Subgrade Exploration Report - Final
GRE-68-13.51 Intersection Improvements
Greene County, Ohio
S&ME Project No. 212619

PREPARED FOR:

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July 7, 2022

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Attention: Mr. Brian K. Moore, P.E.

Reference: **Subgrade Exploration Report – Final**
GRE-68-13.51 Intersection Improvements
PID 111657 Greene County, Ohio
S&ME Project No. 212619

Mr. Moore,

In accordance with our proposal dated March 22, 2021, which was authorized by the Arcadis US, Inc. Subcontract Agreement executed on May 27, 2021, S&ME, Inc. (S&ME) has completed a Subgrade Exploration for the proposed intersection improvements planned at the intersection of US 68 and SR 235 in Greene County, Ohio (see Vicinity Map, Figure 1 in Appendix A).

In accordance with Section 701 of the current ODOT Specifications for Geotechnical Explorations (SGE), S&ME is herewith submitting a "final" version of this report after being advised by Arcadis on June 27, 2022, that no ODOT review comments were received. This final report contains the information obtained from our borings, laboratory test results, as well as analyses and recommendations for this project. Final ODOT Soil Profile plan sheets are also included in PDF form with this submission.

We appreciate having been given the opportunity to be of service. Please do not hesitate to contact us if you have any questions regarding this submission.

Respectfully,

S&ME, Inc.

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1.0 Executive Summary

S&ME understands ODOT proposes to improve the existing skewed intersection of US 68 and SR 235 in Greene County, Ohio, by providing a three-legged roundabout. Based on plan information provided by Arcadis, S&ME understands the roundabout will be shifted slightly east of the existing intersection, with the roadway approaches extending roughly 400 feet north and south of the intersection on US 68, and approximately 300 feet northwest on SR 235. Preliminary profile information indicates that minor profile adjustment is anticipated on the roadway approaches, but up to 4 feet of fill will be required on the east side of the roundabout.

S&ME performed three (3) pavement subgrade borings through the existing US 68 and SR 235 pavement, and one (1) roadway embankment boring for this subgrade exploration. ODOT District 8 also authorized the use of three (3) historic borings from 2004/2005 that were performed on SR 235 on this project.

Four (4) of the seven borings were drilled through the existing pavement. See Table 5.1 on page 4 for the thicknesses of existing pavement encountered.

Below the existing pavement materials and 4 inches of topsoil/rootmat in Boring B-002-0-21, Borings B-001-0-21 and B-003-0-21 encountered 1.9 to 2.2 feet of existing fill consisting of very-stiff to hard SILT AND CLAY (A-6a). Existing fill was also noted in historic Borings B-005-0-04 and B-007-0-05. Boring B-007-0-05 encountered 1.5 feet of dark-brown SANDY SILT (A-4a) over 1.5 feet of reddish-brown CLAY (A-7-6) and 1.5 feet of GRAVEL WITH SAND AND SILT (A-2-4). Boring B-005-0-04 was terminated after encountering 8.2 feet of brown/grayish-brown SILT AND CLAY (A-6a).

Beneath the fill, the remaining borings encountered natural soil consisting of discontinuous layers of stiff to hard brown and gray SANDY SILT (A-4a), stiff to very-stiff SILTY CLAY (A-6b) and CLAY (A-7-6), and granular soil consisting of loose to dense brown and gray GRAVEL (A-1-a), GRAVEL WITH SAND (A-1-b), COARSE AND FINE SAND (A-3a), GRAVEL WITH SAND AND SILT (A-2-4), and GRAVEL WITH SAND, SILT AND CLAY (A-2-6, A-2-7).

No groundwater was observed in the borings.

Based on conditions encountered in the borings, a brief summary of recommendations with respect to the subgrade conditions/remediation, new embankment construction, and pavement design is presented as follows:

- Based on the ODOT Geotechnical Bulletin 1 (GB1) spreadsheet (Ver. 14.5, dated 1/18/19), the average California Bearing Ratio (CBR) of the existing/anticipated subgrade soils encountered during this exploration is 8%.
- The results of the ODOT GB1 spreadsheet indicate the subgrade soils in two (2) of the seven (7) subgrade borings (28.5%) possessed characteristics defined as problematic. ODOT GB1 recommends that global subgrade remediation be considered when 30% of the subgrade requires remediation.
- No soils considered unsuitable by classification and requiring removal were encountered.
- Because of the presence of coarse-grained granular soil at the subgrade level in two (2) borings, and the need for 3 to 4 feet of new fill on the eastern portion of the roundabout, S&ME recommends that subgrade remediation consisting of Item 204 “excavate and replace” be used to remediate portions of the subgrade exhibiting unstable conditions. See Table 6.1 on Page 7 for detailed recommendations.

2.0 Introduction

Based on email and verbal information provided by Arcadis US, Inc. (Arcadis), S&ME understands that a roundabout is being proposed to improve the existing skewed intersection of US 68 and SR 235 in Greene County, Ohio. Plan drawings provided by Arcadis indicate the roundabout will be positioned at the existing intersection, but with the roundabout shifted slightly to the east of existing US 68. The improvements to the roadway approaches will extend approximately 400 feet south and north from the intersection along US 68, and roughly 300 feet northwest along SR 235. Profile information indicates that as much as 3 to 4 feet of embankment fill will need to be placed to attain the proposed profile on the eastern portion of the roundabout, whereas the majority of the roadway approaches will require only minor profile adjustments.

The Subgrade Exploration for this project was performed in general accordance with the July 2021 updates to the ODOT SGE.

3.0 Geology and Observations of the Project

3.1 Available Information

A review of the ODOT Transportation Information Management System located the logs of three roadway borings performed in 2004 and 2005 as part of a roadway improvement and bridge replacement project (GRE-68/235-14.26/0.00) extending northwest from the US 68 and SR 235 intersection. This exploration included three (3) 10-foot-deep embankment borings on SR 235 immediately north of US 68, including one boring drilled through the existing pavement. Two (2) of these borings included 7.5 feet of continuous SPT sampling. As all three (3) of these borings were located within the existing embankment, S&ME suggested that Arcadis contact ODOT District 8 to see if ODOT District 8 would be amenable to re-using these boring logs on the current project, provided additional borings were performed. ODOT District 8 agreed that these borings could be re-used. The approximate locations of the historic borings are shown on the Plan of Borings included as Figure 2 of Appendix A. These borings are designated as B-005-0-04, B-006-0-05, and B-007-0-05, and the logs of these borings are included as Plates 8 through 10 of Appendix A.

3.2 Geology

Geologic references indicate that this project site is located within the Southern Ohio Loamy Till Plain physiographic region, where the soil overburden consists primarily of loamy, high-lime Wisconsinan-age till, outwash, and loess. The uppermost bedrock consists of Lower Paleozoic-age carbonate rocks. ODNR water well log information indicates the uppermost bedrock near the US 68 and SR 235 intersection is more than 100 feet below the existing ground surface.

3.3 Reconnaissance

On June 17, 2021, S&ME performed a site reconnaissance of the project site to observe current site conditions, look for potential utility conflicts, and to assess traffic control requirements. Evidence of multiple existing above and below ground utilities were noted in the project area. The existing US 68 and SR 235 pavements were observed to be generally in good condition with few longitudinal and transverse cracking throughout, increasing in occurrence near the intersection.

4.0 Exploration

4.1 Historic Investigation

On July 6, 2004, and November 21, 2005, three (3) roadway embankment borings (designated B-005-0-04, B-006-0-05, and B-007-0-05) were performed as part of a roadway improvement and bridge replacement project extending northward from the US 68 and SR 235 intersection (GRE-68/235-14.26/0.00, PID No. 24531). These borings were located just northwest of the existing intersection with US 68. The approximate locations of these historic borings are shown on the Plan of Borings included as Figure 2 of Appendix A. Current stationing and offset, and elevations at these historic borings were provided by Arcadis.

Disturbed but representative soil samples were obtained in these borings. Ten (10) feet of 2½-foot interval SPT sampling was attempted beginning immediately below the pavement for Boring B-005-0-04. Seven and one-half (7½) feet of continuous SPT sampling was attempted beginning at the existing ground surface for Borings B-006-0-05 and B-007-0-05. All of the borings were terminated at a depth of 10 feet. As the type of drilling rig used to complete these historic borings was not recorded on the logs, S&ME has utilized the raw blow-counts (N-value) throughout the remainder of this report.

4.2 Field Investigation

On October 12, 2021, three (3) ODOT Type A existing pavement subgrade borings (designated as B-001-0-21, B-003-0-21, and B-004-0-21) and one (1) ODOT Type B roadway boring (designated B-002-0-21) were performed for this Subgrade Exploration. The approximate locations of the borings are shown on the Plan of Borings included as Figure 2 of Appendix A. The borings were generally spaced at 400-foot maximum horizontal intervals. Surveyed locations, stations, offsets, and elevations were provided by Arcadis.

The borings were performed by a truck-mounted drilling rig, using a 4½-inch O.D. continuous flight auger to advance the borings between sampling attempts. Disturbed but representative soil samples were obtained by lowering a 2-inch O.D. split-barrel sampler to the bottom of the boring and then driving the sampler into the soil with blows from a 140-pound hammer freely falling 30 inches (ASTM D1586 - Standard Penetration Test). Six (6) feet of continuous SPT sampling was attempted beginning beneath the top of subgrade for the existing pavement subgrade borings. Ten (10) feet of 2½-foot interval SPT sampling was attempted beginning at the existing ground surface for the roadway boring. SPT samples were examined immediately after recovery and representative portions were preserved in airtight glass jars.

In accordance with the current ODOT SGE, the hammer system on the drill rig had been calibrated on March 1, 2021, in accordance with ASTM D 4633 to determine the drill rod energy ratio (82.0%). At the completion of drilling, the borings were backfilled in accordance with ODOT specifications using cuttings mixed with bentonite chips. Where advanced through existing pavement, the surface of the roadway was repaired using cold-patch asphalt.

In the field, experienced S&ME personnel performed the following: 1) examined all samples recovered from the borings; 2) preserved representative portions of all samples in airtight glass jars; 3) prepared a log of each boring; 4) made seepage and groundwater observations; 5) made hand-penetrometer measurements in soil specimens exhibiting cohesion; and, 6) provided liaison between the field work and the Project Engineer so the exploration program could be modified in the event unusual or unexpected subsurface conditions were encountered. All recovered samples were transported to the soil laboratory of S&ME for further examination and testing

4.3 Laboratory Testing

In the laboratory, soil samples retrieved from the 2021 borings were all subjected to moisture-content testing, and classification testing (liquid/plastic limit determinations and grain-size analyses) was performed on two (2) soil samples recovered from each boring. In addition, sulfate content testing was performed on a selected representative specimen obtained from within 3 feet of the proposed pavement subgrade level in the borings. The results of these laboratory tests are recorded numerically on individual boring logs.

Based upon the results of the laboratory testing program, the field logs were modified, if necessary, and copies of the laboratory corrected boring logs are submitted as Plates 4 through 7 of Appendix A. Shown on these logs are: descriptions of the soil stratigraphy encountered; depths from which samples were preserved; sampling efforts (blow-counts) required to obtain the specimens in the borings; calculated N_{60} values; laboratory testing results; seepage and groundwater observations made at the time of drilling; and, values of hand-penetrometer measurements made in soil samples exhibiting cohesion. For your reference, hand-penetrometer values are roughly equivalent to the unconfined compressive strength of the cohesive fraction of the soil sample.

Soils have been classified in accordance with Section 603 of the ODOT SGE and described in general accordance with Section 602. An explanation of the symbols and terms used on the boring logs, definitions of the special adjectives used to denote the minor soil components, and information pertaining to sampling and identification are presented on Plate 3 of Appendix A. Group Indices determined from the results of the laboratory testing program are also provided on the boring logs.

5.0 Findings

5.1 Existing Pavement Section Thicknesses

Three (3) current borings and one (1) historic boring were performed within existing pavement. Table 5-1 presents the thicknesses of existing pavement materials encountered in each boring.

Table 5-1: Summary of Existing Pavement Material Thicknesses

Boring No.	Asphalt (in.)	Concrete (in.)	Aggregate Base (in.)
B-001-0-21	4	6	3
B-003-0-21	4	--	6
B-004-0-21	4	--	*
B-005-0-04	12	--	10

* A definitive granular base course layer was not identified, but granular fill (A-1-b) was encountered below the asphalt to a depth of 2.1 feet.

5.2 Subsurface Stratigraphy

Below the existing pavement materials and 4 inches of topsoil/rootmat in Boring B-002-0-21, Borings B-001-0-21 and B-003-0-21 encountered 1.9 to 2.2 feet of existing fill consisting of very-stiff to hard SILT AND CLAY (A-6a), which was underlain by 2.0 feet of medium-dense GRAVEL WITH SAND, SILT, AND CLAY (A-2-7) in Boring B-003-

0-21. Existing fill was also noted in historic Borings B-005-0-04 and B-007-0-05. Boring B-007-0-05 encountered 1.5 feet of dark-brown SANDY SILT (A-4a) over 1.5 feet of reddish-brown CLAY (A-7-6) and 1.5 feet of GRAVEL WITH SAND AND SILT (A-2-4). Boring B-005-0-04 was terminated after encountering 8.2 feet of brown/grayish-brown SILT AND CLAY (A-6a).

Beneath the fill, the remaining borings encountered natural soil consisting of discontinuous layers of stiff to hard brown and gray SANDY SILT (A-4a), stiff to very-stiff SILTY CLAY (A-6b) and CLAY (A-7-6), and granular soil consisting of loose to dense brown and gray GRAVEL (A-1-a), GRAVEL WITH SAND (A-1-b), COARSE AND FINE SAND (A-3a), GRAVEL WITH SAND AND SILT (A-2-4), and GRAVEL WITH SAND, SILT AND CLAY (A-2-6, A-2-7).

