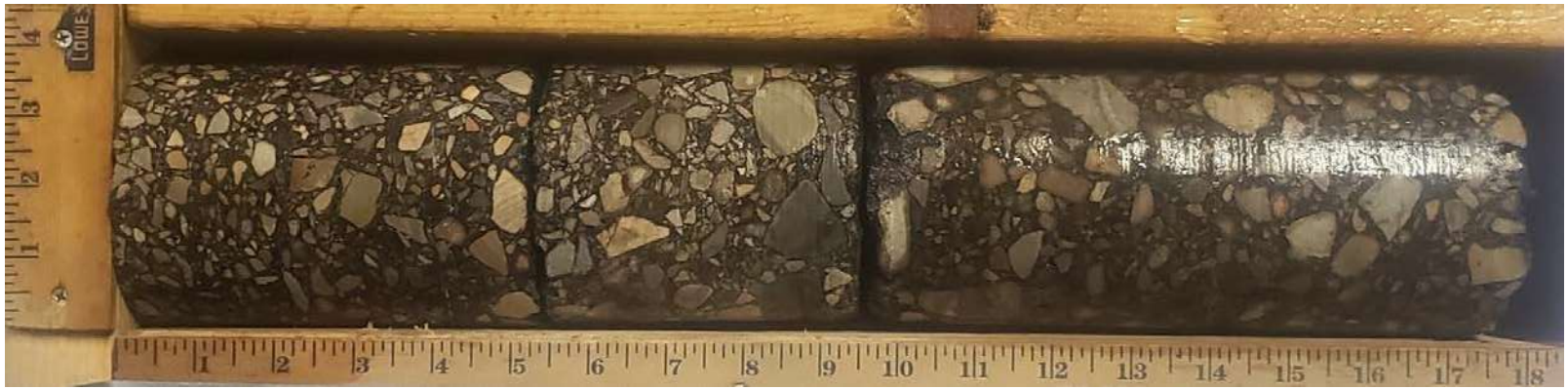
Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project
FRA-71/270

NEAS Project No.: 105435
Date: 4/21/2021
Taken By: MJ
Scale: N/A

Core Photo: X-006-0-21



Core Information				
Core Diameter (in):			**4**	
Core Total Length (in):			**18**	
Layers	Core Composition & Thickness (in)			Remarks
	Asphalt	Concrete	Brick	
1	2			
2	3.25			
3	4.25			
4	8.5			
Rebar Encountered	N/A			

Latitude:	40.118246
Longitude	-82.973248

Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project
FRA-71/270

NEAS Project No.:	105435
Date:	4/21/2021
Taken By:	MJ
Scale:	N/A

Core Photo: X-007-0-21

Core Information				
Core Diameter (in):			**4**	
Core Total Length (in):			**14.75**	
Layers	Core Composition & Thickness (in)			Remarks
	Asphalt	Concrete	Brick	
1	3.5			
2	4.5			
3	6.75			
4				
Rebar Encountered	N/A			

Latitude:	40.125854
Longitude	-82.971865

Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project
FRA-71/270

NEAS Project No.:	105435
Date:	4/21/2021
Taken By:	MJ
Scale:	N/A

APPENDIX C

GEOTECHNICAL BULLETIN 1 (GB1) ANALYSIS SPREADSHEETS

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FRA-071/270-28.27/25.99A
105435

Adding a ramp lane along I-270 Eastbound to I-71 Northbound ramp

NEAS, INC.

Prepared By: ZM
Date prepared: Sunday, October 10, 2021

Chunmei (Melinda) He, Ph.D, P.E.
2800 Corporate Exchange Drive
Suite 240
Columbus, OH, 43231
614-714-0299
che@neasinc.com

