# ROADWAY EXPLORATION

## Proposed Intersection Improvements

OTT-53-11.67, PID 110859

State Route 53 from State Route 2 to E. Knol Crest Dr.

Portage Township, Ottawa County, Ohio


Submitted to Tetra Tech, Inc.
Date *February 2023*

Prepared by

TTL associates inc
Environmental, Geotechnical Engineering & Testing

Ohio Department of Transportation

OTT-53-11.67

PID 110859

# Proposed Intersection Improvements Portage Twp., Ohio

# Roadway Exploration

Tetra Tech, Inc.

Toledo, Ohio

February 15, 2023

TTL Project No. 1902501


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February 15, 2023

**TTL Project No. 1902501**

Mr. Andrew J. Langenderfer, P.E.
Tetra Tech
420 Madison Avenue, Suite 1001
Toledo, Ohio 43604

**Final Report**
**Roadway Exploration**
**Proposed Intersection Improvements**
**OTT-53-11.67, PID 110859**
**State Route 2 to E. Knol Crest Drive**
**Portage Township, Ottawa County, Ohio**

Dear Mr. Langenderfer:

Following is the report of our roadway exploration performed by TTL Associates, Inc. (TTL) for the referenced site. This study was performed in accordance with TTL Proposal No. 1902501R2 dated August 26, 2021, and was authorized with a Tetra Tech, Inc. Subconsultant agreement signed by you on November 15, 2021, for which you referenced Tetra Tech Project No. 200-12914-21001. Amendment 1 to the contract, dated October 17, 2022, was provided by you for removal of one roadway boring from the scope and inclusion of a sign-support foundation boring with recommendations.

A "draft" version of the report, dated June 6, 2022, was previously provided for review by Tetra Tech and ODOT. It was indicated that there were no comments regarding the draft report. This final report contains the results of our study, our engineering interpretation of the results with respect to the project characteristics, as well as our design and construction recommendations for the intersection improvements embankments and pavements, as well as a sign-support foundation.

Should you have any questions regarding this report or require additional information, please contact our office.

Sincerely,

**TTL Associates, Inc.**

Imad El Hajjar, EI
Geotechnical Project Manager

Christopher P. Iott, P.E
Chief Geotechnical Engineer

STATE OF OHIO
CHRISTOPHER P IOTT
E-69734
REGISTERED
PROFESSIONAL ENGINEER

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# FINAL REPORT
# ROADWAY EXPLORATION
# PROPOSED INTERSECTION IMPROVEMENTS
# OTT-53-11.67, PID 110859
# STATE ROUTE 2 TO E. KNOL CREST DRIVE
# PORTAGE TOWNSHIP, OTTAWA COUNTY, OHIO

**FOR**

**TETRA TECH, INC.**
**420 MADISON AVENUE, SUITE 1001**
**TOLEDO, OHIO 43604**

**SUBMITTED**

**FEBRUARY 15, 2023**
**TTL PROJECT NO. 1902501**

**TTL ASSOCIATES, INC.**
**1915 NORTH 12TH STREET**
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## EXECUTIVE SUMMARY

This subgrade exploration report has been prepared for the proposed intersection improvements and widening for State Route 53 (SR 53), from State Route 2 (SR 2) north to E. Knol Crest Drive [approximately 400 feet south of State Route 163 (SR 163)] in Portage Township, Ottawa County, Ohio. Intersection improvements are planned to include roundabouts along SR 53 immediately north of SR 2 (for the westbound SR 2 entrance and exit ramps), and at the intersection with East State Road. Additionally, SR 53 will be widened from East State Road north to E. Knol Crest Drive. As part of the intersection improvements, a new overhead sign will be installed for the westbound SR 2 ramp to northbound SR 53 (sign as traffic approaches Ramp D at exit 124). This exploration included 25 test borings for the evaluation of existing pavement sections and subgrade conditions in areas of proposed roadway construction. Subgrade evaluations were performed in accordance with ODOT GB-1 "Plan Subgrades" (July 16, 2021). A summary of the conclusions and recommendations of this study are as follows:

1. In the borings performed within the existing pavement south of East State Road, the majority of the encountered pavement materials consisted of asphalt underlain by crushed stone. In the borings performed along East State Road, the encountered pavement materials typically consisted of asphalt underlain by concrete. Boring B-005-1 was performed just off the edge of roadway along the existing SR 2 ramp to northbound SR 53, and didn't encounter a distinct surface cover. The surface material in the remaining borings consisted of topsoil. Existing fill materials were encountered underlying the surface materials in 5 of the 25 borings, and extended to depths generally ranging from approximately 2 to 4 feet below existing grades.