5.3 Groundwater Observations

No groundwater was encountered in any of the borings.

5.4 Soil Sulfate Test Results

Results of the sulfate content testing (ODOT Supplement 1122) performed on soil samples obtained near the anticipated subgrade level in Borings B-001-0-21 through B-004-0-21 ranged from 34 to 84 parts per million (ppm). These results are below the threshold value of 5,000 ppm that has been identified by ODOT GB1 as the sulfate content concentration above which chemical stabilization should not be performed. The results of these tests are reported on the individual borings logs, and a summary of the test results is presented on Plate 11 of Appendix A.

6.0 Analyses and Recommendations

6.1 General

S&ME understands a three-legged roundabout is being proposed to improve the existing skewed intersection of US 68 and SR 235 in Greene County, Ohio. New embankment fill will be required to attain the proposed profile on the eastern side of the roundabout, with improvements to the approach roadways extending roughly 400 feet north and south of the roundabout along US 68, and approximately 300 feet northwest of the roundabout along SR 235. Minimal profile adjustments are anticipated on the approach roadways, although some embankment widening will be required for horizontal alignment modifications. Recommendations for embankment construction and subgrade remediation, along with subgrade support parameters for use during new pavement section thickness design are presented in the following sections of this report.

6.2 Subgrade Analyses

6.2.1 ODOT Geotechnical Bulletin GB1 Analysis

The ODOT *Geotechnical Bulletin GB1,* "Plan Subgrades" (*GB1*) document provides a standard approach to performing explorations and assessing roadway subgrades. The associated spreadsheet (Ver. 14.5, updated 1/18/19) created by the ODOT Office of Geotechnical Engineering (OGE) is used to estimate roadway subgrade support parameters and identify areas requiring remediation. The spreadsheet (see Appendix B) summarizes the soil type (by ODOT/HRB classification), group indices, sample depth, blow-counts, Atterberg Limits, and sulfate content values of the proposed subgrade soils encountered in the borings drilled for this project. Using this data,

this table computes an average of the estimated values of the California Bearing Ratio (CBR) for the soils encountered at or below the anticipated subgrade level of the proposed roadway profile.

ODOT *GB1* considers subgrade soils to be "unsuitable" either by classification (A-4b, A-2-5, A-5, A-7-5, A-8a, A-8b), or if the Liquid Limit value is greater than 65%. In general, these unsuitable soils should be completely removed or excavated to 36 inches below proposed subgrade, whichever is less, or be chemically stabilized. *GB1* also considers subgrade soil to be potentially "unstable" and possibly requiring subgrade remediation by comparing the laboratory-measured moisture content to the estimated optimum moisture content of the subgrade soil and/or by correlations to the normalized blow-count (N_{60}) and the lowest N value (N_{60L}) from SPT sampling.

Based on these comparisons and correlations, the *GB1* spreadsheet provides alternative approaches to remediate and establish a stable soil subgrade using either "excavate and replace" (ODOT *Construction and Materials Specifications* (*CMS*) Item 204), or chemical stabilization (*CMS* Item 206 and Supplement 1120). However, soils with a sulfate content above 5,000 ppm are generally prohibited from being chemically stabilized.

The subgrade remediation depths identified by the GB1 spreadsheet presented in Appendix B are based on the conditions encountered in the borings during this subsurface exploration, and the results of the three (3) historic borings performed in 2004 and 2005. However, because the required amount of remediation is dependent on the moisture content of the subgrade soil at the time of construction, ODOT *GB1* states that the ultimate decision on required remediation depths and limits should be based on observations during either proofrolling or test-rolling operations.

6.2.2 Subgrade Support Parameters

Based on the available profile information, the proposed roadway approaches will require minimal adjustment of the subgrade level, however, approximately 3 to 4 feet of fill placement will be required on the eastern portion of the new roundabout. Based on the anticipated vertical profile, the following average California Bearing Ratio (CBR) was computed by the ODOT *GB1* spreadsheet for the anticipated subgrade soils encountered during this exploration:

$$CBR = 8\%$$

Based on this average value and Section 203.1 of the current ODOT Pavement Design Manual, the following value of Resilient Modulus (M_R) correlates to this average CBR value.

$$M_R = 9{,}600 \text{ psi}$$

These subgrade support values may be used during new pavement thickness design for this project provided that the entire proposed pavement subgrade is prepared in strict accordance with Items 204 of the 2019 ODOT *CMS*, and that all borrow soil placed within 3 feet of the final subgrade elevation of the new pavement provides average subgrade support parameters which meet or exceed the above values. This subgrade evaluation also assumes that the subgrade for the new roadway is composed of the materials encountered in the borings. If, at the time of construction, it is determined that the subgrade consists of materials different than those encountered in the borings, the pavement design subgrade criteria should be reviewed and, if necessary, modified.

6.2.3 *Unsuitable Subgrade Soils*

None of the borings, either current or historic, encountered soil within 3 feet of the proposed subgrade level which ODOT *GB1* considers to be unsuitable either by classification (A-4b, A-2-5, A-5, A-7-5, A-8a, A-8b), or which has a Liquid Limit value exceeding 65%. Also, none of the sulfate test results exceeded 100 ppm, well below the threshold of 5,000 ppm above which chemical stabilization is not permitted.

6.2.4 *GB1 Subgrade Remediation Recommendations*

The *GB1* analysis spreadsheet included as Plates 1 through 5 of Appendix B summarizes the laboratory-measured moisture content of the samples obtained from each boring with respect to their estimated optimum moisture contents, along with the lowest N value (N_{60L}) obtained from the Standard Penetration Tests performed in each of these borings. This table also indicates the depths of recommended Item 204 "excavate and replace" remediation at each boring location, along with an overall assessment of the suitability of various types of chemical stabilization on this project.

The results of the *GB1* analysis indicate that two (2) of the seven (7) borings (28.5%) encountered soil at the anticipated subgrade level which possessed characteristics defined as problematic (excessive soil moisture content or a low N_{60} value) and which may require remediation by the procedures recommended in *GB1*. Typical options for subgrade remediation per *GB1* include either Item 204 "excavate and replace", or chemical stabilization. According to *GB1*, where 30% or more of the subgrade area requires remediation, consideration should be given to stabilizing the entire project where new pavement is proposed (global stabilization).

Because of the presence of coarse-grained granular soil at the subgrade level in two (2) borings, and the need for 3 to 4 feet of new fill on the eastern portion of the roundabout, S&ME recommends that subgrade remediation consisting of Item 204 "excavate and replace", including a geosynthetic fabric, be used to remediate portions of the subgrade exhibiting unstable conditions. Table 6-1 below presents the estimated areas of the project and the depth below the proposed subgrade elevation where the need for "excavate and replace" subgrade remediation should be anticipated based on the results of the *GB1* table.

Table 6-1: Summary of GB1 Subgrade Remediation Recommendations

Alignment	Estimated Subgrade Area	Remediation and Recommended Depth	Reference Boring
US 68	Sta. 40+50 "NR" to Sta. 207+10.10	Excavate and Replace - 12"	B-003-0-21
SR 235	Sta. 113+50 to Sta. 114+14.03	Excavate and Replace - 12"	B-005-0-04

The lateral limits of this overexcavation should extend to at least 18 inches outside the outside edge of the proposed widened pavement or paved shoulder, including beneath any curbs and gutters. The procedures of the GB1 analysis also recommend the installation of a geotextile fabric at the bottom of this overexcavation.

In accordance with Section F of ODOT *GB1*, the overexcavated areas are to be backfilled with Item 204 Granular Material Type B or C, and the overexcavation should be drained to an underdrain, catch basin or pipe. Type B material without a geotextile should be used in areas of underdrains. Also, Plan Note G121 of the ODOT L&D Manual should be included in the plans.

The estimated *GB1* subgrade remediation depths are based on conditions encountered in the borings during this subsurface exploration. However, because the required amount of remediation is dependent on the moisture content of the subgrade soil at the time of construction, ODOT *GB1* states that the ultimate decision on required remediation depths and limits should be based on observations during proof rolling operations.

6.2.5 Additional Subgrade Remediation Considerations

S&ME recommends that attention be given to the drainage swales adjacent to the existing roadway embankments, as unsuitable (e.g., soft, saturated, possibly organic) soil or very weak/unstable soil requiring remediation may be present in these areas. S&ME recommends these areas be closely examined and the lower elevations be probed prior to commencing earthwork operations, with all weak, wet, or organic soil removed prior to commencing fill placement. For this reason, Arcadis may consider including a 1- to 2-foot deep overexcavation of existing drainage swales in the project excavation quantities. These drainage swale overexcavations should be backfilled with properly compacted soil (ODOT *CMS* Item 203, or Item 204 if within 12 inches of proposed subgrade).

Existing underground utility lines are present beneath and adjacent to the existing roadways, and the type of material used and the relative compactness of backfill within any such utility trenches are unknown. Some instability of utility trench backfill may occur during earthwork operations, and some recompaction of granular utility trench backfill may become necessary prior to stabilization. Additionally, S&ME recommends that the depth of all utilities beneath the proposed pavement be determined so that the utility lines are not disturbed or damaged during subgrade stabilization or overexcavation activities.

S&ME recommends that construction traffic be minimized once the required subgrade level has been attained. Construction traffic resulting from cyclical haul routes or limited access points may increase the quantity of soil identified by final proof rolling as requiring removal, particularly during periods of moist weather.

6.3 Earthen Embankment Construction

Currently available plan and profile information from Arcadis indicates the proposed approach roadway profiles will be approximately the same as the existing approaches, and that the new roundabout embankment will requiring as much as 3 to 4 feet of new fill on the eastern side of the roundabout.

6.3.1 Embankment Foundation Preparation

Prior to commencing earthwork operations, all existing pavement, granular base, grass, topsoil, vegetation, and other miscellaneous materials be completely removed from the entire footprint of the proposed roadway embankment, including areas of realigned roadway outside the existing embankment. Following removal of these materials, it is recommended that the entire exposed subgrade and embankment foundation surface be examined by the Geotechnical Engineer of Record or their designated representative to identify any weak, wet, organic, or otherwise unsuitable soils that were not encountered during the subsurface exploration, especially in the widening/realignment areas. Any unsuitable materials identified should be removed and replaced with suitable compacted fill (Item 203, or Item 204 when within 12 inches of the proposed subgrade).

Existing underground utility lines may be present beneath and adjacent to the existing roadway, and the type of material used and the relative compactness of backfill within any such utility trenches are unknown. S&ME recommends any planned utility relocation be performed prior to proofrolling. Some instability of utility trench

backfill may occur during earthwork operations and/or proofrolling, and some recompaction of granular utility trench backfill may become necessary. Additionally, if water has accumulated within the utility backfill, the subgrade soil in the vicinity of any saturated utility trenches may have become sufficiently weak, soft, and/or wet that proofrolling may identify these additional areas as requiring overexcavation and replacement. In any case, care should be taken not to disturb any shallow utilities during proofrolling or overexcavation activities.

6.3.1.1 "At-Grade" and "Cut" Soil Subgrade Areas

Once the desired soil subgrade elevation has been attained in all "cut" and "at-grade" subgrade areas, the subgrade soil beneath the entire new roadway and shoulder pavement areas should be scarified and recompacted to a depth of 12 inches below the subgrade level in accordance with ODOT Item 204.03. During recompaction, the moisture content of the subgrade soil should be maintained or adjusted in accordance with ODOT Item 203.07.A.

Following the completion of the scarification and recompaction of the subgrade in these "cut" and "at-grade" areas, it is strongly recommended that construction traffic be restricted from traveling on the compacted subgrade until final acceptance proofrolling has been performed. Cohesive subgrade soils subjected to repeated moisture fluctuations resulting from exposure to rainfall and/or surface water runoff, may exhibit subgrade instability.

6.3.1.2 "Fill" Areas

Prior to commencing fill placement in approach roadway embankment realignment/widening areas, or where construction of new earthen embankment is required for the roundabout, S&ME recommends that consideration be given to performing Item 204.06 Proof Rolling on all exposed embankment foundation soils beneath areas where new fill embankment is required. Proof rolling, performed in accordance with Item 204.06 of the 2019 ODOT *CMS* and Section 204 of the 2017 ODOT *Construction Administration Manual of Procedures*, would assist in identifying soft, wet, or weak zones or areas of unsuitable organic or highly plastic soil that may be present in ditches, drainage swales, or wetland areas. If any such zones of soft, wet, or weak soils are present, the materials contained in these zones should be either scarified, dried, and thoroughly recompacted in place in accordance with ODOT *CMS* Item 203.07. If unsuitable organic soils are encountered, they should be completely removed and the overexcavation filled in a controlled manner with compacted, suitable embankment material (Item 203.02) and the recommendations presented in the following sections of this report.

Soft, weak, wet, or unsuitable soils that are not removed from beneath a thin layer of fill may result in difficulties in achieving the compaction percentages required for the new fill (*CMS* Items 203.07 or 204.03) such that final subgrade acceptance proofrolling may require overexcavation of the new fill where weak soils were "bridged" by a minimal thickness of new fill. Although CMS Item 203.05 permits the use of a "bridge lift" to aid in spanning soft or wet foundation areas, S&ME recommends that this practice not be permitted unless more than 3 feet of new embankment fill placement is required. Additionally, even if more than 3 feet of new fill is required in existing roadway ditches, S&ME does not recommend that a bridge lift be permitted in these areas because of the potential for organic soil in the existing ditches. Long term settlement within any organic soil left in the existing ditch lines may result in the development of a depression in the pavement surface.