NO. OF BORINGS: 27

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-21	I-71	130+13	34	RT	CME 45B	82	913.0	911.0	2.1 C
2	B-002-0-21	I-71	134+39	49	RT	CME 45B	82	914.1	912.1	2.1 C
3	B-003-0-21	I-71	138+27	46	RT	CME 45B	82	913.7	911.6	2.1 C
4	B-004-0-21	I-71	142+24	49	RT	CME 45B	82	911.1	909.0	2.1 C
5	B-005-0-21	I-71	146+00	27	RT	CME 45B	82	908.2	906.2	2.1 C
6	B-006-0-21	I-71	150+64	59	RT	CME 45B	82	903.0	900.9	2.1 C
7	B-007-0-21	I-71	154+37	56	RT	CME 45B	82	899.4	897.3	2.1 C
8	B-008-0-21	I-71	158+41	50	RT	CME 45B	82	895.2	893.2	2.1 C
9	B-009-0-21	I-71	162+45	56	RT	CME 45B	82	891.0	888.9	2.1 C
10	B-010-0-21	I-71	166+31	50	RT	CME 45B	82	887.8	885.7	2.1 C
11	B-011-0-21	I-71	170+40	49	RT	CME 45B	82	885.9	883.8	2.1 C
12	B-012-0-21	I-71	174+32	49	RT	CME 45B	82	886.8	884.7	2.1 C
13	B-013-0-21	I-71	178+31	48	RT	CME 45B	82	889.2	887.1	2.1 C
14	B-014-0-21	I-71	182+40	46	RT	CME 45B	82	891.6	889.6	2.1 C
15	B-015-0-21	I-71	186+38	45	RT	CME 45B	82	894.1	892.1	2.1 C
16	B-016-0-21	I-71	190+40	44	RT	CME 45B	82	896.6	894.5	2.1 C
17	B-017-0-21	I-71	194+38	56	RT	CME 45B	82	898.8	896.7	2.1 C
18	B-018-0-21	Ramp M	84+55	17	RT	CME 45B	82	921.6	920.0	1.5 C
19	B-019-0-21	Ramp M	88+34	26	LT	CME 45B	82	920.4	917.7	2.6 C
20	B-020-0-21	Ramp M	92+14	25	RT	CME 45B	82	917.4	915.5	1.9 C
21	B-021-0-21	Ramp M	96+33	44	RT	CME 45B	82	918.6	916.0	2.5 C
22	B-022-0-21	Ramp M	99+81	43	RT	CME 45B	82	920.6	918.7	2.0 C
23	B-023-0-21	Ramp M	103+52	22	LT	CME 45B	82	923.6	921.5	2.1 C
24	B-024-0-21	Ramp M	107+35	10	LT	CME 45B	82	925.6	924.7	0.9 C
25	B-025-0-21	Ramp P	1010+99	0	LT	CME 45B	82	935.5	933.1	2.4 C
26	B-026-0-21	Ramp P	1018+06	17	LT	CME 45B	82	928.1	926.0	2.1 C
27	B-027-0-21	Ramp P	1022+01	52	LT	CME 45B	82	913.7	912.0	1.7 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	-0.6	0.9	19			NP	NP	NP	24	15	39	10	11	A-4a	1						
	001-0	SS-2	3.0	4.5	0.9	2.4	20		4.5	39	19	20	43	41	84	21	16	A-6b	12	233		Mc			
	21	SS-3	4.5	6.0	2.4	3.9	29		4.5							18	16	A-6b	16						
		SS-4	6.0	7.5	3.9	5.4	26	19	3.75							25	16	A-6b	16						
2	B	SS-1	1.5	3.0	-0.6	0.9	27		4.5	27	17	10	39	27	66	13	12	A-4a	6	400					
	002-0	SS-2	3.0	4.5	0.9	2.4	19		4.5	28	17	11	35	22	57	11	14	A-6a	5						
	21	SS-3	4.5	6.0	2.4	3.9	15		4.5							19	14	A-6a	10						
		SS-4	6.0	7.5	3.9	5.4	11	11	2.75							21	18	A-7-6	16						
3	B	SS-1	1.5	3.0	-0.6	0.9	35									9	6	A-1-a	0						
	003-0	SS-2	3.0	4.5	0.9	2.4	30			NP	NP	NP	6	2	8	4	6	A-1-a	0						
	21	SS-3	4.5	6.0	2.4	3.9	18		2.75	32	18	14	34	29	63	18	14	A-6a	7	100					
		SS-4	6.0	7.5	3.9	5.4	22	18	2.25							21	14	A-6a	10						
4	B	SS-1	1.5	3.0	-0.6	0.9	60									9	6	A-1-b	0						
	004-0	SS-2	3.0	4.5	0.9	2.4	35		4.5	34	19	15	40	33	73	17	14	A-6a	10	20		Mc			
	21	SS-3	4.5	6.0	2.4	3.9	29		3.5	32	17	15	36	32	68	16	14	A-6a	9						
		SS-4	6.0	7.5	3.9	5.4	25	25	3.5							24	18	A-7-6	16						
5	B	SS-1	1.5	3.0	-0.6	0.9	35									8	6	A-1-b	0						
	005-0	SS-2	3.0	4.5	0.9	2.4	23		4.5	26	17	9	34	22	56	14	12	A-4a	4	260					
	21	SS-3	4.5	6.0	2.4	3.9	20		4							15	10	A-4a	8						
		SS-4	6.0	7.5	3.9	5.4	23	20	4.25							12	10	A-4a	8						
6	B	SS-1	1.5	3.0	-0.6	0.9	18		4.5	24	16	8	35	24	59	13	11	A-4a	5	580					
	006-0	SS-2	3.0	4.5	0.9	2.4	30		4.5	25	16	9	27	17	44	9	11	A-4a	2						
	21	SS-3	4.5	6.0	2.4	3.9	37									9	6	A-1-b	0						
		SS-4	6.0	7.5	3.9	5.4	41	18	4.5							10	10	A-4a	8						
7	B	SS-1	1.5	3.0	-0.6	0.9	27									5	6	A-1-b	0	1147					
	007-0	SS-2	3.0	4.5	0.9	2.4	20		4.5	23	16	7	27	15	42	9	11	A-4a	1						
	21	SS-3	4.5	6.0	2.4	3.9	11		4.25	23	15	8	31	19	50	11	10	A-4a	3						
		SS-4	6.0	7.5	3.9	5.4	10	10	2.25							12	10	A-4a	8						
8	B	SS-1	1.5	3.0	-0.6	0.9	41		4.5	23	16	7	34	22	56	9	11	A-4a	4	4267					
	008-0	SS-2	3.0	4.5	0.9	2.4	19		4.5	23	15	8	36	22	58	10	10	A-4a	5						
	21	SS-3	4.5	6.0	2.4	3.9	19		4							12	10	A-4a	8						
		SS-4	6.0	7.5	3.9	5.4	22	19	4.25							11	10	A-4a	8						
9	B	SS-1	1.5	3.0	-0.6	0.9	33		4.5							9	10	A-4a	8	>8000					
	009-0	SS-2	3.0	4.5	0.9	2.4	25		4.5	24	14	10	37	23	60	9	10	A-4a	5						
	21	SS-3	4.5	6.0	2.4	3.9	12		4.5	22	15	7	37	21	58	11	10	A-4a	5						
		SS-4	6.0	7.5	3.9	5.4	15	12	1.75							13	10	A-4a	8						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	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	
10	B	SS-1	1.5	3.0	-0.6	0.9	52									5	6	A-1-a	0						
	010-0	SS-2	3.0	4.5	0.9	2.4	20		4.5	33	25	8	35	14	49	21	20	A-4a	3	5767					
	21	SS-3	4.5	6.0	2.4	3.9	27		4.5							12	10	A-4a	8						
		SS-4	6.0	7.5	3.9	5.4	26	20	3.5	33	19	14	43	31	74	20	14	A-6a	9						
11	B	SS-1	1.5	3.0	-0.6	0.9	78									5	6	A-1-b	0						