2. The subsoils encountered underlying the pavement and fill materials consisted of predominantly very stiff to hard cohesive soils. However, zones of cohesive soils exhibiting medium stiff to stiff consistency were encountered in approximately two-thirds of the borings. Additionally, a couple of borings included zones of **soft** cohesive soils. The lower strength soils were generally encountered in the upper-soil profile, overlying the very stiff to hard cohesive soils but were also encountered as localized layers interbedded within the lower soil profile. These cohesive soils consisted of sandy silt (A-4a), silt and clay (A-6a), silty clay (ODOT A-6b) and clay (ODOT A-7-6). Cobbles were encountered within the subsurface profile in Borings B-002 and B-003 at depths of approximately 8½ feet and 11 feet, respectively. It should be noted that the existence of cobbles or boulders within the glacial till subsoils is not unusual for this region.

3. Groundwater was initially encountered during drilling operations in five of the 25 borings at depths ranging from 4½ to 7½ feet below existing grade. Groundwater was observed upon completion of drilling operations in four of those five borings at depths ranging from 5½ to 8 feet. It is our opinion that the "normal" groundwater level can generally be expected at depths of approximately 5 feet or greater below existing grades. Based on the predominantly clayey soil profile at the site, adequate control of seasonal groundwater seepage, perched water, and surface water run-off into shallow excavations should be achievable by minor dewatering systems, such as pumping from prepared sumps.

4. Based on the GB-1 analysis, a design CBR value of 6 percent was determined for the project. It should be noted that the CBR determination by the GB-1 spreadsheet is based on the average Group Index of all the evaluated samples, which was 11. Group indices for the tested samples ranged from 0 to 17, which would correlate with a CBR value of 3 to 12 percent. Cohesive subgrade soils classified as ODOT A-4a, A-6a, A-6b, or A-7-6 were predominantly present within the upper 3 feet of the subgrade elevation in all borings. The average group index for these samples was 10. Based on the average design value calculations from GB-1, it does not appear to be unconservative to use the GB-1 design CBR value of 6 percent for new pavement sections throughout the project area.

5. The GB-1 analysis indicates options for "planned" subgrade modification of either global stabilization with lime or cement to a depth of 14 inches, or over-excavation of unsuitable subgrade soils and replacement with new granular engineered fill. Sulfate content of the subgrade soils will not preclude use of global chemical stabilization. A summary of the depths of undercut and replacement indicated by GB-1 analyses, as well as recommended extents of the undercut and replacement, are presented in Table 5.1.A of this report.

6. For the maximum embankment height of 11 feet along Ramp D, total settlement due to consolidation of the cohesive subgrade soils was calculated to be on the order of 2 to 3 inches. Based on consolidation test results and correlations with soil index properties, as well as the indicated fill height and range of compressible cohesive soil layer thicknesses, the time required to achieve 90 percent consolidation was calculated to be on the order of 2 to 6 weeks. Based on our experience with similar soils, the time required for 90 percent consolidation may be on the order of 4 to 6 weeks.

7. Review of the ODNR "Ohio Karst Areas" map indicated that the site is in an area of probable karst. Multiple suspected karst features are mapped along the east side of SR 53 on the karst interactive map provided on the ODNR website. These features have been marked as suspect and not field visited. Ground depressions were apparent within the agricultural field located from STA. 86± to STA to 99± during our field reconnaissance visit. Remediation of karst areas may be required.