6.3.2 Benching and Embankment Slopes

It is recommended that horizontal benches be cut into all existing sloping surfaces to permit placement and compaction of new fill in horizontal lifts. Where new fill is to be placed on an existing ground surface which is

sloping more steeply than 8(H):1(V), S&ME recommends that benching of the existing ground be performed in accordance with Item 203.05 of the ODOT *CMS*.

However, at locations where the existing ground surface is steeper than 4(H):1(V), S&ME recommends "Special Benching" procedures as outlined in the ODOT Geotechnical Bulletin *GB2*, "Special Benching and Sidehill Embankment Fills" and the 2017 ODOT Construction Inspection Manual of Procedures should be performed. Sketches illustrating several "typical" Special Benching configurations for sidehill fills on various slopes are included in Figures 1, 2 and 3 on pages 3 and 6 of the ODOT Geotechnical Bulletin *GB2* document.

During any required Special Benching procedures, S&ME also recommends the followings: 1) only one bench be exposed at any given time and that excavation of the next bench should not be permitted until embankment fill placement and compaction has been completed to the top of the backslope of the previous bench; and, 2) the length of any given bench that is exposed should not exceed the quantity of embankment fill which may be properly placed and compacted in one day. Additionally, S&ME recommends that the final, completed side slopes of embankments, either cut slopes or fill embankments, be constructed no steeper than 2(H):1(V).

As stated in ODOT *GB2*, wherever "Special Benching" is used, Plan Note G109 from the ODOT L&D Manual, Vol. 3, should be included in the General Notes.

6.3.3 Borrow Requirements and Compaction Criteria

New fill should consist of inorganic soil free of all miscellaneous materials, cobbles, and boulders, which is placed in uniform, thin layers and then compacted in accordance with either Item 203, *"Roadway Excavation and Embankment"*, or when within 12 inches of the proposed subgrade level, Item 204 *"Subgrade Compaction and Proofrolling"*, of the ODOT *CMS*. Borrow materials should not be placed in a frozen condition or upon a frozen surface, and any sloping surfaces on which new fill is to be placed should first be benched in accordance with either Item 203.05 or ODOT *GB2*, depending on the slope of the existing ground surface at each location.

As previously discussed in Section 6.2.2 of this report, any borrow materials to be used as new fill or backfill within 3 feet of the proposed subgrade level should be tested in the laboratory to determine that the borrow materials are capable of exhibiting subgrade support characteristics that are no less than the CBR value used during the pavement design.

Compaction requirements for the construction of earthen embankments are based on ODOT *CMS* Item 203.07.B (or Item 204.03 when within 12 inches of subgrade level), which specifies a minimum percent compaction based on the dry unit weight of the type of soil fill being placed as borrow. S&ME recommends that once the source of borrow for this project is determined, sampling and testing of this borrow material be performed prior to construction to verify the borrow soils are suitable for the planned construction.

6.3.4 Compaction/Moisture Conditioning Concerns

The cohesive soils encountered in the borings performed for this project, if exposed to inclement weather or rainfall, may rapidly absorb additional moisture, and weaken. It is imperative that these soil types not be exposed to rainfall while in a loosened state (such as during discing and drying for moisture conditioning during fill placement). Should these materials become sufficiently saturated that additional moisture conditioning is impractical, the material should be wasted. Therefore, it is recommended that moisture conditioning only be

performed when extended periods of suitable weather are anticipated, and that only the amount of borrow soil be exposed that may be moisture conditioned and properly compacted during suitable weather periods.

6.3.5 Subgrade Preparation

Once the design subgrade elevation has been attained, the subgrade should be compacted and proof rolled in accordance with Item 204 of the ODOT *CMS*, with any weak or unsuitable areas being repaired in accordance with Item 204.07.

6.4 Groundwater Considerations for Roadway Construction

Based upon observations made in the 2021 explorations, significant groundwater problems are not anticipated for the proposed roadway widening and improvements.

The new roadway subgrade should be graded to prevent surface runoff from pooling on the cohesive soils during construction as exposure of cohesive soils to moisture will result in a decrease in strength and an increase in compressibility. Soil softened by standing water or disturbed by construction activities should be removed before proceeding with construction.

The presence of water bearing granular layers or seams in the walls of any utility excavations may also result in caving or sloughing of the excavation walls. S&ME recommends that all excavations be braced, or sloped back at a safe angle, in accordance with current OSHA Excavation Regulations.

7.0 Final Considerations

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

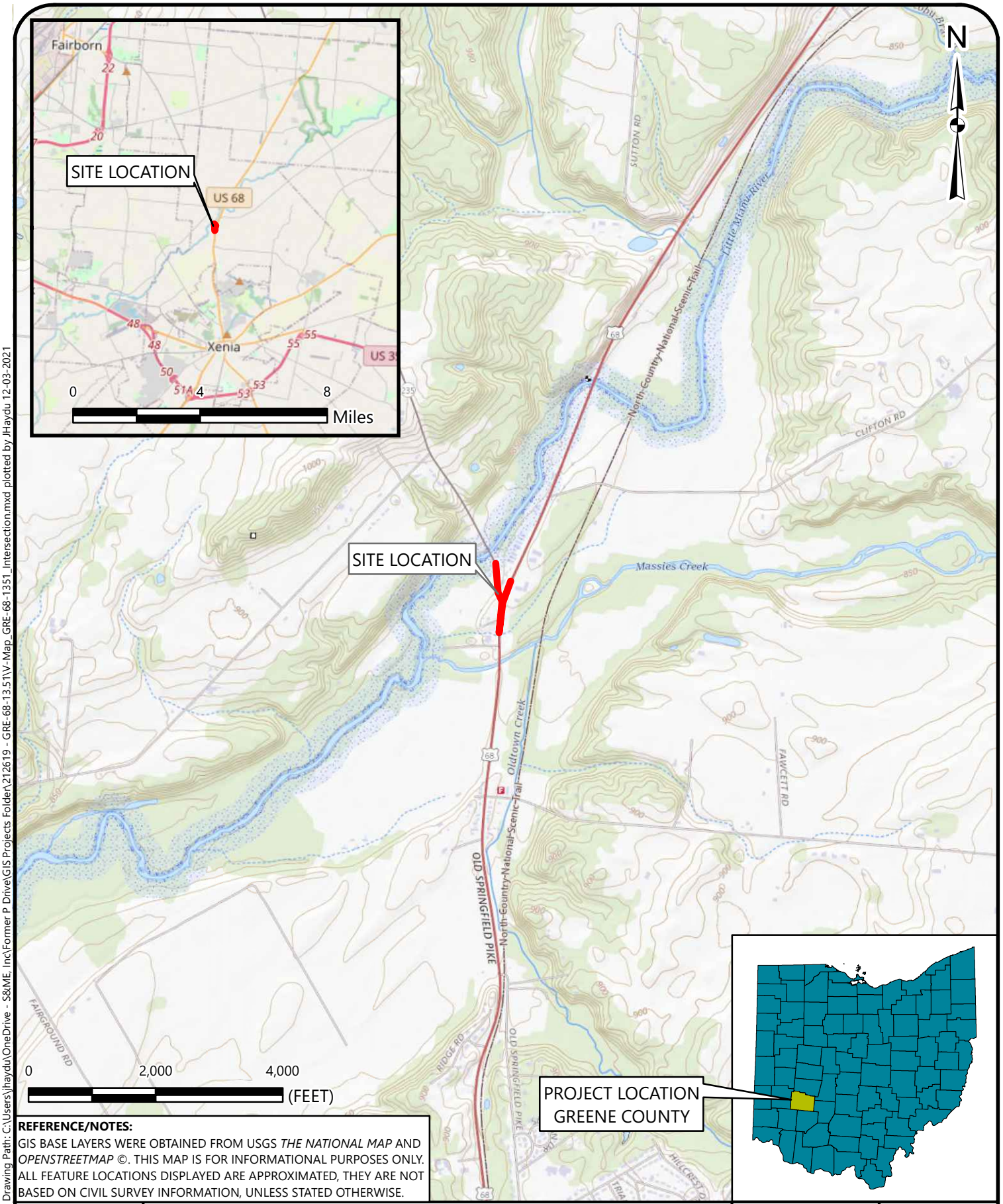
Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be retained to review the final plans and specifications to confirm that earthwork and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and construction activities.

Appendices

Appendix A



REFERENCE/NOTES:
GIS BASE LAYERS WERE OBTAINED FROM USGS *THE NATIONAL MAP* AND *OPENSTREETMAP* ©. THIS MAP IS FOR INFORMATIONAL PURPOSES ONLY. ALL FEATURE LOCATIONS DISPLAYED ARE APPROXIMATED, THEY ARE NOT BASED ON CIVIL SURVEY INFORMATION, UNLESS STATED OTHERWISE.

Drawing Path: C:\Users\jhaydu\OneDrive - S&ME, Inc\Former P Drive\GIS Projects Folder\212619 - GRE-68-13.51\V-Map_GRE-68-1351_Intersection.mxd plotted by JHaydu 12-03-2021

VICINITY MAP

GRE-68-13.51 INTERSECTION IMPROVEMENTS (PID 111657)
GREENE COUNTY, OHIO

SCALE:	1 " = 2,000 '
DATE:	12-3-21
PROJECT NUMBER	212619
FIGURE No.	1

APPROXIMATE BORING LOCATION

APPROXIMATE HISTORIC BORING LOCATION

REFERENCE/NOTES:
GIS BASE LAYERS WERE OBTAINED FROM USGS *THE NATIONAL MAP* AND *OPENSTREETMAP* ©. THIS MAP IS FOR INFORMATIONAL PURPOSES ONLY. ALL FEATURE LOCATIONS DISPLAYED ARE APPROXIMATED, THEY ARE NOT BASED ON CIVIL SURVEY INFORMATION, UNLESS STATED OTHERWISE.

Drawing Path: C:\Users\jhaydu\OneDrive - S&ME, Inc\Former P Drive\GIS Projects Folder\212619 - GRE-68-13.51\POB_GRE-68_Intersection.mxd plotted by JHaydu 12-08-2021

PLAN OF BORINGS

GRE-68-13.51 INTERSECTION IMPROVEMENTS (PID 111657)
GREENE COUNTY, OHIO

SCALE: 1 " = 200 '

DATE: 12-3-21

PROJECT NUMBER 212619

FIGURE No. 2

EXPLANATION OF SYMBOLS AND TERMS USED ON BORING LOGS FOR SAMPLING AND DESCRIPTION OF SOIL

SAMPLING DATA

 - Indicates sample was attempted within this depth interval.

2
3
5 - The number of blows required for each 6-inch increment of penetration of a "Standard" 2-inch O.D. split-barrel sampler, driven a distance of 18 inches by a 140-pound hammer freely falling 30 inches (SPT). The raw "blowcount" or "N" is equal to the sum of the second and third 6-inch increments of penetration.

N_{60} - Corrected Blowcount = [(Drill Rod Energy Ratio) / (0.60 Standard)] X N

SS - Split-barrel sampler, any size.

ST - Shelby tube sampler, 3″ O.D., hydraulically pushed.

R - Refusal of sampler in very-hard or dense soil, or on a resistant surface.

50-0.3′ - Number of blows (50) to drive a split-barrel sampler a certain distance (0.3 feet), other than the normal 6-inch increment.

DEPTH DATA

W - Depth of water or seepage encountered during drilling.

▼ AD - Depth to water in boring after drilling (AD) is terminated.

▼ 5 days - Depth to water in monitoring well or piezometer in boring a certain number of days (5) after termination of drilling.

TR - Depth to top of rock.

SOIL DESCRIPTIONS

Soils have been classified in general accordance with Section 603 of the most recent ODOT SGE, and described in general accordance with Section 602, including the use of special adjectives to designate approximate percentages of minor components as follows:

Adjective	Percent by Weight
trace	1 to 10
little	10 to 20
some	20 to 35
"and"	35 to 50

The following terms are used to describe density and consistency of soils:

Term (Granular Soils)	Blows per foot (N_{60})
Very-loose	Less than 5
Loose	5 to 10
Medium-dense	11 to 30
Dense	31 to 50
Very-dense	Over 50

Term (Cohesive Soils)	Qu (tsf)
Very-soft	Less than 0.25
Soft	0.25 to 0.5
Medium-stiff	0.5 to 1.0
Stiff	1.0 to 2.0
Very-stiff	2.0 to 4.0
Hard	Over 4.0

S&ME JOB: 212619

PROJECT: GRE-68-13.51 INTERSECTION	DRILLING FIRM / OPERATOR: S&ME / P. TUTTLE	DRILL RIG: S&ME 45B TRUCK (R52)	STATION / OFFSET: 198+81, 15' LT
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: S&ME / P. TUTTLE	HAMMER: CME AUTOMATIC	ALIGNMENT: US 68
PID: 111657 BR ID:	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/1/21	ELEVATION: 830.2 (MSL) EOB: 7.5 ft.
START: 10/12/21 END: 10/12/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 82	COORD: 39.737565 N, 83.936119 W

EXPLORATION ID **B-001-0-21**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 830.2	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
ASPHALT - 4 INCHES	829.9																		
CONCRETE - 6 INCHES	829.4																		
GRANULAR BASE - 3 INCHES	829.1																		
Fill: Very-stiff brown, gray and dark-gray **SILT AND CLAY**, some fine to coarse sand, little fine to coarse gravel, few slag fragments, damp.	827.2	1	4 5 5	14	72	SS-1	3.5-4.0	15	13	16	32	24	28	14	14	13	A-6a (6)	34	
Very-stiff to hard grayish-brown **SANDY SILT**, little clay, little fine to coarse gravel, damp.	825.7	2	5 7 7	19	61	SS-2	3.0-4.5	20	14	10	37	19	24	17	7	12	A-4a (4)	-	
Dense gray **GRAVEL WITH SAND**, trace silt, trace clay, dry.	824.2	3	7 19 17	49	50	SS-3	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	-	
Very-stiff grayish-brown **SANDY SILT**, little to some fine to coarse gravel, trace clay, damp.	822.7	4	4 5 5	14	39	SS-4	3.0-3.5	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
EOB		5																	
		6																	
		7																	

- No groundwater noted.