	011-0	SS-2	3.0	4.5	0.9	2.4	18		4.5	26	16	10	37	30	67	12	11	A-4a	6	440					
	21	SS-3	4.5	6.0	2.4	3.9	16		4.5	28	17	11	35	27	62	13	14	A-6a	6						
		SS-4	6.0	7.5	3.9	5.4	18	16	1.5							28	14	A-6a	10						
12	B	SS-1	1.5	3.0	-0.6	0.9	52									10	6	A-1-b	0						
	012-0	SS-2	3.0	4.5	0.9	2.4	15		4.5	28	17	11	36	29	65	14	14	A-6a	6	220					
	21	SS-3	4.5	6.0	2.4	3.9	15		4.5	26	16	10	36	24	60	13	11	A-4a	5						
		SS-4	6.0	7.5	3.9	5.4	14	14	2.5							22	14	A-6a	10						
13	B	SS-1	1.5	3.0	-0.6	0.9	80									24	6	A-1-b	0						
	013-0	SS-2	3.0	4.5	0.9	2.4	33			24	17	7	21	13	34	9	10	A-2-4	0	1433					
	21	SS-3	4.5	6.0	2.4	3.9	14		4.25	24	14	10	38	29	67	12	10	A-4a	6						
		SS-4	6.0	7.5	3.9	5.4	12	12	2.5							15	10	A-4a	8						
14	B	SS-1	1.5	3.0	-0.6	0.9	34		4.5	27	17	10	31	24	55	5	12	A-4a	4	4767					
	014-0	SS-2	3.0	4.5	0.9	2.4	20		4.5							13	10	A-4a	8			Mc			
	21	SS-3	4.5	6.0	2.4	3.9	20		4.5	24	16	8	25	16	41	11	11	A-4a	1						
		SS-4	6.0	7.5	3.9	5.4	23	20	4.5							11	10	A-4a	8						
15	B	SS-1	1.5	3.0	-0.6	0.9	109									12	6	A-1-b	0						
	015-0	SS-2	3.0	4.5	0.9	2.4	15		4.5	28	18	10	31	18	49	12	13	A-4a	3	2300					
	21	SS-3	4.5	6.0	2.4	3.9	11		3.25	25	16	9	32	22	54	11	11	A-4a	4						
		SS-4	6.0	7.5	3.9	5.4	12	11	3.25							13	10	A-4a	8						
16	B	SS-1	1.5	3.0	-0.6	0.9	50									14	6	A-1-b	0						
	016-0	SS-2	3.0	4.5	0.9	2.4	18		4.5	25	16	9	36	24	60	11	11	A-4a	5	3767					
	21	SS-3	4.5	6.0	2.4	3.9	25		4.5	25	16	9	34	24	58	12	11	A-4a	5						
		SS-4	6.0	7.5	3.9	5.4	25	18	4.5							13	10	A-4a	8						
17	B	SS-1	1.5	3.0	-0.6	0.9	23		4.5	32	19	13	33	24	57	13	14	A-6a	6	193					
	017-0	SS-2	3.0	4.5	0.9	2.4	29		4.5	26	17	9	35	23	58	11	12	A-4a	5						
	21	SS-3	4.5	6.0	2.4	3.9	20		4.5							11	14	A-6a	10						
		SS-4	6.0	7.5	3.9	5.4	16	16	3.75							11	14	A-6a	10						
18	B	SS-1	1.5	3.0	0.0	1.5	20		4.5	36	20	16	29	26	55	12	16	A-6b	6	213					
	018-0	SS-2	3.0	4.5	1.5	3.0	15		2.25	50	22	28	33	40	73	25	19	A-7-6	17			Mc			
	21	SS-3	4.5	6.0	3.0	4.5	10		1.75							27	18	A-7-6	16						
		SS-4	6.0	7.5	4.5	6.0	12	10	1.5							22	18	A-7-6	16						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	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	
19	B	SS-1	1.5	3.0	-1.1	0.4	19		4.5	31	17	14	36	25	61	13	14	A-6a	7	633					
	019-0	SS-2	3.0	4.5	0.4	1.9	19		4.5	28	17	11	38	26	64	14	14	A-6a	6						
	21	SS-3	4.5	6.0	1.9	3.4	15		4.5							16	14	A-6a	10						
		SS-4	6.0	7.5	3.4	4.9	15	15	4.5							15	14	A-6a	10						
20	B	SS-1	1.5	3.0	-0.4	1.1	29		4.5	26	17	9	35	25	60	12	12	A-4a	5	393					
	020-0	SS-2	3.0	4.5	1.1	2.6	23		4.5	27	16	11	34	25	59	12	14	A-6a	5						
	21	SS-3	4.5	6.0	2.6	4.1	10		3.75							13	16	A-6b	16						
		SS-4	6.0	7.5	4.1	5.6	11	10	2.25							14	16	A-6b	16						
21	B	SS-1	1.5	3.0	-1.0	0.5	20		4.5	32	18	14	36	30	66	13	14	A-6a	8	293					
	021-0	SS-2	3.0	4.5	0.5	2.0	23		4.5	29	18	11	37	28	65	14	14	A-6a	6						
	21	SS-3	4.5	6.0	2.0	3.5	20		4.5							15	14	A-6a	10						
		SS-4	6.0	7.5	3.5	5.0	16	16	4.5							15	14	A-6a	10						
22	B	SS-1	1.5	3.0	-0.5	1.0	16									6	6	A-1-b	0						
	022-0	SS-2	3.0	4.5	1.0	2.5	12			NP	NP	NP	14	4	18	6	6	A-1-b	0						
	21	SS-3	4.5	6.0	2.5	4.0	11		4.25	38	19	19	39	36	75	18	16	A-6b	12	240					
		SS-4	6.0	7.5	4.0	5.5	10	10								11	6	A-1-a	0						
23	B	SS-1	1.5	3.0	-0.6	0.9	20		4.5							14	16	A-6b	16	533					
	023-0	SS-2	3.0	4.5	0.9	2.4	18		4.5	35	19	16	31	27	58	16	16	A-6b	7						
	21	SS-3	4.5	6.0	2.4	3.9	30		4.25							11	16	A-6b	16						
		SS-4	6.0	7.5	3.9	5.4	34	18		32	18	14	22	16	38	9	14	A-6a	2						
24	B	SS-1	1.5	3.0	0.6	2.1	22		4.5							16	16	A-6b	16						
	024-0	SS-2	3.0	4.5	2.1	3.6	26		4.5	26	16	10	37	25	62	11	11	A-4a	5	1967					
	21	SS-3	4.5	6.0	3.6	5.1	29		4.5	25	16	9	38	22	60	10	11	A-4a	5						
		SS-4	6.0	7.5	5.1	6.6	35	22	4.5							10	10	A-4a							
25	B	SS-1	1.5	3.0	-0.9	0.6	14		4.5							10	10	A-4a	8						
	025-0	SS-2	3.0	4.5	0.6	2.1	5		2.5	25	15	10	39	23	62	13	10	A-4a	5	1227		N_{60} & Mc		**21"**	
	21	SS-3	4.5	6.0	2.1	3.6	8		3.75	24	15	9	38	24	62	13	10	A-4a	5						
		SS-4	6.0	7.5	3.6	5.1	10	5	4							13	10	A-4a	8						
26	B	SS-1	1.5	3.0	-0.6	0.9	8		3	32	17	15	37	32	69	17	14	A-6a	9	673		N_{60} & Mc		**12"**	
	026-0	SS-2	3.0	4.5	0.9	2.4	10		3.75	33	19	14	38	33	71	19	14	A-6a	9			N_{60} & Mc		**12"**	
	21	SS-3	4.5	6.0	2.4	3.9	5		3.5							13	14	A-6a	10						
		SS-4	6.0	7.5	3.9	5.4	5	5	2.5							17	14	A-6a	10						
27	B	SS-1	1.5	3.0	-0.2	1.3	7			NP	NP	NP	19	14	33	10	10	A-2-4	0			N_{60}		**15"**	
	027-0	SS-2	3.0	4.5	1.3	2.8	19			34	20	14	27	21	48	12	15	A-6a	4	807					
	21	SS-3	4.5	6.0	2.8	4.3	18									16	14	A-6a	10						
		SS-4	6.0	7.5	4.3	5.8	18	7								14	14	A-6a	10						