8. Based on ODOT GDM Section 1204, for use of foundations on ODOT standard drawings for sign-support foundations, the average soil parameters over the length of the drilled shaft foundation should include an undrained shear strength ($S_u$) of at least 2,000 pounds per square foot (psf) for cohesive soils and an internal angle of friction ($\phi$) of at least 30 degrees for granular soils. Standard drawings also reference that the total unit weight of granular soils should also be a minimum of 120 pounds per cubic foot (pcf). Otherwise Special Foundation Design would be required. Based on the conditions encountered in the test borings performed for this exploration, the minimum design criteria are met and Special Foundation Design would not be required.

9. We are not privy to grading that may be performed in the area of the proposed sign-support foundation. It should be noted that the sign-support foundation location at Boring B-005-1 is along a slope. The aforementioned standard drawings indicate that drilled shaft **tip depths should be adjusted where grades are sloped 6 horizontal to 1 vertical (6H:1V)**

**or steeper, which would be the case for the existing conditions at the sign-support foundation location.**

This executive summary highlights our evaluations and recommendations and should only be utilized in conjunction with the accompanying report, including the detailed findings, analysis and recommendations, and qualifications presented herein.

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**APPENDICES**

# 1.0 INTRODUCTION

This roadway exploration report has been prepared for the proposed intersection improvements along State Route 53 (SR 53), from State Route 2 (SR 2) north to E. Knol Crest Drive [approximately 400 feet south of State Route 163 (SR 163)] in Portage Township, Ottawa County, Ohio. The general project area is shown on the Site Location Map (Plate 1.0).

This study was performed in accordance with TTL Proposal No. 1902501R2 dated August 26, 2021, and was authorized with a Tetra Tech, Inc. Subconsultant agreement signed by Mr. Andrew J. Langenderfer, P.E. on November 15, 2021, which referenced Tetra Tech Project No. 200-12914-21001. Amendment 1 to the contract, dated October 17, 2022, was provided by Mr. Langenderfer to TTL for removal of one roadway boring from the scope and inclusion of a sign-support foundation boring with recommendations.

## 1.1 Purpose and Scope of Exploration

The purpose of this exploration was to evaluate the subsurface conditions and laboratory data relative to the design and construction of new roundabout pavements and associated embankments, as well as State Route 53 (SR 53) widening, for the proposed intersection improvements for the referenced project. As part of the intersection improvements, a new overhead sign will be installed for the westbound SR 2 ramp to northbound SR 53 (sign as traffic approaches Ramp D at exit 124). To accomplish this, TTL performed 25 test borings, laboratory soil testing, a geotechnical engineering evaluation of the test results, and review of available geologic and soils data for the project area.

This report summarizes our understanding of the proposed construction, describes the investigative and testing procedures utilized to evaluate the subsurface conditions at the site, and presents our findings from the field and laboratory testing. This report also presents our evaluations and conclusions in accordance with ODOT GB-1 “Plan Subgrades” (July 16, 2021) and provides our design and construction recommendations for pavements and sign-support foundations.

This report includes:

- A description of the existing surface materials, subsurface soils, bedrock, and groundwater conditions encountered in the borings.
- Design recommendations for pavements and sign-support foundations.
- Recommendations concerning soil and groundwater-related construction procedures such as subgrade preparation in accordance with ODOT GB-1 criteria, earthwork, pavement construction, foundation installation and related field testing.

Appendix C includes pertinent ODOT Geotechnical Engineering Design Checklists that apply to the scope of this report.

## 1.2 Proposed Construction

The project is located along State Route 53 (SR 53), from State Route 2 (SR 2) north to E. Knol Crest Drive [approximately 400 feet south of State Route 163 (SR 163)] in Portage Township, Ottawa County, Ohio. Intersection improvements are planned to include roundabouts along SR 53 immediately north of SR 2 (for the westbound SR 2 entrance and exit ramps), and at the intersection with East State Road. Additionally, SR 53 will be widened from East State Road north to E. Knol Crest Drive. Also, a new overhead sign will be installed for the westbound SR 2 ramp to northbound SR 53 (sign as traffic approaches Ramp D at exit 124).