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; PLASTIC HOLE PLUG DEVICE; SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT SULFATE (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/8/21 06:55 - Z:\SHARED\SME\OPS\CS\RESOURCES\COLUMBUS\GINT\WPROJECTS\212619.GPJ

PLATE 4

S&ME JOB: 212619

PROJECT: GRE-68-13.51 INTERSECTION	DRILLING FIRM / OPERATOR: S&ME / P. TUTTLE	DRILL RIG: S&ME 45B TRUCK (R52)	STATION / OFFSET: 202+55, 63' RT
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: S&ME / P. TUTTLE	HAMMER: CME AUTOMATIC	ALIGNMENT: US 68
PID: 111657 BR ID:	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/1/21	ELEVATION: 829.4 (MSL) EOB: 10.0 ft.
START: 10/12/21 END: 10/12/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 82	COORD: 39.738540 N, 83.935673 W

EXPLORATION ID **B-002-0-21**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 829.4	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
TOPSOIL - 4 INCHES	829.1																		
Very-stiff brown **CLAY**, "and" silt, trace fine to coarse sand, trace fine gravel, damp to moist.	826.4	1	3 3 3	8	67	SS-1	3.0-3.7	1	1	1	59	38	47	19	28	23	A-7-6 (17)	84	
Stiff to very-stiff brown **SILTY CLAY**, some fine to coarse sand, trace fine gravel, damp to moist.	823.4	2 3 4	3 4 5	12	100	SS-2	1.5-3.0	1	2	28	41	28	33	15	18	20	A-6b (10)	-	
Loose brown **GRAVEL WITH SAND, SILT AND CLAY**, moist.	821.4	5 6 7	3 3 3	8	72	SS-3	-	-	-	-	-	-	-	-	-	15	A-2-6 (V)	-	
Medium-dense brown **GRAVEL WITH SAND AND SILT**, trace clay, damp.	819.4	8 9	5 4 4	11	50	SS-4	-	-	-	-	-	-	-	-	-	7	A-2-4 (V)	-	
		EOB 10																	

- No groundwater noted.

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLASTIC HOLE PLUG DEVICE; SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT SULFATE (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/8/21 06:55 - Z:\SHARED\SME\OPS\CS\RESOURCES\COLUMBUS\GINT\WPROJECTS\212619.GPJ

PLATE 5

S&ME JOB: 212619

PROJECT: GRE-68-13.51 INTERSECTION	DRILLING FIRM / OPERATOR: S&ME / P. TUTTLE	DRILL RIG: S&ME 45B TRUCK (R52)	STATION / OFFSET: 206+84, 11' RT
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: S&ME / P. TUTTLE	HAMMER: CME AUTOMATIC	ALIGNMENT: US 68
PID: 111657 BR ID:	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/1/21	ELEVATION: 835.1 (MSL) EOB: 8.0 ft.
START: 10/12/21 END: 10/12/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 82	COORD: 39.739679 N, 83.935372 W

EXPLORATION ID **B-003-0-21**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 835.1	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
ASPHALT - 4 INCHES	834.8																		
GRANULAR BASE - 6 INCHES	834.3																		
Fill: Hard grayish-brown **SILT AND CLAY**, little fine to coarse sand, little fine to coarse gravel, damp.	832.1	1	3 3 3	8	33	SS-1	4.5+	16	10	7	43	24	31	17	14	15	A-6a (8)	66	
Fill: Medium-dense brown **GRAVEL WITH SAND, SILT AND CLAY**, few concrete fragments, damp.	830.1	2	3 4 5	12	0	--		-	-	-	-	-	-	-	-	-		-	
		3	5	-	83	SS-2	-	40	21	9	11	19	51	19	32	16	A-2-7 (3)	-	
Medium-dense brown **COARSE AND FINE SAND**, some fine gravel, trace silt, trace clay, damp.	828.6	4	5 7 8	21	33	SS-3	-	-	-	-	-	-	-	-	-	8	A-3a (V)	-	
Medium-dense brown and gray **GRAVEL WITH SAND**, trace silt, trace clay, dry.	827.1	5	7 7 8	21	44	SS-4	-	-	-	-	-	-	-	-	-	4	A-1-b (V)	-	
		EOB 6																	
		7																	
		8																	

- No groundwater noted.

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; PLASTIC HOLE PLUG DEVICE; SOIL CUTTINGS MIXED WITH BENTONITE

PLATE 6

S&ME JOB: 212619

PROJECT: GRE-68-13.51 INTERSECTION	DRILLING FIRM / OPERATOR: S&ME / P. TUTTLE	DRILL RIG: S&ME 45B TRUCK (R52)	STATION / OFFSET: 113+34, 16' RT
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: S&ME / P. TUTTLE	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 235
PID: 111657 BR ID:	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/1/21	ELEVATION: 827.6 (MSL) EOB: 8.5 ft.
START: 10/12/21 END: 10/12/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 82	COORD: 39.739391 N, 83.936113 W

EXPLORATION ID **B-004-0-21**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 827.6	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
ASPHALT - 4 INCHES	827.3																		
Fill: Dense grayish-brown **GRAVEL WITH SAND**, trace silt, trace clay, dry.	825.5	1	15 14 11	34	67	SS-1	-	-	-	-	-	-	-	-	-	5	A-1-b (V)	-	
Stiff to very-stiff dark-gray becoming brown **SANDY SILT**, little clay, little fine gravel, slightly organic, contains decayed roots, damp.	823.6	2 3	4 4 5	12	61	SS-2	1.5-2.5	13	20	16	34	17	27	17	10	17	A-4a (3)	78	
Dense brown **GRAVEL** "and" fine to coarse sand, trace silt, trace clay, dry.	822.1	4 5	7 11 15	36	28	SS-3	-	50	26	11	9	4	NP	NP	NP	5	A-1-a (0)	-	
Medium-dense brownish-gray **GRAVEL WITH SAND**, trace silt, trace clay, dry.	820.6	6	8 11 8	26	33	SS-4	-	-	-	-	-	-	-	-	-	3	A-1-b (V)	-	
Medium-dense brown **COARSE AND FINE SAND**, little fine to coarse gravel, trace silt, trace clay, dry.	819.1	7 8 EOB	9 9 9	25	56	SS-5	-	-	-	-	-	-	-	-	-	6	A-3a (V)	-	

- No groundwater noted.

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; PLASTIC HOLE PLUG DEVICE; SOIL CUTTINGS MIXED WITH BENTONITE

PLATE 7

S&ME ODOT SULFATE (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/8/21 06:55 - Z:\SHARED\SME\OPS\CS\RESOURCES\COLUMBUS\GINTW\PROJECTS\212619.GPJ

LOG OF BORING

Date Started 7/6/04 | Sampler: Type SS | Dia. 1.5" O.D. | Water Elevation:
Date Completed 7/6/04 | Casing: Length NA | Dia. NA I.D. | Immediate NW
Core Barrel: Type NA | Size NA I.D. | Completion NW

Project Identification: GPD GROUP
GRE-68 / 235-14.26 / 0.00
GREENE COUNTY, OHIO; PID NO. 24531

Boring No. B-5 | Station & Offset 4+52.82, 2.52' LT | Surface Elev. 825.9 ft

Elev. (ft)	Depth (ft)	Std. Pen.	Rec. (in)	RQD (%)	Description	Sample No.	Physical Characteristics								ODOT Class
							% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	
825.9	0														
824.9					ASPHALT (12")										
824.1	2	50/2"	2		Light brown, GRAVEL WITH SAND (BASE), trace silt and clay, moist, very dense	1	35	40	15	-10-		-	-	-	A-1-b
	4	5 / 5 / 5	12		Brown and gray, SILT AND CLAY (FILL), some sand, little gravel, moist, stiff	2	-	-	-	-	-	36	15	13	VISUAL
819.4	6	5 / 7 / 3	14			3	17	17	12	32	22	29	12	10	A-6a
	8				Grayish brown to brown, SILT AND CLAY (FILL), some sand, trace gravel, moist, stiff										
815.9	10	3 / 5 / 5	14			4	-	-	-	-	-	-	-	36	VISUAL

Boring completed at 10.0 feet

Boring Location/Elevation Information for GRE-68-13.51 (PID 111657)

- Historic Boring No. B-005-0-04
- STA 114+53, 3' Rt of Proposed Centerline SR 235
- Latitude/Longitude = N 39.739700 / W 83.936223

PLATE 8

LOG OF BORING

Date Started 11/21/05 | Sampler: Type SS | Dia. 1.5" O.D. | Water Elevation:
Date Completed 11/21/05 | Casing: Length NA | Dia. NA I.D. | Immediate NW
Core Barrel: Type NA | Size NA I.D. | Completion Dry cave @ 2.5'

Project Identification: GPD GROUP
GRE-68 / 235-14.26 / 0.00
GREENE COUNTY, OHIO; PID NO. 24531

Boring No. B-6 | Station & Offset 1+78.55, 12.32' LT | Surface Elev. 831.2 ft

Elev. (ft)	Depth (ft)	Std. Pen.	Rec. (in)	RQD (%)	Description	Sample No.	Physical Characteristics: % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
831.2	0														
829.7	2	6 / 8 / 9	6		Dark brown, GRAVEL WITH SAND, little silt, trace clay, trace organics, moist, medium dense	1	51	22	10	12	5	NP	NP	6	A-1-b
828.2		17 / 11 / 10	4		Brown, GRAVEL AND STONE FRAGMENTS, little sand, moist, medium dense	2	80	12	5	-3-		NP	NP	4	A-1-a
826.7	4	7 / 5 / 6	10		Brown, GRAVEL AND SAND, trace silt and clay, moist, medium dense	3	54	35	6	3	2	NP	NP	3	A-1-a
	6	9 / 11 / 15	15		Brown, COARSE AND FINE SAND, some gravel and rock fragments, moist, medium dense - dense	4	-	-	-	-	-	-	-	4	VISUAL
	8	16 / 20 / 32	15			5	-	-	-	-	-	-	-	4	VISUAL
821.2	10	13 / 11 / 9	10			6	-	-	-	-	-	-	-	4	VISUAL

Boring completed at 10.0 feet

Boring Location/Elevation Information for GRE-68-13.51 (PID 111657)

- Historic Boring No. B-006-0-05
- STA 111+79, 12' Lt of Proposed Centerline SR 235
- Latitude/Longitude = N 39.738949 / W 83.936239

PLATE 9

LOG OF BORING

Date Started 11/21/05 | Sampler: Type SS | Dia. 1.5" O.D. | Water Elevation:
Date Completed 11/21/05 | Casing: Length NA | Dia. NA I.D. | Immediate NW
Core Barrel: Type NA | Size NA I.D. | Completion Dry cave @ 5.5'

Project Identification: GPD GROUP
GRE-68 / 235-14.26 / 0.00
GREENE COUNTY, OHIO; PID NO. 24531

Boring No. B-7 | Station & Offset 0+33.65, 12.13' LT | Surface Elev. 833.4 ft

Elev. (ft)	Depth (ft)	Std. Pen.	Rec. (in)	RQD (%)	Description	Sample No.	Physical Characteristics								ODOT Class
							% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	
833.4	0														
831.9	2	3 / 10 / 15	14		Dark brown, SANDY SILT (FILL), some gravel and rock fragments, moist, very stiff	1	24	18	12	31	15	23	7	8	A-4a
830.4	4	3 / 3 / 6	10		Reddish brown, CLAY (FILL), some sand, trace gravel, moist, stiff	2	4	8	16	31	41	46	30	23	A-7-6
828.9	6	3 / 6 / 10	6		Brown, GRAVEL AND ROCK FRAGMENTS WITH SAND AND SILT (FILL), trace clay, moist, medium dense	3	48	12	8	25	7	24	6	16	A-2-4
827.4	8	8 / 7 / 9	4		Brown, GRAVEL AND STONE FRAGMENTS, with sand, moist, medium dense	4	–	–	–	–	–	–	–	7	VISUAL
	10	10 / 9 / 10	12			5	–	–	–	–	–	–	–	5	VISUAL
823.4		6 / 6 / 7	13		Brown, COARSE AND FINE SAND, trace silt, trace gravel, moist, medium dense	6	–	–	–	–	–	–	–	5	VISUAL
					Boring completed at 10.0 feet										

Boring Location/Elevation Information for GRE-68-13.51 (PID 111657)

- Historic Boring No. B-007-0-05
- STA 110+34, 12' Lt of Proposed Centerline SR 235
- Latitude/Longitude = N 39.738565 / W 83.936043

PLATE 10

OHIO DEPARTMENT OF TRANSPORTATION

DETERMINING SULFATE CONTENT IN SOILS

SUPPLEMENT 1122

Project C-R-S: GRE-68-13.51

PID No: 111657

Report Date: 12/17/2021

Consultant: Alloway

Technician: BRM

Boring ID and Sample Number	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/S-1	198+81	15' LT	N39.737565°	W83.936119°	830.2	21:55	20	1.55	20	1.61	20	1.9	33.75
B-002/S-1	202+55	63' RT	N39.738540°	W83.935673°	829.4	21:52	20	3.8	20	4.04	20	4.73	83.75
B-003/S-1	206+84	11' RT	N39.739679°	W83.935372°	835.1	21:48	20	3.9	20	2.73	20	3.29	66.13
B-004/S-2	113+34	16' RT	N39.739391°	W83.936113°	827.6	21:45	20	3.61	20	3.85	20	4.22	77.87

PLATE 11

Important Information About Your
Geotechnical Engineering Report

Variations in subsurface conditions can be a principal cause of construction delays, cost overruns and claims. The following information is provided to assist you in understanding and managing the risk of these variations.