PID: 105435

County-Route-Section: FRA-071/270-28.27/25.99A

No. of Borings: 27

Geotechnical Consultant: NEAS, INC.

Prepared By: ZM

Date prepared: 10/10/2021

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

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

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	3%	HP ≤ 0.5	0%
$N_{60} < 12$	16%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	7%	1 < HP ≤ 2	4%
$N_{60} \geq 20$	52%	HP > 2	76%
M+	6%		
Rock	0%		
Unsuitable	0%		

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

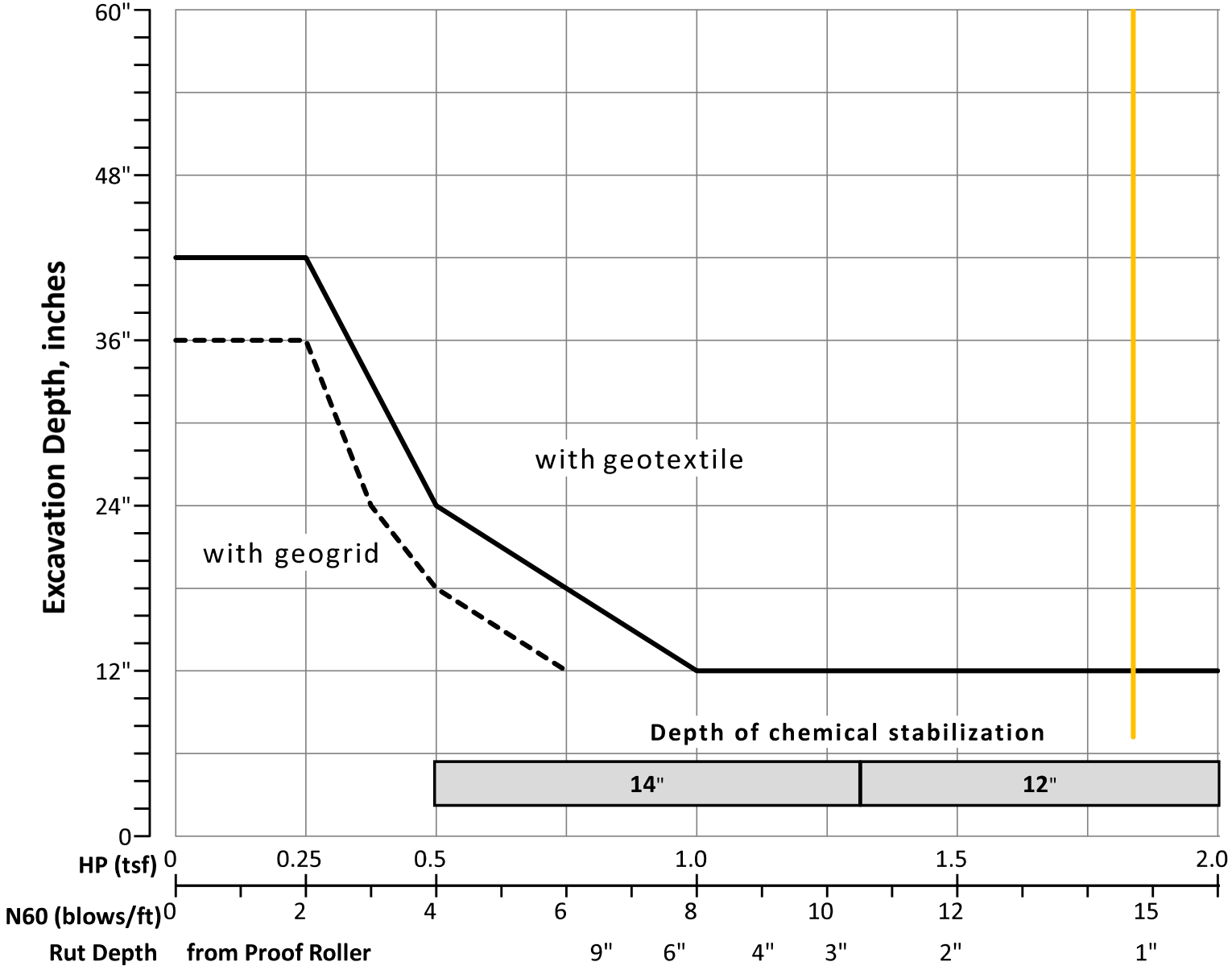
% Proposed Subgrade Surface	
Unstable & Unsuitable	10%
Unstable	10%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	23	15	3.96	29	17	11	33	24	57	13	12	7
Maximum	109	25	4.50	50	25	28	43	41	84	28	20	17
Minimum	5	5	1.50	22	14	7	6	2	8	4	6	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	4	11	2	0	0	0	0	0	44	0	0	31	11	0	5	0	0	108
Percent	0%	4%	10%	2%	0%	0%	0%	0%	0%	41%	0%	0%	29%	10%	0%	5%	0%	0%	100%
% Rock|Granular|Cohesive	0%	56%									44%								100%
Surface Class Count	0	3	11	2	0	0	0	0	0	32	0	0	20	9	0	1	0	0	78
Surface Class Percent	0%	4%	14%	3%	0%	0%	0%	0%	0%	41%	0%	0%	26%	12%	0%	1%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.96	0.50	☐ HP
14.70	6.00	☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FRA-071/270-28.27/25.99A
105435