To facilitate new SR 2 entrance/exit alignments to the roundabout, embankment fill will be required south of the existing ramps, as well as northeast of the westbound off ramp. It is estimated that the maximum fill may be on the order of 10 to 11 feet in height, and will occur with along the SR-2 Ramp D.

Due to widening of SR 53, an existing pipe culvert located approximately half way between East State Road and SR 163 (Near STA 16+50) will be extended on both sides of the road. The existing culvert is 24" RCP, and it is planned to extend the culvert with 24" Type C with inclusion of HW-2.2 ODOT Standard half-height headwalls. Since half-height headwalls and a pipe culvert with diameter less than 5 feet are planned, ODOT prescribes that borings not be performed for the culvert. Hence, this report does not include design recommendations for culvert support.

New pavements are planned to consist of flexible (asphalt) sections.

## 2.0 GEOLOGY AND OBSERVATIONS OF THE PROJECT

### 2.1 General Geology and Hydrogeology

Published geologic maps from the Ohio Department of Natural Resources (ODNR) indicate that the project site is located in the Maumee Lake Plains Physiographic Region. Within this region, the upper profile geology includes predominantly Pleistocene-age silts and clays that were lake-laid (lacustrine) sediments, deposited in historic glacial lakes following retreat and melting of glacial ice. The lacustrine soils are underlain by glacial till deposits, underlain by sedimentary bedrock.

The lacustrine soils consist of predominantly cohesive soils, and may exhibit alternating thin layers of interbedded silts and clays known as varves. Varved soils are characteristic of lacustrine deposits, and the thin layering is typically attributed to seasonal or other cyclic variations of sedimentation in the lake waters. In addition, thin sand seams and partings may be encountered.

The glacial till, also referred to as moraine, was deposited by the advance and retreat of glacial ice. Due to the weight of the ice mass, the till deposits are moderately to highly over-consolidated, that is, the existing soil deposits have experienced a previous vertical stress significantly higher than the present effective vertical stress due to the remaining overlying soil strata in the profile. The upper portion of the till may be wave-planed, due to the wave action of the historic lakes. The till may contain cobbles and/or boulders in the till soil matrix. Additionally, seams of granular soils may be encountered within glacial tills. These granular seams may or may not be water bearing.

Bedrock in the project area is broadly mapped on the “Geologic Map of Ohio” as upper and lower Silurian Aged dolomite of the Salina group. This groups is known to include localized layers of anhydrite, gypsum, salt, and shale interbedded within the dolomite. Bedrock is mapped across the site at Elevations varying from approximately 540 to 560, generally corresponding to depths on the order of 20 to 40 feet below existing grades.

**Review of the ODNR “Ohio Karst Areas” map indicated that the site is in an area of probable karst. Multiple suspected karst features are mapped along the east side of SR 53 on the Karst interactive map provided on the ODNR website. These features have been marked as suspect and not field visited. Observed depressions were apparent within the agricultural field located from STA. 86± to STA to 99± during our field reconnaissance visit.**

A Review of the Ohio Department of Natural Resources (ODNR) Map of Mines indicated no historic mining activity within the immediate site area. However, an abandoned gypsum mine named “Lower Mine” and operated by United States Gypsum Company has been mapped

roughly 2,000 feet west of the SR-53 centerline. The base elevation of the mined gypsum has been noted at Elev. 516, which is roughly 70 feet below existing grades.

## 2.2 Site Reconnaissance

TTL performed site reconnaissance on December 3, 2021. The site is generally located in a commercial area with many retail and lodging developments along both sides of SR 53. The Erie Ottawa International Airport was present along the west side of SR 53 from STA 89± to STA 99±. An agricultural field was present along the east side of SR 53 from STA 89± to STA 95±. A wooded area was present along the east side of SR 53 from STA 95± to STA 99± . State Route 53 generally runs perpendicular to SR 2.

Approximately half way between East State Road and SR 163, an existing culvert pipe was present. This culvert was observed to consist of a 24-inch-dia reinforced concrete pipe. A swale was observed to extend along SR 53 on the west and east sides of the road. The swale was observed to be 1 to 3 feet deep and exhibited ponded water in some areas.