Geotechnical Findings Are Professional Opinions

Geotechnical engineers cannot specify material properties as other design engineers do. Geotechnical material properties have a far broader range on a given site than any manufactured construction material, and some geotechnical material properties may change over time because of exposure to air and water, or human activity.

Site exploration identifies subsurface conditions at the time of exploration and only at the points where subsurface tests are performed or samples obtained. Geotechnical engineers review field and laboratory data and then apply their judgment to render professional opinions about site subsurface conditions. Their recommendations rely upon these professional opinions. Variations in the vertical and lateral extent of subsurface materials may be encountered during construction that significantly impact construction schedules, methods and material volumes. While higher levels of subsurface exploration can mitigate the risk of encountering unanticipated subsurface conditions, no level of subsurface exploration can eliminate this risk.

Geotechnical Findings Are Professional Opinions

Professional geotechnical engineering judgment is required to develop a geotechnical exploration scope to obtain information necessary to support design and construction. A number of unique project factors are considered in developing the scope of geotechnical services, such as the exploration objective; the location, type, size and weight of the proposed structure; proposed site grades and improvements; the construction schedule and sequence; and the site geology.

Geotechnical engineers apply their experience with construction methods, subsurface conditions and exploration methods to develop the exploration scope. The scope of each exploration is unique based on available project and site information. Incomplete project information or constraints on the scope of exploration increases the risk of variations in subsurface conditions not being identified and addressed in the geotechnical report.

Services Are Performed for Specific Projects

Because the scope of each geotechnical exploration is unique, each geotechnical report is unique. Subsurface conditions are explored and recommendations are made for a specific project.

Subsurface information and recommendations may not be adequate for other uses. Changes in a proposed structure location, foundation loads, grades, schedule, etc. may require additional geotechnical exploration, analyses, and consultation. The geotechnical engineer should be consulted to determine if additional services are required in response to changes in proposed construction, location, loads, grades, schedule, etc.

Geo-Environmental Issues

The equipment, techniques, and personnel used to perform a geo-environmental study differ significantly from those used for a geotechnical exploration. Indications of environmental contamination may be encountered incidental to performance of a geotechnical exploration but go unrecognized. Determination of the presence, type or extent of environmental contamination is beyond the scope of a geotechnical exploration.

Geotechnical Recommendations Are Not Final

Recommendations are developed based on the geotechnical engineer's understanding of the proposed construction and professional opinion of site subsurface conditions. Observations and tests must be performed during construction to confirm subsurface conditions exposed by construction excavations are consistent with those assumed in development of recommendations. It is advisable to retain the geotechnical engineer that performed the exploration and developed the geotechnical recommendations to conduct tests and observations during construction. This may reduce the risk that variations in subsurface conditions will not be addressed as recommended in the geotechnical report.

Appendix B

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

GRE-68-13.15 Intersection
PID 111657

PROJECT DESCRIPTION - Proposed roundabout at the intersection of US 68 and SR 235 in Greene County. Four (4) new borings and three (3) historic borings. Moisture contents of historic borings not included.

S&ME, Inc.

Prepared By: Richard S. Weigand, PE
Date prepared: Friday, December 3, 2021

S&ME, Inc.
6190 Enterprise Court
Dublin, OH 43016

614-793-2226
rweigand@smeinc.com

NO. OF BORINGS: 7

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-21	US 68 CL	198+81	15	Lt	CME Truck 45	82	830.2	828.5	1.7 C
2	B-002-0-21	US 68 CL	202+55	63	Rt	CME Truck 45	82	829.4	833.0	3.6 F
3	B-003-0-21	US 68 CL	206+84	11	Rt	CME Truck 45	82	835.1	833.9	1.2 C
4	B-007-0-05	SR 235 CL	110+34	12	Lt	Unknown - Used HSA	60	833.4	834.2	0.8 F
5	B-006-0-05	SR 235 CL	111+79	12	Lt	Unknown - Used HSA	60	831.2	829.6	1.6 C
6	B-004-0-21	SR 235 CL	113+34	16	Rt	CME Truck 45	82	827.6	826.3	1.3 C
7	B-005-0-04	SR 235 CL	114+53	3	Lt	Unknown - Used HSA	60	825.9	824.3	1.6 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 001-0 21	SS-1	1.5	3.0	-0.2	1.3	14		3.5	28	14	14	32	24	56	13	14	A-6a	6	34					
		SS-2	3.0	4.5	1.3	2.8	19		3	24	17	7	37	19	56	12	12	A-4a	4						
		SS-3	4.5	6.0	2.8	4.3	49									6	6	A-1-b	0						
		SS-4	6.0	7.5	4.3	5.8	14	14	3							11	10	A-4a	8						
2	B 002-0 21	SS-1	1.0	2.5	4.6	6.1	8		3	47	19	28	59	38	97	23	18	A-7-6	17	84					
		SS-2	3.5	5.0	7.1	8.6	12		1.5	33	15	18	41	28	69	20	16	A-6b							
		SS-3	6.0	7.5	9.6	11.1	8									15	10	A-2-6							
		SS-4	8.5	10.0	12.1	13.6	11	8								7	10	A-2-4							
3	B 003-0 21	SS-1	1.5	3.0	0.3	1.8	8		4.5	31	17	14	43	24	67	15	14	A-6a	8	66		N_{60}		12"	Exc & Replace 12" 204 Geotextile or CS 14"
		SS-2	3.0	5.0	1.8	3.8	12			51	19	32	11	19	30	16	10	A-2-7	3						
		SS-3	5.0	6.5	3.8	5.3	21									8	8	A-3a	0						
		SS-4	6.5	8.0	5.3	6.8	21	8								4	6	A-1-b							
4	B 007-0 05	SS-1	0.0	1.5	0.8	2.3	25			23	16	7	31	15	46	8	11	A-4a	2						
		SS-2	1.5	3.0	2.3	3.8	9			46	16	30	31	41	72	23	18	A-7-6	17						
		SS-3	3.0	4.5	3.8	5.3	16			24	18	6	26	7	33	16	10	A-2-4	0						
		SS-4	4.5	6.0	5.3	6.8	16	9								7	6	A-1-b							
5	B 006-0 05	SS-1	0.0	1.5	-1.6	-0.1	17			NP	NP	NP	12	13	25	9	6	A-1-b	0						
		SS-2	1.5	3.0	-0.1	1.4	21			NP	NP	NP	3	0	3	4	6	A-1-a	0						
		SS-3	3.0	4.5	1.4	2.9	11			NP	NP	NP	3	2	5	7	6	A-1-a	0						
		SS-4	4.5	6.0	2.9	4.4	26	11								7	8	A-3a	0						
6	B 004-0 21	SS-1	1.0	2.5	-0.3	1.2	34									5	6	A-1-b	0						
		SS-2	2.5	4.0	1.2	2.7	12		1.5	27	17	10	34	17	51	17	12	A-4a	3	78		HP & Mc			
		SS-3	4.0	5.5	2.7	4.2	36			NP	NP	NP	9	4	13	5	6	A-1-b	0						
		SS-4	5.5	7.0	4.2	5.7	26	12								3	6	A-1-b	0						
7	B 005-0 04	SS-1	1.0	1.8	-0.6	0.2	-						10	0	10		6	A-1-b	0						Exc & Replace 12" 204 Geotextile or CS 14"
		SS-2	2.5	4.0	0.9	2.4	10			36	21	15				13	16	A-6a	10			N_{60}		12"	
		SS-3	5.0	6.5	3.4	4.9	10			29	17	12	32	22	54	10	14	A-6a	5						
		SS-4	8.5	10.0	6.9	8.4	10	10								36	14	A-6a							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: PID 111657

County-Route-Section: GRE-68-13.15 Intersection
No. of Borings: 7

Geotechnical Consultant: S&ME, Inc.
Prepared By: Richard S. Weigand, PE
Date prepared: 12/3/2021

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

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

Design CBR	8

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	26%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	17%	1 < HP ≤ 2	4%
$N_{60} \geq 20$	39%	HP > 2	22%
M+	4%		
Rock	0%		
Unsuitable	4%		

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

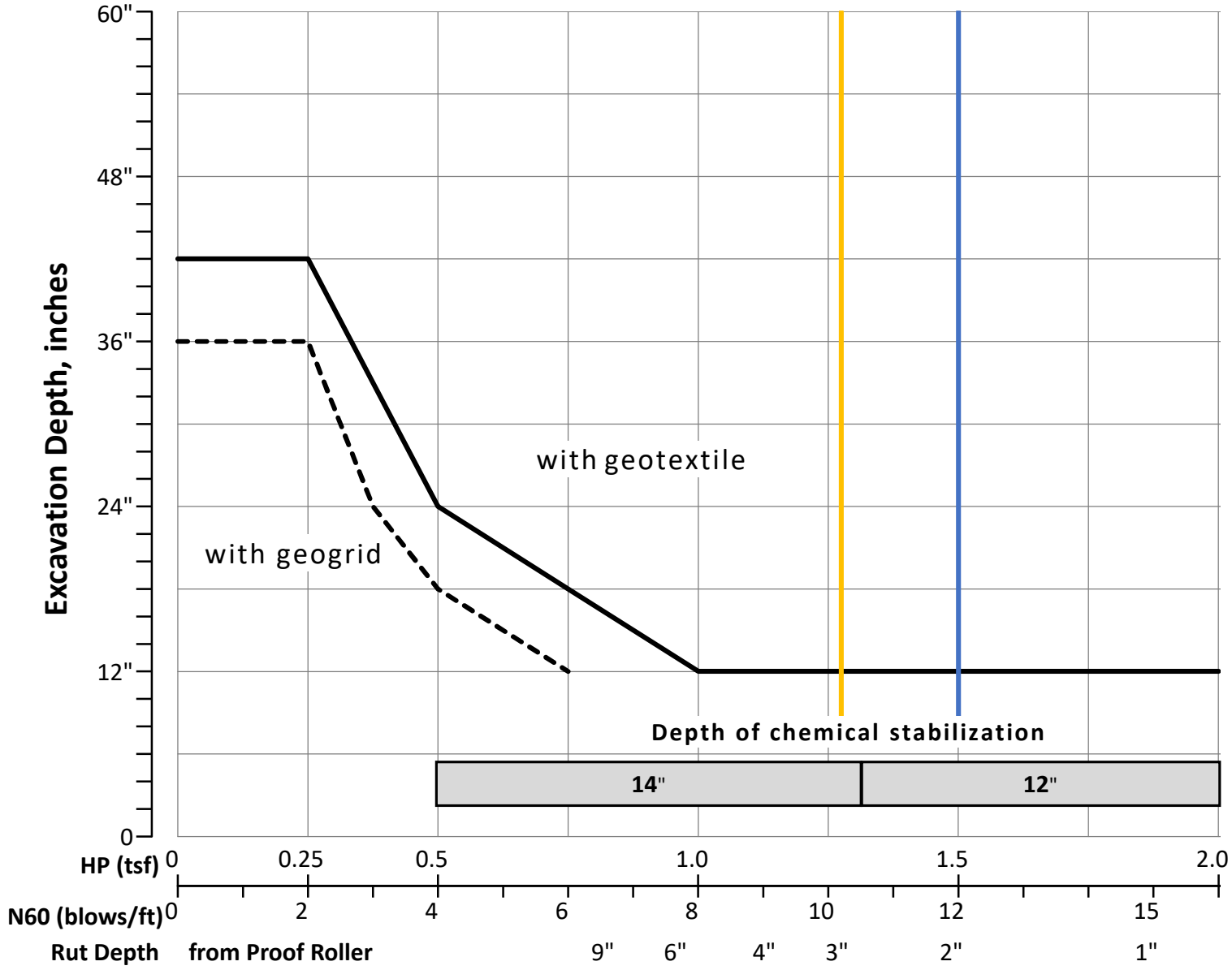
% Proposed Subgrade Surface	
Unstable & Unsuitable	21%
Unstable	21%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	18	10	2.86	33	17	16	27	17	44	12	10	4
Maximum	49	14	4.50	51	21	32	59	41	97	36	18	17
Minimum	8	8	1.50	23	14	6	3	0	3	3	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	2	7	2	0	1	1	0	2	4	0	0	5	1	0	2	0	0	27
Percent	0%	7%	26%	7%	0%	4%	4%	0%	7%	15%	0%	0%	19%	4%	0%	7%	0%	0%	100%
% Rock|Granular|Cohesive	0%	70%									30%								100%
Surface Class Count	0	2	4	0	0	0	1	0	0	3	0	0	3	0	0	1	0	0	14
Surface Class Percent	0%	14%	29%	0%	0%	0%	7%	0%	0%	21%	0%	0%	21%	0%	0%	7%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
2.86	1.50	☑ HP
10.29		☐ N60L

Average HP

Average N_{60L}

Appendix C

I. Geotechnical Design Checklists	
Project: GRE-68-13.51	**PDP Path:**
PID: 111657	**Review Stage:**

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

II. Reconnaissance and Planning Checklist

C-R-S:	GRE-68-13.51	PID:	111657	Reviewer:	RSW	Date:	12/9/2021

Reconnaissance		(Y/N/X)	Notes:
1	Based on Section 302.1 in the SGE, have the necessary plans been developed in the following areas prior to the commencement of the subsurface exploration reconnaissance:		By others
	Roadway plans	✓	
	Structures plans		
	Geohazards plans		
2	Have the resources listed in Section 302.2.1 of the SGE been reviewed as part of the office reconnaissance?	Y	
3	Have all the features listed in Section 302.3 of the SGE been observed and evaluated during the field reconnaissance?	Y	
4	If notable features were discovered in the field reconnaissance, were the GPS coordinates of these features recorded?	X	

Planning - General		(Y/N/X)	Notes:
5	In planning the geotechnical exploration program for the project, have the specific geologic conditions, the proposed work, and historic subsurface exploration work been considered?	Y	
6	Has the ODOT Transportation Information Mapping System (TIMS) been accessed to find all available historic boring information and inventoried geohazards?	Y	District 8 authorized inclusion of 3 historic roadway embankment borings (2004/2005)
7	Have the borings been located to develop the maximum subsurface information while using a minimum number of borings, utilizing historic geotechnical explorations to the fullest extent possible?	Y	
8	Have the topography, geologic origin of materials, surface manifestation of soil conditions, and any other special design considerations been utilized in determining the spacing and depth of borings?	Y	
9	Have the borings been located so as to provide adequate overhead clearance for the equipment, clearance of underground utilities, minimize damage to private property, and minimize disruption of traffic, without compromising the quality of the exploration?	Y	

II. Reconnaissance and Planning Checklist

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

II. Reconnaissance and Planning Checklist

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

III.C. Subgrade Checklist

C-R-S:	GRE-68-13.51	PID:	111657	Reviewer:	RSW	Date:	12/9/2021

If you do not have any subgrade work on the project, you do not have to fill out this checklist.