Adding a ramp lane along I-270 Eastbound ramp to I-71 Northbound
I-270 Eastbound to I-71 Northbound

NEAS, INC.

Prepared By: ZM
Date prepared: Monday, October 25, 2021

Chunmei (Melinda) He, Ph.D, P.E.
2800 Corporate Exchange Drive
Suite 240
Columbus, OH, 43231
614-714-0299
che@neasinc.com

NO. OF BORINGS: 18

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-027-0-21	I-71	127+54	76	RT	CME 45B	82	913.7	911.7	2.1 C
2	B-001-0-21	I-71	130+13	34	RT	CME 45B	82	913.0	911.0	2.1 C
3	B-002-0-21	I-71	134+39	49	RT	CME 45B	82	914.1	912.1	2.1 C
4	B-003-0-21	I-71	138+27	46	RT	CME 45B	82	913.7	911.6	2.1 C
5	B-004-0-21	I-71	142+24	49	RT	CME 45B	82	911.1	909.0	2.1 C
6	B-005-0-21	I-71	146+00	27	RT	CME 45B	82	908.2	906.2	2.1 C
7	B-006-0-21	I-71	150+64	59	RT	CME 45B	82	903.0	900.9	2.1 C
8	B-007-0-21	I-71	154+37	56	RT	CME 45B	82	899.4	897.3	2.1 C
9	B-008-0-21	I-71	158+41	50	RT	CME 45B	82	895.2	893.2	2.1 C
10	B-009-0-21	I-71	162+45	56	RT	CME 45B	82	891.0	888.9	2.1 C
11	B-010-0-21	I-71	166+31	50	RT	CME 45B	82	887.8	885.7	2.1 C
12	B-011-0-21	I-71	170+40	49	RT	CME 45B	82	885.9	883.8	2.1 C
13	B-012-0-21	I-71	174+32	49	RT	CME 45B	82	886.8	884.7	2.1 C
14	B-013-0-21	I-71	178+31	48	RT	CME 45B	82	889.2	887.1	2.1 C
15	B-014-0-21	I-71	182+40	46	RT	CME 45B	82	891.6	889.6	2.1 C
16	B-015-0-21	I-71	186+38	45	RT	CME 45B	82	894.1	892.1	2.1 C
17	B-016-0-21	I-71	190+40	44	RT	CME 45B	82	896.6	894.5	2.1 C
18	B-017-0-21	I-71	194+38	56	RT	CME 45B	82	898.8	896.7	2.1 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	-0.6	0.9	7									10	10	A-2-4	0			N_{60}		15"	
	027-0	SS-2	3.0	4.5	0.9	2.4	19			34	20	14	27	21	48	12	15	A-6a	4	807					
	21	SS-3	4.5	6.0	2.4	3.9	18									16	14	A-6a	10						
		SS-4	6.0	7.5	3.9	5.4	18	7								14	14	A-6a	10						
2	B	SS-1	1.5	3.0	-0.6	0.9	19			NP	NP	NP	24	15	39	10	11	A-4a	1						
	001-0	SS-2	3.0	4.5	0.9	2.4	20		4.5	39	19	20	43	41	84	21	16	A-6b	12	233		Mc			
	21	SS-3	4.5	6.0	2.4	3.9	29		4.5							18	16	A-6b	16						
		SS-4	6.0	7.5	3.9	5.4	26	19	3.75							25	16	A-6b	16						
3	B	SS-1	1.5	3.0	-0.6	0.9	27		4.5	27	17	10	39	27	66	13	12	A-4a	6	400					
	002-0	SS-2	3.0	4.5	0.9	2.4	19		4.5	28	17	11	35	22	57	11	14	A-6a	5						
	21	SS-3	4.5	6.0	2.4	3.9	15		4.5							19	14	A-6a	10						
		SS-4	6.0	7.5	3.9	5.4	11	11	2.75							21	18	A-7-6	16						
4	B	SS-1	1.5	3.0	-0.6	0.9	35									9	6	A-1-a	0						
	003-0	SS-2	3.0	4.5	0.9	2.4	30			NP	NP	NP	6	2	8	4	6	A-1-a	0						
	21	SS-3	4.5	6.0	2.4	3.9	18		2.75	32	18	14	34	29	63	18	14	A-6a	7	100					
		SS-4	6.0	7.5	3.9	5.4	22	18	2.25							21	14	A-6a	10						
5	B	SS-1	1.5	3.0	-0.6	0.9	60									9	6	A-1-b	0						
	004-0	SS-2	3.0	4.5	0.9	2.4	35		4.5	34	19	15	40	33	73	17	14	A-6a	10	20		Mc			
	21	SS-3	4.5	6.0	2.4	3.9	29		3.5	32	17	15	36	32	68	16	14	A-6a	9						
		SS-4	6.0	7.5	3.9	5.4	25	25	3.5							24	18	A-7-6	16						
6	B	SS-1	1.5	3.0	-0.6	0.9	35									8	6	A-1-b	0						
	005-0	SS-2	3.0	4.5	0.9	2.4	23		4.5	26	17	9	34	22	56	14	12	A-4a	4	260					
	21	SS-3	4.5	6.0	2.4	3.9	20		4							15	10	A-4a	8						
		SS-4	6.0	7.5	3.9	5.4	23	20	4.25							12	10	A-4a	8						
7	B	SS-1	1.5	3.0	-0.6	0.9	18		4.5	24	16	8	35	24	59	13	11	A-4a	5	580					
	006-0	SS-2	3.0	4.5	0.9	2.4	30		4.5	25	16	9	27	17	44	9	11	A-4a	2						
	21	SS-3	4.5	6.0	2.4	3.9	37									9	6	A-1-b	0						
		SS-4	6.0	7.5	3.9	5.4	41	18	4.5							10	10	A-4a	8						
8	B	SS-1	1.5	3.0	-0.6	0.9	27									5	6	A-1-b	0	1147					
	007-0	SS-2	3.0	4.5	0.9	2.4	20		4.5	23	16	7	27	15	42	9	11	A-4a	1						
	21	SS-3	4.5	6.0	2.4	3.9	11		4.25	23	15	8	31	19	50	11	10	A-4a	3						
		SS-4	6.0	7.5	3.9	5.4	10	10	2.25							12	10	A-4a	8						
9	B	SS-1	1.5	3.0	-0.6	0.9	41		4.5	23	16	7	34	22	56	9	11	A-4a	4	4267					
	008-0	SS-2	3.0	4.5	0.9	2.4	19		4.5	23	15	8	36	22	58	10	10	A-4a	5						
	21	SS-3	4.5	6.0	2.4	3.9	19		4							12	10	A-4a	8						
		SS-4	6.0	7.5	3.9	5.4	22	19	4.25							11	10	A-4a	8						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	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	
10	B	SS-1	1.5	3.0	-0.6	0.9	33		4.5							9	10	A-4a	8	>8000					
	009-0	SS-2	3.0	4.5	0.9	2.4	25		4.5	24	14	10	37	23	60	9	10	A-4a	5						
	21	SS-3	4.5	6.0	2.4	3.9	12		4.5	22	15	7	37	21	58	11	10	A-4a	5						
		SS-4	6.0	7.5	3.9	5.4	15	12	1.75							13	10	A-4a	8						
11	B	SS-1	1.5	3.0	-0.6	0.9	52									5	6	A-1-a	0						
	010-0	SS-2	3.0	4.5	0.9	2.4	20		4.5	33	25	8	35	14	49	21	20	A-4a	3	5767					
	21	SS-3	4.5	6.0	2.4	3.9	27		4.5							12	10	A-4a	8						
		SS-4	6.0	7.5	3.9	5.4	26	20	3.5	33	19	14	43	31	74	20	14	A-6a	9						
12	B	SS-1	1.5	3.0	-0.6	0.9	78									5	6	A-1-b	0						
	011-0	SS-2	3.0	4.5	0.9	2.4	18		4.5	26	16	10	37	30	67	12	11	A-4a	6	440					
	21	SS-3	4.5	6.0	2.4	3.9	16		4.5	28	17	11	35	27	62	13	14	A-6a	6						
		SS-4	6.0	7.5	3.9	5.4	18	16	1.5							28	14	A-6a	10						
13	B	SS-1	1.5	3.0	-0.6	0.9	52									10	6	A-1-b	0						
	012-0	SS-2	3.0	4.5	0.9	2.4	15		4.5	28	17	11	36	29	65	14	14	A-6a	6	220					
	21	SS-3	4.5	6.0	2.4	3.9	15		4.5	26	16	10	36	24	60	13	11	A-4a	5						
		SS-4	6.0	7.5	3.9	5.4	14	14	2.5							22	14	A-6a	10						
14	B	SS-1	1.5	3.0	-0.6	0.9	80									24	6	A-1-b	0						
	013-0	SS-2	3.0	4.5	0.9	2.4	33			24	17	7	21	13	34	9	10	A-2-4	0	1433					
	21	SS-3	4.5	6.0	2.4	3.9	14		4.25	24	14	10	38	29	67	12	10	A-4a	6						
		SS-4	6.0	7.5	3.9	5.4	12	12	2.5							15	10	A-4a	8						
15	B	SS-1	1.5	3.0	-0.6	0.9	34		4.5	27	17	10	31	24	55	5	12	A-4a	4	4767					
	014-0	SS-2	3.0	4.5	0.9	2.4	20		4.5							13	10	A-4a	8			Mc			
	21	SS-3	4.5	6.0	2.4	3.9	20		4.5	24	16	8	25	16	41	11	11	A-4a	1						
		SS-4	6.0	7.5	3.9	5.4	23	20	4.5							11	10	A-4a	8						
16	B	SS-1	1.5	3.0	-0.6	0.9	109									12	6	A-1-b	0						
	015-0	SS-2	3.0	4.5	0.9	2.4	15		4.5	28	18	10	31	18	49	12	13	A-4a	3	2300					
	21	SS-3	4.5	6.0	2.4	3.9	11		3.25	25	16	9	32	22	54	11	11	A-4a	4						
		SS-4	6.0	7.5	3.9	5.4	12	11	3.25							13	10	A-4a	8						
17	B	SS-1	1.5	3.0	-0.6	0.9	50									14	6	A-1-b	0						
	016-0	SS-2	3.0	4.5	0.9	2.4	18		4.5	25	16	9	36	24	60	11	11	A-4a	5	3767					
	21	SS-3	4.5	6.0	2.4	3.9	25		4.5	25	16	9	34	24	58	12	11	A-4a	5						
		SS-4	6.0	7.5	3.9	5.4	25	18	4.5							13	10	A-4a	8						
18	B	SS-1	1.5	3.0	-0.6	0.9	23		4.5	32	19	13	33	24	57	13	14	A-6a	6	193					
	017-0	SS-2	3.0	4.5	0.9	2.4	29		4.5	26	17	9	35	23	58	11	12	A-4a	5						
	21	SS-3	4.5	6.0	2.4	3.9	20		4.5							11	14	A-6a	10						
		SS-4	6.0	7.5	3.9	5.4	16	16	3.75							11	14	A-6a	10						

PID: 105435

County-Route-Section: FRA-071/270-28.27/25.99A

No. of Borings: 18

Geotechnical Consultant: NEAS, INC.

Prepared By: ZM

Date prepared: 10/25/2021

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

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

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	7%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	7%	1 < HP ≤ 2	3%
$N_{60} \geq 20$	60%	HP > 2	72%
M+	4%		
Rock	0%		
Unsuitable	0%		