The pavements along the SR 2 ramps were observed to be generally in fair condition. Signs of distress were not noticeable throughout the pavement areas. However, we did observe longitudinal cracking within the shoulder area along with localized transverse cracking, generally spanning from edge to edge of pavement. The embankment associated with the ramps were observed to be in good condition; notable signs of slope instability and/or erosion were not overserved. Tire ruts and areas of ponded water were observed along the toe of the slopes associated with the ramp embankments.

The pavement along East State Road appeared to be newly resurfaced and was observed to generally be in good condition. Significant distresses and/or pavement cracks were not observed.

The pavement along SR 53 from the southern extent north to STA 94+50± (in the vicinity of Boring B-021-0-21) appeared to be recently resurfaced as compared to the sections north of this Station. Signs of distress were not noticeable throughout the southern portion of the SR 53 project pavement areas. However, we did observe longitudinal cracking down the center of the pavement areas were apparent along with minor localized transverse cracking, generally spanning from edge to edge of pavement.

The pavement along SR 53 north of STA 94+50± appeared to exhibit localized signs of distress. Again, longitudinal cracking down the center of the pavement area was apparent, along with transverse cracking, generally spanning from edge to edge of pavement.

# 3.0 EXPLORATION

## 3.1 Historic Borings

Review of ODOT records for the project area indicated historic test borings had been performed for the SR 2 exit ramps and for the Erie Ottawa International Airport Runway 6-27. Soil Profiles from these projects are included in Appendix B of this report.

In the historic borings for the SR 2 entrance/exit ramps construction project, the encountered subgrade soils consisted of predominantly cohesive soils (ODOT A-7-6, A-6a, A-6b and A-4a). Granular soils (ODOT A-1-B) indicating an apparent decomposed bedrock were encountered starting at 15 feet below existing grades. Bedrock consisting of limestone was encountered at depths varying from 16 feet to 42 feet below original grades. In most of the hand auger borings, refusal was noted at depths ranging from 4 to 7 feet. Boulders were noted in a few of the borings.

The historic borings for the Erie Ottawa International Airport Runway 6-27 realignment project extended to approximately 5 feet. The encountered subgrade soils consisted of predominantly cohesive soils (ODOT A-7-6, A-6a and A-6b).

We have assumed that the information provided in the historic borings was accurate and correct, at the time of those respective investigations, but cannot guarantee as such. Additionally, subgrade soil conditions may have changed or may have been modified due to construction performed following completion of the historic subsurface explorations.

## 3.2 Project Exploration Program

Our original field exploration included 24 test borings, designated as Borings B-001-0-21 through B-025-0-21, performed by TTL during the period from December 28, 2021 through January 4, 2022. One (1) supplemental test boring, designated as Boring B-005-1-22, was drilled on November 17, 2022. The test borings were advanced using 3¼-inch diameter hollow-stem augers. The borings have been identified in accordance with ODOT protocol, but the "-0-21 and -22" portions of the nomenclature are generally omitted for discussion in this report. Based on discussion between TTL and Tetra Tech, Boring B-010-0-21, which was included in the original proposal, was not performed because it was planned along the alignment of the ramp for EB SR 2, just north of SR 2 overpass. Due to only two lanes (one for EB SR 2 entrance and one for EB SR 2 exit) present and guardrail on each side, a lane would have needed closing. This boring was removed from the scope of work as part of Amendment 1 to the contract. Since Boring B-010 was removed from the scope of work, Boring B-011 was moved south of its planned location, just north of the extent of the aforementioned guardrail, to encounter existing embankment materials. The approximate locations of the borings are shown on the Test Boring Location Plans (Plates 2.1 through 2.5).

Latitude, Longitude, and ground surface elevation for all borings were initially surveyed by TTL via a hand-held GPS device. The accuracy from the handheld GPS device was generally found to be approximately 2 to 6 inches horizontal, and approximately 4 to 12 inches vertical. Stationing, offsets and ground surface elevations were subsequently provided by Tetra Tech based on field survey (expected to be more accurate) for all of the borings, except Borings B-013, B-014, B-16, B-18, B-20 and B-25. Stationing and offsets of Borings B-013, B-014, B-16, B-18, B-20 and B-25 were estimated by TTL from provided Stage 1 plans. The boring data are presented on the logs of test borings, and are summarized in the following table.