Subgrade	(Y/N/X)	Notes:
1 Has the subsurface exploration adequately characterized the soil or rock according to Geotechnical Bulletin 1: Plan Subgrades (GB1)?	Y	
a. Has each sample been visually classified and inspected for the presence of gypsum? Has a moisture content been performed on each sample?	Y	On current (2021) explorations
b. Has mechanical classification (Plastic Limit (PL), Liquid Limit (LL), and gradation testing) been done on at least two samples from each boring within six feet of the proposed subgrade?	Y	On current (2021) explorations
c. Has the sulfate content of at least one sample from each boring within 3 feet of the proposed subgrade been determined, per Supplement 1122, Determining Sulfate Content in Soils?	Y	On current (2021) explorations
d. Has the sulfate content of all samples that exhibit gypsum crystals been determined?	X	
e. Have A-2-5, A-4b, A-5, A-7-5, A-8a, or A-8b soils within the top 3 feet of the proposed subgrade been mechanically classified?	X	
2 If soils classified as A-2-5, A-4b, A-5, A-7-5, A-8a, or A-8b, or having a LL>65, are present at the proposed subgrade (soil profile), do the plans specify that these materials need to be removed and replaced or chemically stabilized?	X	
a. If these materials are to be removed and replaced, have the station limits, depth, and lateral limits for the planned removal been provided?	X	
3 If there is any rock, shale, or coal present at the proposed subgrade (C&MS 204.05), do the plans specify the removal of the material?	X	
a. If removal of any rock, shale, or coal is required, have the station limits, depth, and lateral limits for the planned removal of the material at proposed subgrade been provided?	X	

III.C. Subgrade Checklist

Subgrade	(Y/N/X)	Notes:
4 In accordance with GB1, do the SPT (N_{60})/HP values and existing moisture contents for the proposed subgrade soils indicate the need for subgrade stabilization?	Y	
a. If removal and replacement is applicable, has the detail of subgrade removal been shown on the plans, including depth of removal, station limits, lateral extent, replacement material, and plan notes (Item 204 - Subgrade Compaction and Proof Rolling)?	Y	Plans prepared by others. See Section 6.2.3 of Subgrade Exploration report.
b. If chemical stabilization is applicable, has the detail of this treatment been shown on the plans, including depth, percentage of chemical, station limits, lateral extent, and plan notes?	X	
Indicate type of chemcial stabilization specified:		
cement stabilization		
lime stabilization		
5 If removal and replacement has been specified, do the plans include Plan Note G121 from L&D3?	X	See Section 6.2.2 of Subgrade Exploration Report. Plans to be prepared by others.
6 If drainage or groundwater is an issue with the proposed subgrade, has an appropriate drainage system (e.g., pipe, underdrains) been provided?	X	
7 Has an appropriate quantity of Proof Rolling (C&MS 204.06) and has Plan Note G111 from L&D3 been included in the plans?	X	Plans prepared by others.
8 Has a design CBR value been provided?	Y	See Section 6.2.1 of Subgrade Exploration Rpt.

VI.A. Soil Profile Checklist

C-R-S:	GRE-68-13.51	PID:	111657	Reviewer:	RSW	Date:	12/9/2021

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

VI.A. Soil Profile Checklist

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

VI.A. Soil Profile Checklist

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

VI.A. Soil Profile Checklist

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

VI.A. Soil Profile Checklist

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

VI.A. Soil Profile Checklist

Subsurface Data	(Y/N/X)	Notes:
38 Have the existing and proposed groundlines been displayed on cross section sheets according to ODOT CADD standards?	X	
39 Have bedrock exposures shown on the cross sections been plotted along the contour of the cross section?	X	
40 Has the following information been provided adjacent to the graphical logs or bedrock exposure:		
a. Thickness, to the nearest inch, of sod/topsoil or other shallow surface material written above the boring (with corresponding symbology at top of log)?	Y	
b. Moisture content, to nearest whole percent, with the bottom of the text aligned with the bottom of the sample? Label this column as 'WC' at bottom of the boring.	Y	
c. N_{60}, aligned with the bottom of sample? Label column as 'N_{60}' at bottom of boring.	Y	
d. Free water indicated by a horizontal line with a 'w' attached, and water level at the end of drilling indicated by an open equilateral triangle, point down?	X	No water encountered
e. Complete geologic description of each bedrock unit, including unit core loss, unit RQD, SDI, and compressive strength test results? (Do not present geologic descriptions for structure borings for which this information is presented on the boring logs as described in 703.3)	X	
f. Visual description of any uncontrolled fill or interval not adequately defined by a graphical symbol?	X	
g. Organic content with modifiers, per 603.5?	X	
h. Designate a plastic soil with moisture content equal to or greater than the liquid limit minus three with a 1/8" solid black circle adjacent to the moisture content?	X	
i. Designate a non-plastic soil with moisture content exceeding 25% or exceeding 19% but appearing wet initially, with a 1/8" open circle with a horizontal line through it adjacent to the moisture content?	X	
j. The reason for discontinuing a boring prior to reaching the planned depth indicated immediately below the boring?	X	

VI.A. Soil Profile Checklist

Boring Logs	(Y/N/X)	Notes:
41 Have the boring logs of all structure borings, all geohazard borings, and any roadway borings drilled in the vicinity of the structures or geohazard been shown on the boring log sheets following the plan and profile sheets? (Create the logs in accordance with 703.3)	X	
42 Have the boring logs been developed by integrating the driller's field logs, laboratory test data, and visual descriptions?	X	
43 Has the following boring information been included in the heading of each boring log:		
a. Exploration identification number?	X	
b. Project designation (C-R-S) and PID?	X	
c. Structure File Number (if applicable) and project type.	X	
d. Centerline or baseline name, station, offset, and surface elevation?	X	
e. Coordinates?	X	
f. Method of drilling?	X	
g. Date started and date completed?	X	
h. Method and material (including quantity) used for backfilling or sealing, including type of instrumentation, if any?	X	
i. Date of last calibration and drill rod energy ratio (ER) in percent for the hammer system(s) used?	X	
44 Has the following boring information been included in each boring log:	X	
a. A depth and elevation scale?	X	
b. Indication of stratum change?	X	
c. Description of material in each stratum?	X	
d. Depth of bottom of boring?	X	
e. Depth of boulders or cobbles, if encountered?	X	
f. Caving depth?	X	
g. Water level observations?	X	
h. Artesian water level and height of rise?	X	
i. Heaving sand?	X	
j. Cavities or other unusual conditions?	X	
k. Depth interval represented by sample?	X	
l. Sample number and type?	X	
m. Percent recovery for each sample?	X	
n. Measured blow counts for each 6 inches of drive for split spoon samples?	X	
o. N_{60} to the nearest whole number?	X	
p. Hand penetrometer?	X	

VI.A. Soil Profile Checklist

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

VI.B. Geotechnical Reports

C-R-S:	GRE-68-13.51	PID:	111657	Reviewer:	RSW	Date:	12/9/2021

General		(Y/N/X)	Notes:
1	Has an electronic copy of all geotechnical submissions been provided to the District Geotechnical Engineer (DGE)?	X	Electronic copy provided to Arcadis to be included with ODOT submission
2	Has the first complete version of a geotechnical report being submitted been labeled as 'Draft'?	Y	
3	Subsequent to ODOT's review and approval, has the complete version of the revised geotechnical report being submitted been labeled 'Final'?	X	
4	Has the boring data been submitted in a native format that is DIGGS (Data Interchange for Geotechnical and Geoenvironmental) compatable? gINT files may be used for this.	X	
5	Does the report cover format follow ODOT's Brand and Identity Guidelines Report Standards found at http://www.dot.state.oh.us/brand/Pages/default.aspx ?	Y	
6	Have all geotechnical reports being submitted been titled correctly as prescribed in Section 705.1 of the SGE?	Y	
Report Body		(Y/N/X)	Notes:
7	Do all geotechnical reports being submitted contain the following:		
a.	an Executive Summary as described in Section 705.2 of the SGE?	Y	
b.	an Introduction as described in Section 705.3 of the SGE?	Y	
c.	a section titled "Geology and Observations of the Project," as described in Section 705.4 of the SGE?	Y	
d.	a section titled "Exploration," as described in Section 705.5 of the SGE?	Y	
e.	a section titled "Findings," as described in Section 705.6 of the SGE?	Y	
f.	a section titled "Analyses and Recommendations," as described in Section 705.7 of the SGE?	Y	
Appendices		(Y/N/X)	Notes:
8	Do all geotechnical reports being submitted contain all applicable Appendices as described in Section 705.8 of the SGE?	Y	
9	Do the Appendices present a site Boring Plan showing all boring locations as described in Section 705.8.1 of the SGE?	Y	

VI.B. Geotechnical Reports

Appendices		(Y/N/X)	Notes:
10	Do the Appendices include boring logs and color pictures of rock, if applicable, as described in Section 705.8.2 of the SGE?	Y	Boring logs
11	Do the Appendices include reports of undisturbed test data as described in Section 705.8.3 of the SGE?	X	
12	Do the Appendices include calculations in a logical format to support recommendations as described in Section 705.8.4 of the SGE?	Y	GB1 Spreadsheet

Appendix D

PROJECT DESCRIPTION

IT IS PROPOSED TO IMPROVE THE INTERSECTION OF US 68 AND SR 235 BY CONTRUCTING A 3-LEGGED ROUNDABOUT. THE ROUNDABOUT WILL BE POSTIONED ROUGHLY AT THE EXISTING INTERSECTION, WITH ROADWAY APPROACH IMPROVEMENTS EXTENDING ROUGHLY 400 FEET NORTH AND SOUTH ON US 68 AND 300 FEET NORTHWEST ALONG SR 235. RELATIVELY MINOR PROFILE ADJUSTMENTS ARE ANTICIPATED ON THE EXISTING ROADWAYS; HOWEVER, ROUGHLY 3 TO 4 FEET OF NEW FILL WILL BE REQUIRED ON THE EAST SIDE OF THE ROUNDABOUT.

HISTORIC RECORDS

A REVIEW OF THE ODOT TRANSPORTATION INFORMATION MANAGEMENT SYSTEM (TIMS) LOCATED THE LOGS OF THREE ROADWAY BORINGS PERFORMED IN 2004 AND 2005 AS PART OF A ROADWAY IMPROVEMENT AND BRIDGE REPLACEMENT PROJECT EXTENDING NORTHWARD FROM THE US 68/SR 235 INTERSECTION. THIS EXPLORATION INCLUDED THREE (3) 10-FOOT-DEEP EMBANKMENT BORINGS IN SR 235, IMMEDIATELY NORTH OF US 68, INCLUDING ONE BORING DRILLED THROUGH THE EXISTING PAVEMENT. TWO (2) OF THESE BORINGS INCLUDED 7.5 FEET OF CONTINUOUS SPT SAMPLING.

GEOLOGY

GEOLOGIC REFERENCES INDICATE THAT THIS PROJECT SITE IS LOCATED WITHIN THE SOUTHERN OHIO LOAMY TILL PLAIN PHYSIOGRAPHIC REGION, WHERE THE SOIL OVERBURDEN CONSISTS PRIMARILY OF LOAMY, HIGH-LIME WISCONSINAN-AGE TILL, OUTWASH, AND LOESS. THE UPPERMOST BEDROCK CONSISTS OF LOWER PALEOZOIC-AGE CARBONATE ROCKS. ODNR WATER WELL LOG INFORMATION INDICATES THE UPPERMOST BEDROCK NEAR THE US 68/SR 235 INTERSECTION IS IN EXCESS OF 100 FEET BELOW THE EXISTING GROUND SURFACE.

RECONNAISSANCE

ON JUNE 17, 2021, S&ME PERFORMED A SITE RECONNAISSANCE OF THE PROJECT SITE TO OBSERVE CURRENT CONDITIONS, POTENTIAL UTILITY CONFLICTS, AND TRAFFIC CONTROL REQUIREMENTS. THE EXISTING US 68 AND SR 235 PAVEMENTS WERE OBSERVED TO BE GENERALLY IN GOOD CONDITION WITH FEW LONGITUDINAL AND TRANSVERSE CRACKING THROUGHOUT, INCREASING IN OCCURRENCE NEAR THE INTERSECTION.

SUBSURFACE EXPLORATION

ON OCTOBER 12, 2021, THREE (3) SUBGRADE BORINGS (DESIGNATED AS B-001-0-21, B-003-0-21, AND B-004-0-21) AND ONE (1) ROADWAY BORING (DESIGNATED B-002-0-21) WERE PERFORMED FOR THIS SUBGRADE EXPLORATION.