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

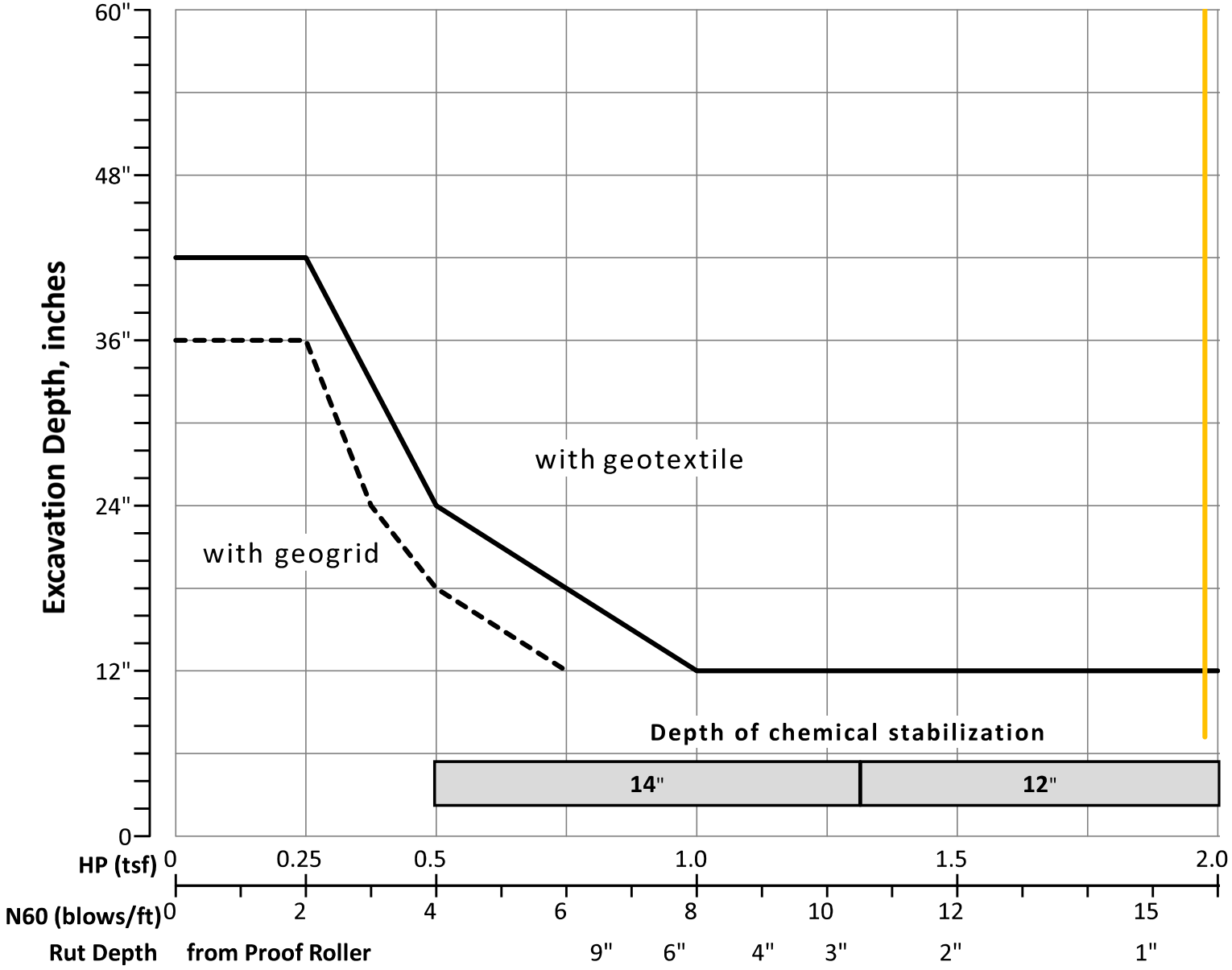
% Proposed Subgrade Surface	
Unstable & Unsuitable	7%
Unstable	7%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	26	16	4.00	27	17	10	33	23	56	13	11	6
Maximum	109	25	4.50	39	25	20	43	41	84	28	20	16
Minimum	7	7	1.50	22	14	7	6	2	8	4	6	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	3	9	2	0	0	0	0	0	36	0	0	17	3	0	2	0	0	72
Percent	0%	4%	13%	3%	0%	0%	0%	0%	0%	50%	0%	0%	24%	4%	0%	3%	0%	0%	100%
% Rock|Granular|Cohesive	0%	69%									31%								100%
Surface Class Count	0	3	9	2	0	0	0	0	0	27	0	0	11	2	0	0	0	0	54
Surface Class Percent	0%	6%	17%	4%	0%	0%	0%	0%	0%	50%	0%	0%	20%	4%	0%	0%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.00	0.50	☐ HP
15.89	6.00	☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FRA-071/270-28.27/25.99A
105435

Adding a ramp lane along I-270 Eastbound ramp to I-71 Northbound Ramp M

NEAS, INC.

Prepared By: ZM
Date prepared: Monday, October 25, 2021

Chunmei (Melinda) He, Ph.D, P.E.
2800 Corporate Exchange Drive
Suite 240
Columbus, OH, 43231
614-714-0299
che@neasinc.com

NO. OF BORINGS: 7

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-018-0-21	Ramp M	84+55	17	RT	CME 45B	82	921.6	920.0	1.5 C
2	B-019-0-21	Ramp M	88+34	26	LT	CME 45B	82	920.4	917.7	2.6 C
3	B-020-0-21	Ramp M	92+14	25	RT	CME 45B	82	917.4	915.5	1.9 C
4	B-021-0-21	Ramp M	96+33	44	RT	CME 45B	82	918.6	916.0	2.5 C
5	B-022-0-21	Ramp M	99+81	43	RT	CME 45B	82	920.6	918.7	2.0 C
6	B-023-0-21	Ramp M	103+52	22	LT	CME 45B	82	923.6	921.5	2.1 C
7	B-024-0-21	Ramp M	107+35	10	LT	CME 45B	82	925.6	924.7	0.9 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	0.0	1.5	20		4.5	36	20	16	29	26	55	12	16	A-6b	6	213					
	018-0	SS-2	3.0	4.5	1.5	3.0	15		2.25	50	22	28	33	40	73	25	19	A-7-6	17			Mc			
	21	SS-3	4.5	6.0	3.0	4.5	10		1.75							27	18	A-7-6	16						
		SS-4	6.0	7.5	4.5	6.0	12	10	1.5							22	18	A-7-6	16						
2	B	SS-1	1.5	3.0	-1.1	0.4	19		4.5	31	17	14	36	25	61	13	14	A-6a	7	633					
	019-0	SS-2	3.0	4.5	0.4	1.9	19		4.5	28	17	11	38	26	64	14	14	A-6a	6						
	21	SS-3	4.5	6.0	1.9	3.4	15		4.5							16	14	A-6a	10						
		SS-4	6.0	7.5	3.4	4.9	15	15	4.5							15	14	A-6a	10						
3	B	SS-1	1.5	3.0	-0.4	1.1	29		4.5	26	17	9	35	25	60	12	12	A-4a	5	393					
	020-0	SS-2	3.0	4.5	1.1	2.6	23		4.5	27	16	11	34	25	59	12	14	A-6a	5						
	21	SS-3	4.5	6.0	2.6	4.1	10		3.75							13	16	A-6b	16						
		SS-4	6.0	7.5	4.1	5.6	11	10	2.25							14	16	A-6b	16						
4	B	SS-1	1.5	3.0	-1.0	0.5	20		4.5	32	18	14	36	30	66	13	14	A-6a	8	293					
	021-0	SS-2	3.0	4.5	0.5	2.0	23		4.5	29	18	11	37	28	65	14	14	A-6a	6						
	21	SS-3	4.5	6.0	2.0	3.5	20		4.5							15	14	A-6a	10						
		SS-4	6.0	7.5	3.5	5.0	16	16	4.5							15	14	A-6a	10						
5	B	SS-1	1.5	3.0	-0.5	1.0	16									6	6	A-1-b	0						
	022-0	SS-2	3.0	4.5	1.0	2.5	12			NP	NP	NP	14	4	18	6	6	A-1-b	0						
	21	SS-3	4.5	6.0	2.5	4.0	11		4.25	38	19	19	39	36	75	18	16	A-6b	12	240					
		SS-4	6.0	7.5	4.0	5.5	10	10								11	6	A-1-a	0						
6	B	SS-1	1.5	3.0	-0.6	0.9	20		4.5							14	16	A-6b	16	533					
	023-0	SS-2	3.0	4.5	0.9	2.4	18		4.5	35	19	16	31	27	58	16	16	A-6b	7						
	21	SS-3	4.5	6.0	2.4	3.9	30		4.25							11	16	A-6b	16						
		SS-4	6.0	7.5	3.9	5.4	34	18		32	18	14	22	16	38	9	14	A-6a	2						
7	B	SS-1	1.5	3.0	0.6	2.1	22		4.5							16	16	A-6b	16						
	024-0	SS-2	3.0	4.5	2.1	3.6	26		4.5	26	16	10	37	25	62	11	11	A-4a	5	1967					
	21	SS-3	4.5	6.0	3.6	5.1	29		4.5	25	16	9	38	22	60	10	11	A-4a	5						
		SS-4	6.0	7.5	5.1	6.6	35	22	4.5							10	10	A-4a							

PID: 105435

County-Route-Section: FRA-071/270-28.27/25.99A

No. of Borings: 7

Geotechnical Consultant: NEAS, INC.