**Table 3.2 General Boring Location Information**

| Boring Number | Location | Centerline SR 53 Station (feet) | Offset (feet) | Ground Surface Elevation (feet) | Latitude (Degrees) | Longitude (Degrees) |
|---|---|---|---|---|---|---|
| B-001-0-21 | SR 2 Ramp | STA 51+14 | 474 LT | 584.4 | 41.506192 | -82.861249 |
| B-002-0-21 | SR 2 Ramp | STA 52+62 | 93 LT | 585.3 | 41.506192 | -82.861249 |
| B-003-0-21 | SR 2 Ramp | STA 52+86 | 59 RT | 587.5 | 41.506589 | -82.859866 |
| B-004-0-21 | SR 2 Ramp | STA 52+74 | 193 RT | 589.7 | 41.506642 | -82.859273 |
| B-005-0-21 | SR 2 Ramp | STA 58+84 | 452 RT | 584.5 | 41.506612 | -82.858807 |
| B-005-1-22 | SR 2 Ramp | STA 532+97 [1] | 6 RT [1] | 584.7 | 41.506028 | -82.850106 |
| B-006-0-21 | East State Road | STA 58+84 | 298 LT | 582.6 | 41.506188 | -82.85787 |
| B-007-0-21 | SR 53 | STA 59+47 | 29 LT | 583.4 | 41.508306 | -82.860578 |
| B-008-0-21 | SR 53 | STA 59+73 | 31 RT | 584.2 | 41.508457 | -82.859594 |
| B-009-0-21 | East State Road | STA 58+68 | 352 RT | 590.4 | 41.508537 | -82.859364 |
| B-011-0-21 | SR 53 | STA 53+86 | 23 LT | 596.1 | 41.50825 | -82.858215 |
| B-012-0-21 | SR 53 | STA 57+17 | 30 RT | 586.2 | 41.506861 | -82.859589 |
| B-013-0-21 | SR 53 | STA 61+50 | 24 LT | 581 | 41.507838 | -82.859383 |
| B-014-0-21 | SR 53 | STA 66+01 | 25 LT | 580 | 41.508903 | -82.859575 |
| B-015-0-21 | SR 53 | STA 69+84 | 18 RT | 581.2 | 41.510142 | -82.859567 |
| B-016-0-21 | SR 53 | STA 74+16 | 19 LT | 580 | 41.511309 | -82.859351 |
| B-017-0-21 | SR 53 | STA 77+55 | 22 RT | 584.4 | 41.512379 | -82.859448 |
| B-018-0-21 | SR 53 | STA 82+31 | 27 LT | 584 | 41.513413 | -82.859174 |
| B-019-0-21 | SR 53 | STA 86+10 | 25 RT | 586.4 | 41.514604 | -82.859263 |
| B-020-0-21 | SR 53 | STA 91+11 | 24 LT | 588 | 41.51576 | -82.859004 |
| B-021-0-21 | SR 53 | STA 94+82 | 51 RT | 589.6 | 41.51702 | -82.859131 |
| B-022-0-21 | SR 53 | STA 99+26 | 22 LT | 588.2 | 41.518161 | -82.858813 |
| B-023-0-21 | SR 53 | STA 102+89 | 14 RT | 589.4 | 41.519381 | -82.859019 |
| B-024-0-21 | SR 53 | STA 107+52 | 27 LT | 589.2 | 41.520376 | -82.858818 |
| B-025-0-21 | SR 53 | STA 111+52 | 45 RT | 586 | 41.521643 | -82.858928 |

1: Station and offset for Boring B-005-1-22 is relative to Stationing along SR 2 Ramp D.