THE BORINGS WERE PERFORMED BY A TRUCK-MOUNTED DRILLING RIG USING A 4½-INCH O.D. CONTINUOUS FLIGHT AUGER TO ADVANCE THE BORINGS BETWEEN SAMPLING ATTEMPTS. DISTURBED BUT REPRESENTATIVE SOIL SAMPLES WERE OBTAINED BY LOWERING A 2-INCH O.D. SPLIT-BARREL SAMPLER TO THE BOTTOM OF THE BORING AND THEN DRIVING THE SAMPLER INTO THE SOIL WITH BLOWS FROM A 140-POUND HAMMER FREELY FALLING 30 INCHES (ASTM D1586 - STANDARD PENETRATION TEST). SIX (6) FEET OF CONTINUOUS SPT SAMPLING WAS ATTEMPTED BEGINNING BENEATH THE TOP OF SUBGRADE FOR THE EXISTING PAVEMENT SUBGRADE BORINGS. TEN (10) FEET OF 2½-FOOT INTERVAL SPT SAMPLING WAS ATTEMPTED BEGINNING AT THE EXISTING GROUND SURFACE FOR THE ROADWAY BORING. SPT SAMPLES WERE EXAMINED IMMEDIATELY AFTER RECOVERY AND REPRESENTATIVE PORTIONS WERE PRESERVED IN AIRTIGHT GLASS JARS.

THE HAMMER SYSTEM ON THE DRILL RIG WAS CALIBRATED ON MARCH 1, 2021, IN ACCORDANCE WITH ASTM D 4633 TO DETERMINE THE DRILL ROD ENERGY RATIO (82.0%). AT THE COMPLETION OF DRILLING, THE BORINGS WERE BACKFILLED IN ACCORDANCE WITH ODOT SPECIFICATIONS USING CUTTINGS MIXED WITH BENTONITE CHIPS. WHERE ADVANCED THROUGH EXISTING PAVEMENT, THE SURFACE OF THE ROADWAY WAS REPAIRED USING COLD-PATCH ASPHALT.

EXPLORATION FINDINGS

THE BORINGS PERFORMED IN 2021 EITHER 4 INCHES OF TOPSOIL OR 4 INCHES OF ASPHALT OVER 3 TO 6 INCHES OF GRANULAR BASE. BORING B-001 ALSO ENCOUNTERED 6 INCHES OF CONCRETE IMMEDIATELY BELOW THE ASPHALT. A DEFINED GRANULAR BASE COURSE WAS NOT IDENTIFIED IN BORING B-004; HOWEVER, THIS BORING ENCOUNTERED APPROXIMATELY 1.7 FEET OF DENSE GRANULAR FILL BELOW THE ASPHALT. HISTORIC BORING B-005-0-04 ENCOUNTERED 12 INCHES OF ASPHALT AND 0.8 FEET OF GRANULAR BASE COURSE (A-1-b).

BENEATH THESE SURFACE MATERIALS, BORINGS B-001 AND B-003 ENCOUNTERED 1.9 TO 2.2 FEET OF EXISITNG FILL CONSISTING OF VERY-STIFF TO HARD SILT AND CLAY (A-6a), WHICH WAS UNDERLAIN BY 2.0 FEET OF MEDIUM-DENSE BROWN GRAVEL WITH SAND, SILT, AND CLAY (A-2-7). EXISTING FILL WAS ALSO NOTED IN HISTORIC BORINGS B-005-0-04 AND B-007-0-05. BORING B-007-0-05 ENCOUNTERED 1.5 FEET OF DARK-BROWN SANDY SILT (A-4a) OVER 1.5 FEET OF REDDISH-BROWN CLAY (A-7-6) AND 1.5 FEET OF GRAVEL WITH SAND AND SILT (A-2-4). BORING B-005-0-04 WAS TERMINATED AFTER ENCOUNTERING 8.2 FEET OF BROWN/GRAYISH-BROWN SILT AND CLAY (A-6a).

BENEATH THE FILL, THE REMAINING BORINGS ENCOUNTERED NATURAL SOIL CONSISTING OF DISCONTINUOUS LAYERS OF STIFF TO HARD BROWN AND GRAY SANDY SILT (A-4a), STIFF TO VERY-STIFF SILTY CLAY (A-6b) AND CLAY (A-7-6), AND LOOSE TO DENSE BROWN AND GRAY GRAVEL (A-1-a), GRAVEL WITH SAND (A-1-b), COARSE AND FINE SAND (A-3a), GRAVEL WITH SAND AND SILT (A-2-4), AND GRAVEL WITH SAND, SILT AND CLAY (A-2-6, A-2-7).

NO GROUNDWATER WAS ENCOUNTERED IN THE BORINGS DURING DRILLING OR DURING THE SHORT PERIOD THE BOREHOLES WERE LEFT OPEN PRIOR TO BACKFILLING.

SPECIFICATIONS

THIS GEOTECHNICAL EXPLORATION WAS PERFORMED IN ACCORDANCE WITH THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, OFFICE OF GEOTECHNICAL ENGINEERING, SPECIFICATIONS FOR GEOTECHNICAL EXPLORATIONS, DATED JULY 2020.

AVAILABLE INFORMATION

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

LEGEND

DESCRIPTION	ODOT CLASS	CLASSIFIED MECH.	CLASSIFIED VISUAL
GRAVEL	A-1-a	1	--
GRAVEL WITH SAND	A-1-b	--	4
GRAVEL WITH SAND AND SILT	A-2-4	--	1
GRAVEL WITH SAND, SILT AND CLAY	A-2-6	1	--
GRAVEL WITH SAND, SILT AND CLAY	A-2-7	--	2
COARSE AND FINE SAND	A-3a	--	1
SANDY SILT	A-4a	2	1
SILT AND CLAY	A-6a	2	--
SILTY CLAY	A-6b	1	--
CLAY	A-7-6	1	--
	TOTAL	8	9

SOD AND TOPSOIL = X = APPROXIMATE THICKNESS — VISUAL

BORING LOCATION - PLAN VIEW

HISTORIC BORING LOCATION - PLAN VIEW - GRE-68/235-14.26/0.00 (2004-2005)

DRIVE SAMPLE AND/OR ROCK CORE BORING PLOTTED TO VERTICAL SCALE ONLY. HORIZONTAL BAR INDICATES A CHANGE IN STRATIGRAPHY.

WC — INDICATES WATER CONTENT IN PERCENT.

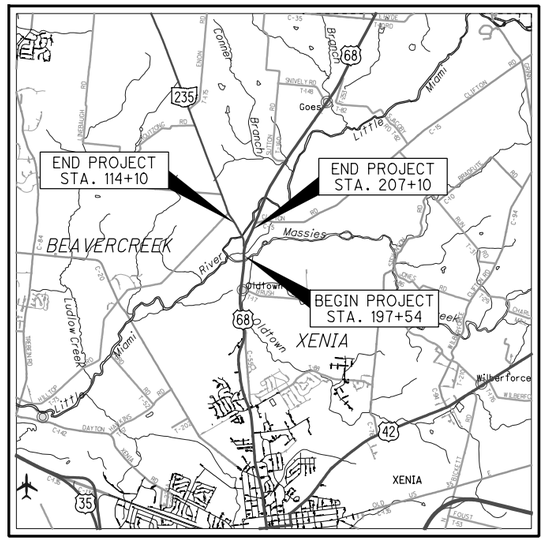
N_{60} — INDICATES STANDARD PENETRATION RESISTANCE NORMALIZED TO 60% DRILL ROD ENERGY RATIO.

X/Y/Z — NUMBER OF BLOWS FOR STANDARD PENETRATION TEST (SPT):
X= NUMBER OF BLOWS FOR FIRST 6 INCHES.
Y= NUMBER OF BLOWS FOR SECOND 6 INCHES.
Z= NUMBER OF BLOWS FOR THIRD 6 INCHES.

NP — INDICATES A NON-PLASTIC SAMPLE.

SS — INDICATES A SPLIT SPOON SAMPLE, STANDARD PENETRATION TEST.

HISTORIC BORING DESCRIPTIONS	ODOT CLASS	CLASSIFIED MECH.	CLASSIFIED VISUAL
GRAVEL	A-1-a	2	--
GRAVEL WITH SAND	A-1-b	2	--
GRAVEL WITH SAND AND SILT	A-2-4	1	--
COARSE AND FINE SAND	A-3a	--	5
SANDY SILT	A-4a	1	--
SILT AND CLAY	A-6a	2	1
CLAY	A-7-6	1	--
	TOTAL	9	6



LOCATION MAP
SCALE IN MILES
0 1 2 3 4

N

PARTICLE SIZE DEFINITIONS

12"	3"	2.0 mm	0.42 mm	0.074 mm	0.005 mm
BOULDERS	COBBLES	GRAVEL	COARSE SAND	FINE SAND	SILT	CLAY
		No. 10 SIEVE	No. 40 SIEVE	No. 200 SIEVE	

INDEX OF SHEETS

LOCATION FROM STA.	TO STA.	PLAN VIEW SHEET	PROFILE SHEET	CROSS-SECTION SHEET	CUT MAX.	FILL MAX.
US-68						
197+00	208+00	3	3	--	< 1 FT.	< 1 FT.
SR-235						
110+00	115+00	4	4	--	2 FT.	< 1 FT.

RECON. - S&ME 6/17/21

DRILLING - S&ME 10/12/21
GPD 11/21/05, 7/6/04

DRAWN - KAH 11/18/21 - 12/6/21
DWM 07/06/22

REVIEWED - RSW 12/6/21 - 12/9/21

6190 ENTERPRISE COURT
DUBLIN, OHIO 43016
(614) 793-2226

PID NO. 111657

SOIL PROFILE - ROADWAY

GRE-68-1351

1

SUMMARY OF SOIL TEST DATA
U.S. 68

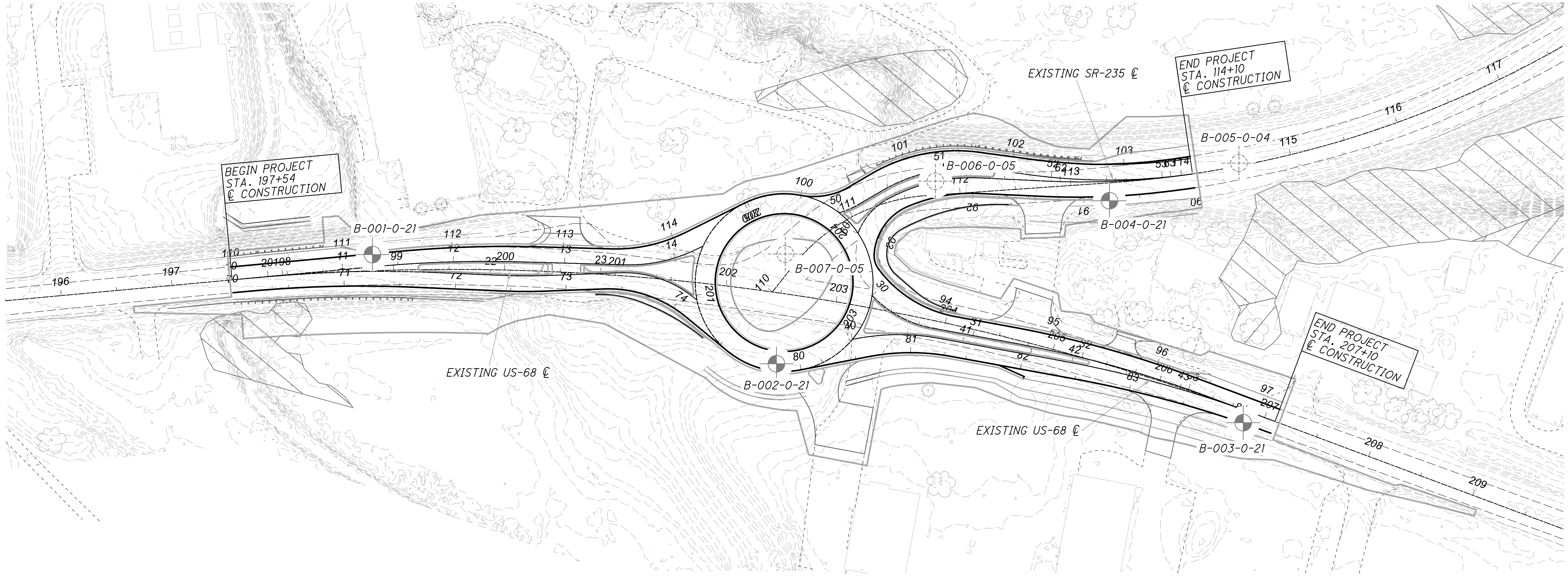
EXPLORATION ID., STATION & OFFSET	FROM - TO	SAMPLE ID	N_{60}	% REC	tsf HP	% GR	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	ODOT CLASS (GI)	ppm SO_4
B-001-0-21	1.5 - 3.0	SS-1	14	72	3.5-4.0	15	13	16	32	24	28	14	14	13	A-6a (6)	34
STA. 198+81, 15' LT.	3.0 - 4.5	SS-2	19	61	3.0-4.5	20	14	10	37	19	24	17	7	12	A-4a (4)	
LATITUDE = N 39.737565	4.5 - 6.0	SS-3	49	50	--	Dense gray GRAVEL WITH SAND								6	A-1-b (Visual)	
LONGITUDE = W 83.936119	6.0 - 7.5	SS-4	14	39	3.0-3.5	Very-stiff grayish-brown SANDY SILT								11	A-4a (Visual)	
B-002-0-21	1.0 - 2.5	SS-1	8	67	3.0-3.7	1	1	1	59	38	47	19	28	23	A-7-6 (17)	84
STA. 202+55, 63' RT.	3.5 - 5.0	SS-2	12	100	1.5-3.0	1	2	28	41	28	33	15	18	20	A-6b (10)	
LATITUDE = N 39.738540	6.0 - 7.5	SS-3	8	72	--	Loose brown GRAVEL WITH SAND, SILT AND CLAY								15	A-2-6 (Visual)	
LONGITUDE = W 83.935673	8.5 - 10.0	SS-4	11	50	--	Medium-dense brown GRAVEL WITH SAND AND SILT								7	A-2-4 (Visual)	
B-003-0-21	1.5 - 3.0	SS-1	8	33	4.5+	16	10	7	43	24	31	17	14	15	A-6a (8)	66
STA. 206+84, 11' RT.	3.0 - 5.0	SS-2	12	21	--	40	21	9	11	19	51	19	32	16	A-2-7 (3)	
LATITUDE = N 39.739679	5.0 - 6.5	SS-3	21	33	--	Medium-dense brown COARSE AND FINE SAND								8	A-3a (Visual)	
LONGITUDE = W 83.935372	6.5 - 8.0	SS-4	21	44	--	Medium-dense brown and gray GRAVEL WITH SAND								4	A-1-b (Visual)	