Prepared By: ZM

Date prepared: 10/25/2021

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

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

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	18%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	7%	1 < HP ≤ 2	7%
$N_{60} \geq 20$	46%	HP > 2	79%
M+	4%		
Rock	0%		
Unsuitable	0%		

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

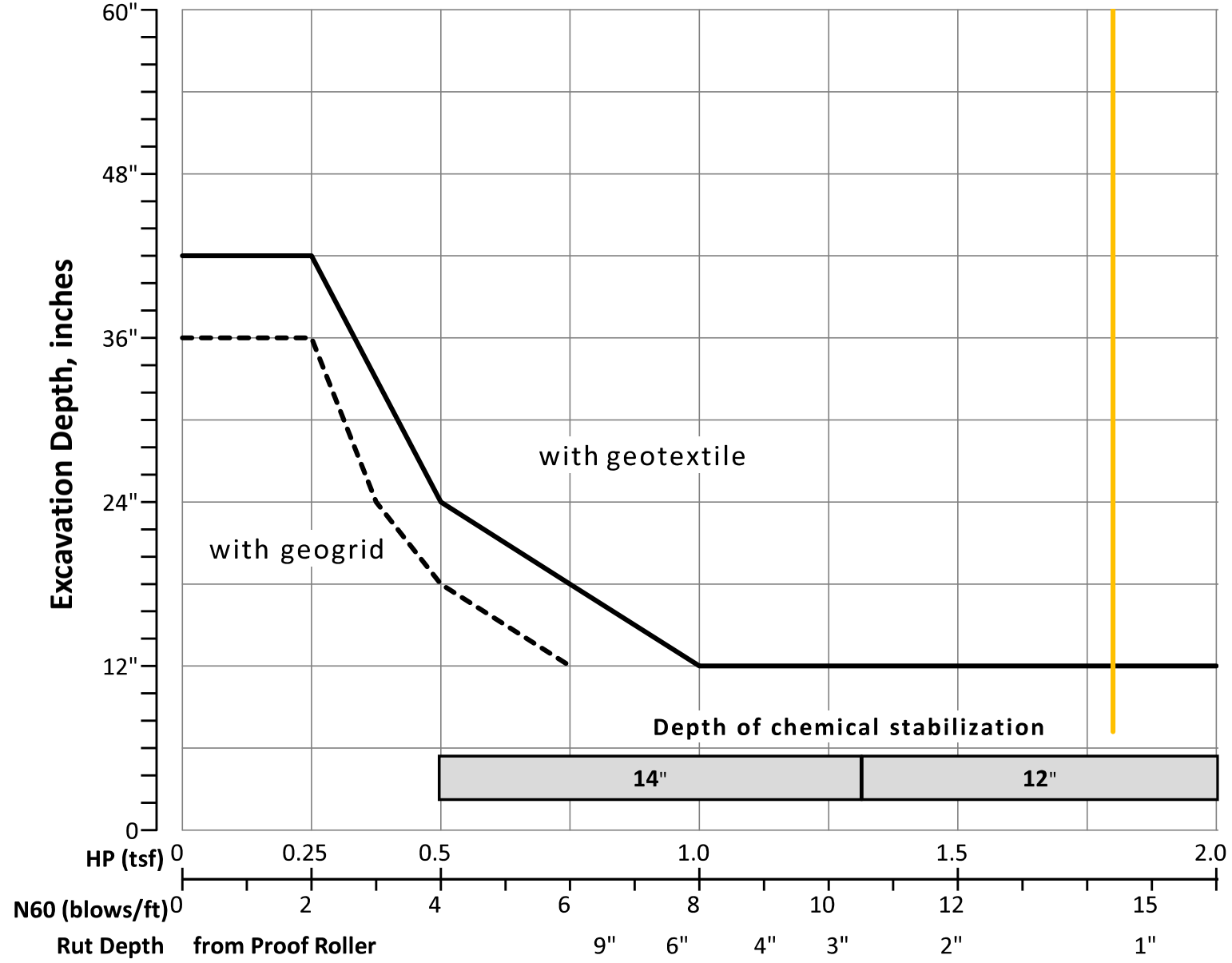
% Proposed Subgrade Surface	
Unstable & Unsuitable	5%
Unstable	5%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	19	14	4.02	32	18	14	33	25	58	14	14	9
Maximum	35	22	4.50	50	22	28	39	40	75	27	19	17
Minimum	10	10	1.50	25	16	9	14	4	18	6	6	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	1	2	0	0	0	0	0	0	4	0	0	10	8	0	3	0	0	28
Percent	0%	4%	7%	0%	0%	0%	0%	0%	0%	14%	0%	0%	36%	29%	0%	11%	0%	0%	100%
% Rock|Granular|Cohesive	0%	25%									75%								100%
Surface Class Count	0	0	2	0	0	0	0	0	0	2	0	0	7	7	0	1	0	0	19
Surface Class Percent	0%	0%	11%	0%	0%	0%	0%	0%	0%	11%	0%	0%	37%	37%	0%	5%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.02	0.50	☐ HP
14.43	6.00	☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FRA-071/270-28.27/25.99A
105435

Adding a ramp lane along I-270 Eastbound ramp to I-71 Northbound Ramp P

NEAS, INC.

Prepared By: ZM
Date prepared: Monday, October 25, 2021

Chunmei (Melinda) He, Ph.D, P.E.
2800 Corporate Exchange Drive
Suite 240
Columbus, OH, 43231
614-714-0299
che@neasinc.com

NO. OF BORINGS: 7

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-022-0-21	Ramp P	999+85	65	RT	CME 45B	82	920.6	919.0	1.6 C
2	B-023-0-21	Ramp P	1003+59	17	RT	CME 45B	82	923.6	922.3	1.3 C
3	B-024-0-21	Ramp P	1007+41	44	RT	CME 45B	82	925.6	925.5	0.1 C
4	B-025-0-21	Ramp P	1010+99	0	LT	CME 45B	82	935.5	933.1	2.4 C
5	B-026-0-21	Ramp P	1018+06	17	LT	CME 45B	82	928.1	926.0	2.1 C
6	B-027-0-21	Ramp P	1022+01	52	LT	CME 45B	82	913.7	912.0	1.7 C
7	B-001-0-21	Ramp P	1024+58	57	LT	CME 45B	82	913.0	909.9	3.1 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	-0.1	1.4	16									6	6	A-1-b	0						
	022-0	SS-2	3.0	4.5	1.4	2.9	12			NP	NP	NP	14	4	18	6	6	A-1-b	0						
	21	SS-3	4.5	6.0	2.9	4.4	11		4.25	38	19	19	39	36	75	18	16	A-6b	12	240					
		SS-4	6.0	7.5	4.4	5.9	10	10								11	6	A-1-a	0						
2	B	SS-1	1.5	3.0	0.2	1.7	20		4.5							14	16	A-6b	16	533					
	023-0	SS-2	3.0	4.5	1.7	3.2	18		4.5	35	19	16	31	27	58	16	16	A-6b	7						
	21	SS-3	4.5	6.0	3.2	4.7	30		4.25							11	16	A-6b	16						
		SS-4	6.0	7.5	4.7	6.2	34	18		32	18	14	22	16	38	9	14	A-6a	2						
3	B	SS-1	1.5	3.0	1.4	2.9	22		4.5							16	16	A-6b	16						
	024-0	SS-2	3.0	4.5	2.9	4.4	26		4.5	26	16	10	37	25	62	11	11	A-4a	5	1967					
	21	SS-3	4.5	6.0	4.4	5.9	29		4.5	25	16	9	38	22	60	10	11	A-4a	5						
		SS-4	6.0	7.5	5.9	7.4	35	22	4.5							10	10	A-4a							
4	B	SS-1	1.5	3.0	-0.9	0.6	14		4.5							10	10	A-4a	8						
	025-0	SS-2	3.0	4.5	0.6	2.1	5		2.5	25	15	10	39	23	62	13	10	A-4a	5	1227		N_{60} & Mc		**21"**	
	21	SS-3	4.5	6.0	2.1	3.6	8		3.75	24	15	9	38	24	62	13	10	A-4a	5						
		SS-4	6.0	7.5	3.6	5.1	10	5	4							13	10	A-4a	8						
5	B	SS-1	1.5	3.0	-0.6	0.9	8		3	32	17	15	37	32	69	17	14	A-6a	9	673		N_{60} & Mc		**12"**	
	026-0	SS-2	3.0	4.5	0.9	2.4	10		3.75	33	19	14	38	33	71	19	14	A-6a	9			N_{60} & Mc		**12"**	
	21	SS-3	4.5	6.0	2.4	3.9	5		3.5							13	14	A-6a	10						
		SS-4	6.0	7.5	3.9	5.4	5	5	2.5							17	14	A-6a	10						
6	B	SS-1	1.5	3.0	-0.2	1.3	7			NP	NP	NP	19	14	33	10	10	A-2-4	0			N_{60}		**15"**	
	027-0	SS-2	3.0	4.5	1.3	2.8	19			34	20	14	27	21	48	12	15	A-6a	4	807					
	21	SS-3	4.5	6.0	2.8	4.3	18									16	14	A-6a	10						
		SS-4	6.0	7.5	4.3	5.8	18	7								14	14	A-6a	10						
7	B	SS-1	1.5	3.0	-1.6	-0.1	19			NP	NP	NP	24	15	39	10	11	A-4a	1						
	001-0	SS-2	3.0	4.5	-0.1	1.4	20		4.5	39	19	20	43	41	84	21	16	A-6b	12	233		Mc			
	21	SS-3	4.5	6.0	1.4	2.9	29		4.5							18	16	A-6b	16						
		SS-4	6.0	7.5	2.9	4.4	26	20	3.75							25	16	A-6b	16						

PID: 105435

County-Route-Section: FRA-071/270-28.27/25.99A

No. of Borings: 7

Geotechnical Consultant: NEAS, INC.

Prepared By: ZM

Date prepared: 10/25/2021

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

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

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	11%	HP ≤ 0.5	0%
$N_{60} < 12$	37%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	7%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	37%	HP > 2	70%
M+	15%		
Rock	0%		
Unsuitable	0%		

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

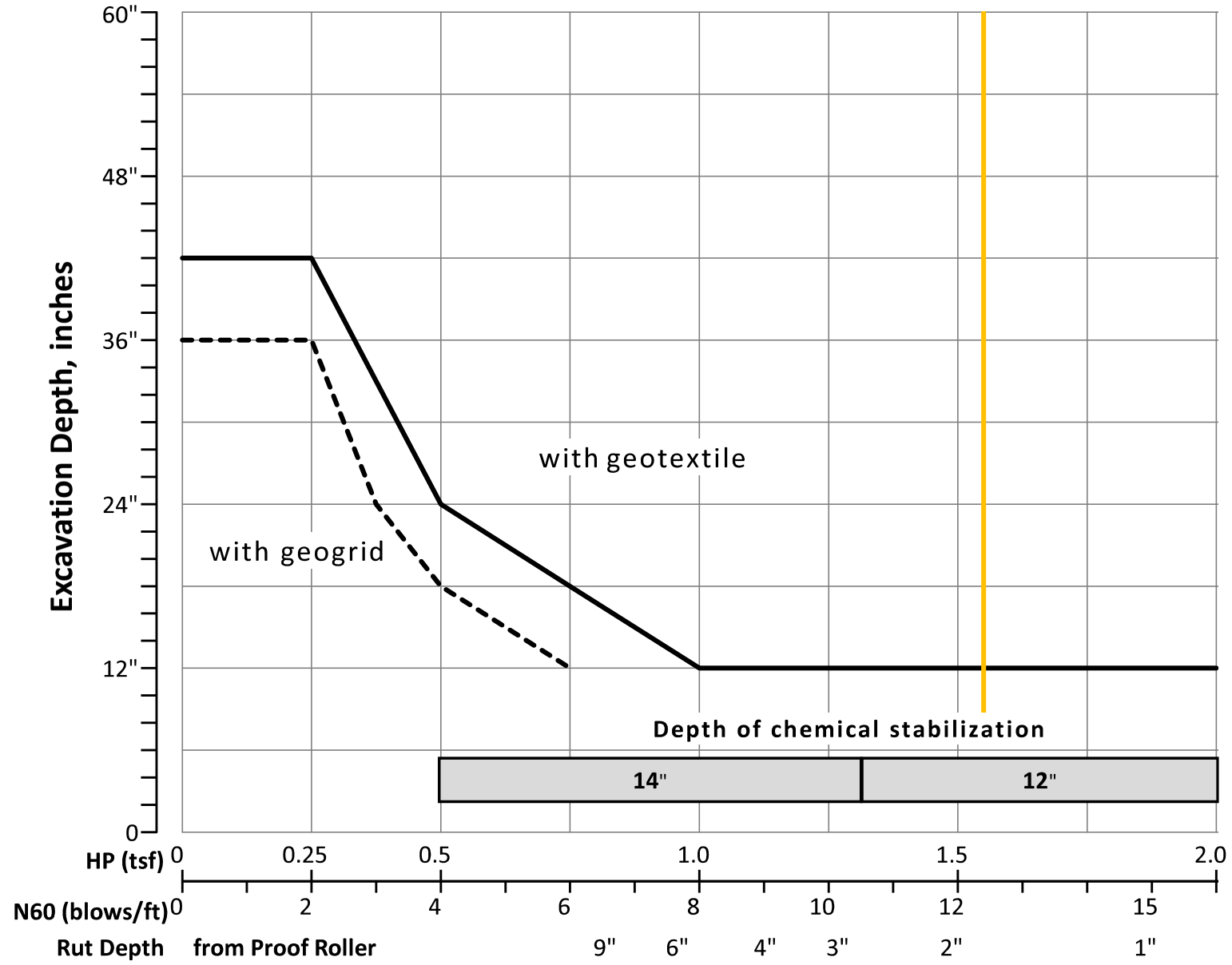
% Proposed Subgrade Surface	
Unstable & Unsuitable	31%
Unstable	31%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	17	12	3.99	31	18	14	32	24	57	14	13	8
Maximum	35	22	4.50	39	20	20	43	41	84	25	16	16
Minimum	5	5	2.50	24	15	9	14	4	18	6	6	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	1	2	1	0	0	0	0	0	7	0	0	8	8	0	0	0	0	27
Percent	0%	4%	7%	4%	0%	0%	0%	0%	0%	26%	0%	0%	30%	30%	0%	0%	0%	0%	100%
% Rock|Granular|Cohesive	0%	41%									59%								100%
Surface Class Count	0	0	2	1	0	0	0	0	0	4	0	0	4	5	0	0	0	0	16
Surface Class Percent	0%	0%	13%	6%	0%	0%	0%	0%	0%	25%	0%	0%	25%	31%	0%	0%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.99	0.50	☐ HP
12.43	6.00	☐ N60L

Average HP
Average N_{60L}