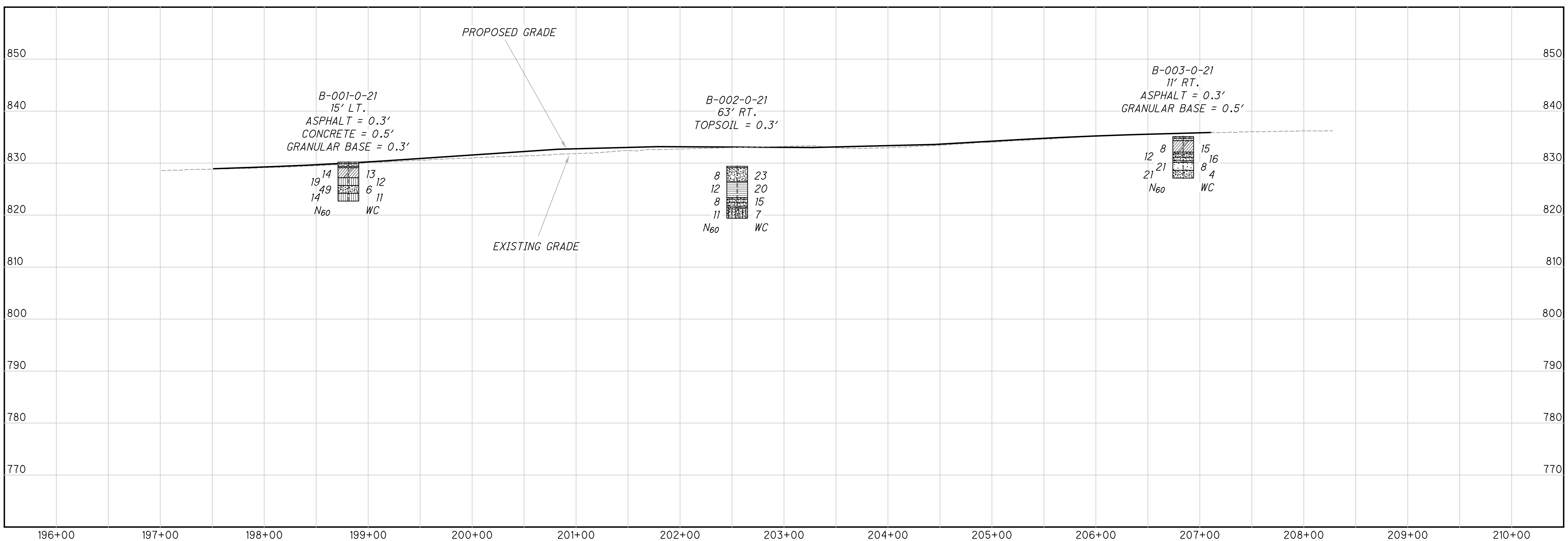
SUMMARY OF SOIL TEST DATA
S.R. 235

EXPLORATION ID., STATION & OFFSET	FROM - TO	SAMPLE ID	N_{60}	% REC	tsf HP	% GR	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	ODOT CLASS (GI)	ppm SO_4
B-004-0-21	1.0 - 2.5	SS-1	34	67	--	Dense grayish-brown GRAVEL WITH SAND (Fill)								5	A-1-b (Visual)	
STA. 113+34, 16' RT.	2.5 - 4.0	SS-2	12	61	1.5-2.5	13	20	16	34	17	27	17	10	17	A-4a (3)	78
LATITUDE = N 39.739391	4.0 - 5.5	SS-3	36	28	--	50	26	11	9	4	NP	NP	NP	5	A-1-b (0)	
LONGITUDE = W 83.936113	5.5 - 7.0	SS-4	26	33	--	Medium-dense brownish-gray GRAVEL WITH SAND								3	A-1-b (Visual)	
	7.0 - 8.5	SS-5	25	56	--	Medium-dense brown COARSE AND FINE SAND								6	A-3a (Visual)	

SUMMARY OF SOIL TEST DATA
S.R. 235 HISTORIC BORINGS

EXPLORATION ID., STATION & OFFSET	FROM - TO	SAMPLE ID	N	% REC	tsf HP	% GR	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	ODOT CLASS (GI)	ppm SO_4
B-007-0-05	0.0 - 1.5	SS-1	25	78	-	24	18	12	31	15	23	16	7	8	A-4a (2)	
STA. 110+34, 12' LT.	1.5 - 3.0	SS-2	9	56	-	4	8	16	31	41	46	16	30	23	A-7-6 (17)	
LATITUDE = N 39.738565	3.0 - 4.5	SS-3	16	33	-	48	12	8	26	7	24	18	6	16	A-2-4 (0)	
LONGITUDE = W 83.936043	4.5 - 6.0	SS-4	16	22	-	Medium-dense GRAVEL & STONE FRAGMENTS W/ SAND								7	A-1-b (Visual)	
	6.0 - 7.5	SS-5	19	67	-	Medium-dense brown COARSE AND FINE SAND								5	A-3a (Visual)	
	8.5 - 10.0	SS-6	13	72	-	Same as SS-5								5	A-3a (Visual)	
B-006-0-05	0.0 - 1.5	SS-1	17	33	-	51	22	10	12	5	NP	NP	NP	6	A-1-b (0)	
STA. 111+79, 12' LT.	1.5 - 3.0	SS-2	21	22	-	80	12	5	--	3 --	NP	NP	NP	4	A-1-a (0)	
LATITUDE = N 39.738949	3.0 - 4.5	SS-3	11	56	-	54	35	6	3	2	NP	NP	NP	3	A-1-a (0)	
LONGITUDE = W 83.936239	4.5 - 6.0	SS-4	26	80	-	Medium-dense to dense brown COARSE AND FINE SAND								4	A-3a (Visual)	
	6.0 - 7.5	SS-5	52	80	-	Same as SS-4								4	A-3a (Visual)	
	8.5 - 10.0	SS-6	20	56	-	Same as SS-4								4	A-3a (Visual)	
B-005-0-04	1.0 - 1.2	SS-1	-	100	-	35	40	15	--	10 --	--	--	--	--	A-1-b (Visual)	
STA. 114+53, 3' LT.	2.5 - 4.0	SS-2	10	67	-	Stiff brown/gray SILT & CLAY					36	21	15	13	A-6a (Visual)	
LATITUDE = N 39.739700	5.0 - 6.5	SS-3	10	78	-	17	17	12	32	22	29	17	12	10	A-6a (5)	
LONGITUDE = W 83.936223	8.5 - 10.0	SS-4	10	78	-	Stiff grayish-brown to brown SILT AND CLAY (Fill)								36	A-6a (Visual)	





HORIZONTAL SCALE IN FEET

0 50 100

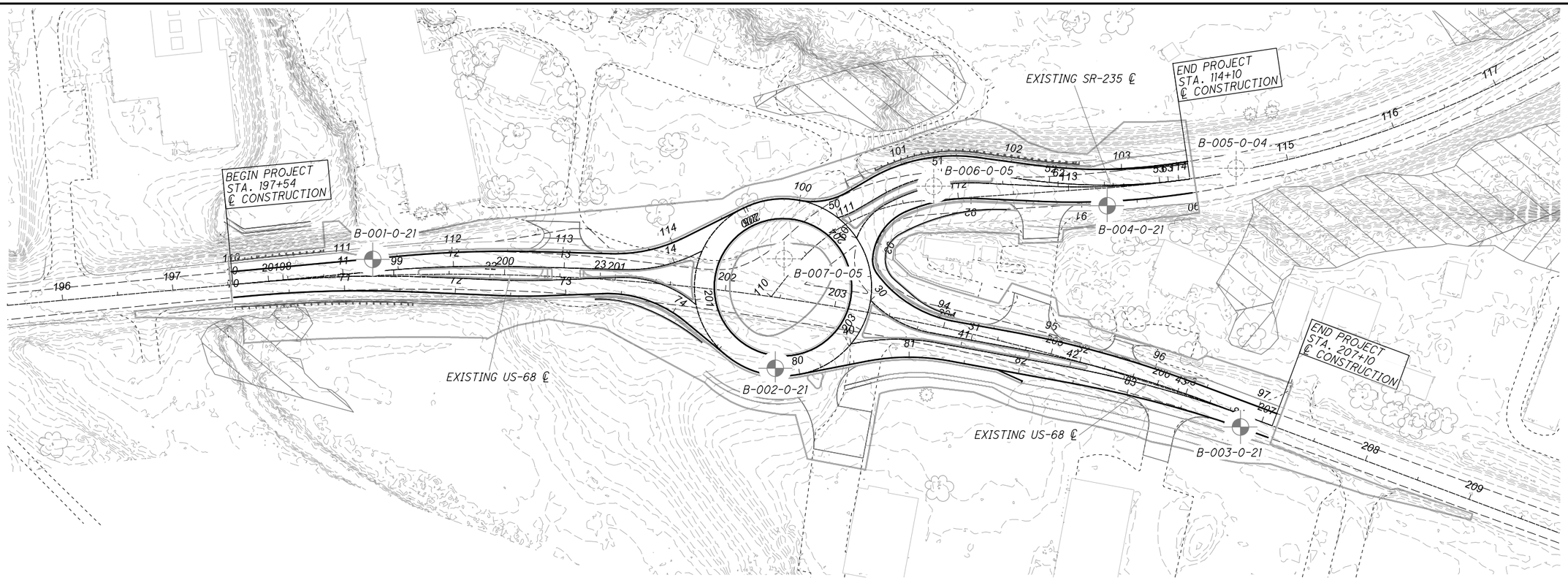
DRAWN KAH

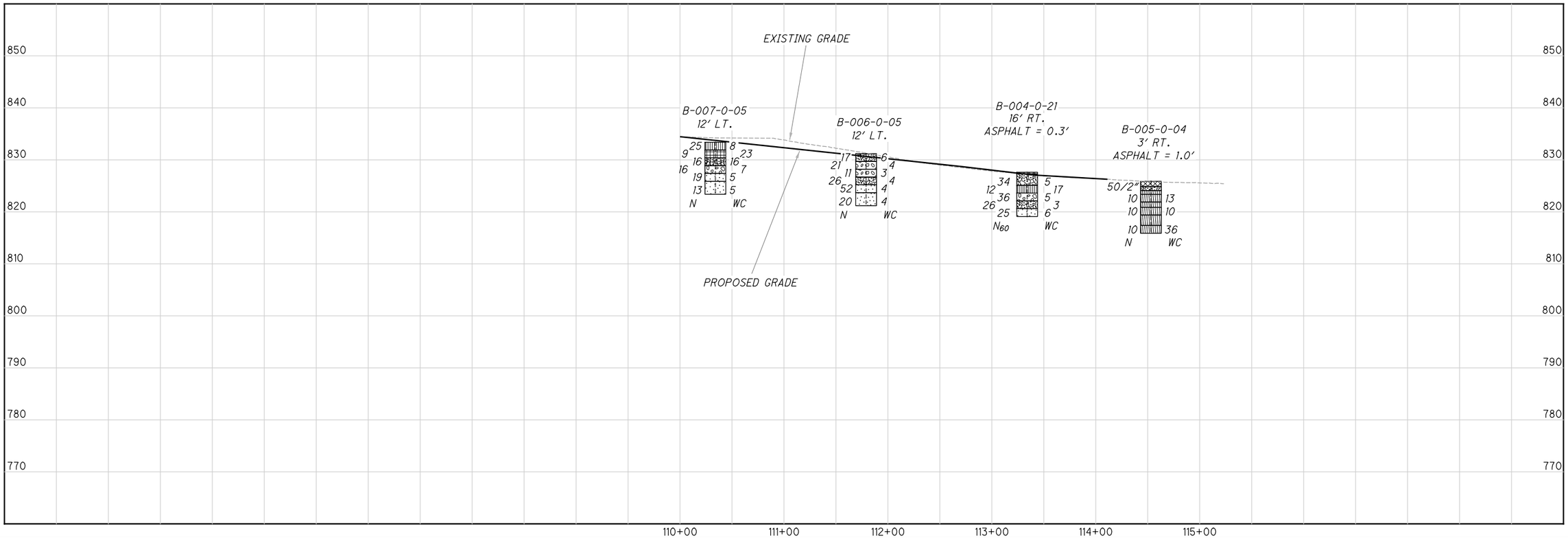
CHECKED RSW

SOIL PROFILE - ROADWAY

U.S. 68 STA. 197+00 TO STA. 208+00

GRE-68-1351





HORIZONTAL SCALE IN FEET
0 50 100

DRAWN KAH
CHECKED RSW

SOIL PROFILE - ROADWAY
S.R. 235 STA. 110+00 TO STA. 115+00

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