In accordance with the ODOT Specifications for Geotechnic al Explorations (SGE), The borings for SR 2 entrance/exit ramp embankment (B-002, B-003, and B-004) were performed as Type B1 borings, and extended to a depth of 15 feet below existing grade. The borings for new embankment fill in the northern portion of the East State Road roundabout area (B-007 and B-008) were performed as Type B1 borings, and extended to a depth of 10 feet below existing grade. Boring B-005-1 was performed as a Type E5 boring and extended to a depth of 25 feet. These borings were sampled at 2½-foot intervals using 18-inch split-spoon sample drives.

The remaining 19 borings were performed as ODOT Type A roadway borings for subgrade evaluations in areas of new roadway along existing alignment or roadway widening with less than 3 feet vertical change. In existing roadways, after extension through existing pavements, the borings were sampled continuously for 6 to 7½ feet using 18-inch split-spoon sample drives. In widening areas, the borings were sampled continuously for 7½ feet using 18-inch split-spoon sample drives, assuming planned subgrade elevation will be approximately 1½ feet or less below existing grade.

The borings were backfilled with a mixture of bentonite chips and auger cuttings. At the boring locations within existing roadways, the surface was patched using asphalt "cold" patch.

Experience indicates that the actual subsoil or rock conditions at a site could vary from those generalized on the basis of test borings made at specific locations. Therefore, it is essential that a geotechnical engineer be retained to provide engineering services during the site preparation and pavement construction phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations, and to allow design changes in the event subsurface conditions differ from those anticipated prior to the start of construction.

### 3.3 Boring Methods

The test borings performed during this exploration were drilled with a GeoProbe 7822DT with drilling capabilities, an ATV-mounted drilling rig, or a truck-mounted drilling rig. The borings were extended utilizing 3¼-inch diameter hollow-stem augers. Samples were generally obtained using 18-inch split-spoon (SS) sample drives. The samples were sealed in jars and transported to our laboratory for further classification and testing.

Split-spoon soil samples were obtained by the Standard Penetration Test Method (ASTM D 1586). The Standard Penetration Test (SPT) consists of driving a 2-inch outside diameter split-spoon sampler into the soil with a 140-pound weight falling freely through a distance of 30 inches. The sampler was driven in three successive 6-inch increments, with the number of blows per increment being recorded. The number of blows per increment was recorded at each depth interval, and these data are presented under the "SPT" column on the Logs of Test

Borings attached to this report. The sum of the number of blows required to advance the sampler the second and third 6-inch increments is termed the Standard Penetration Resistance, or $N_m$-value, and is typically reported in blows per foot (bpf). The $N_m$-values were corrected to an equivalent rod energy ratio of 60 percent, $N_{60}$. The calibrated hammer/rod energy ratio for the CME 75 truck-mounted drill rig utilized in this project was 66.0 percent, based on calibration on March 15, 2021. The calibrated hammer/rod energy ratio for the CME 550X ATV-mounted drill rig utilized in this project was 78.1 percent, based on calibration on March 15, 2021. The hammer/rod energy ratio for the Geoprobe 7822DT was 91 percent, and was last calibrated on March 16, 2022. In any case, energy ratio is limited to an upper bound of 90 percent for the purposes of analyses and reporting in accordance with the ODOT Specification for Geotechnical Explorations (SGE). The $N_{60}$-values are presented on the attached Logs of Test Borings.

Two Shelby tube samples, designated ST on the Logs of Test Borings, were obtained from Borings B-007 (5 to 7 feet) and B-008 (6 to 8 feet). The Shelby tube samples were obtained by hydraulically advancing a 3-inch diameter, thin-walled sampler approximately 24 inches beyond the hollow-stem auger into undisturbed soil, in accordance with ASTM D 1587. The Shelby tubes were then extracted from the subsoils, and the ends were capped and sealed. The samples were transported to our laboratory where they were extruded, classified, and tested.

Soil conditions encountered in the test borings are presented in the Logs of Test Borings, along with information related to sample data, SPT results, water conditions observed in the borings, and laboratory test data. In conjunction with published data and typical correlations, the $N_{60}$-values can be evaluated as a measure of soil compactness/consistency as well as shear strength.

Field and laboratory data were incorporated into gINT™ software for presentation purposes. It should be noted that these logs have been prepared on the basis of laboratory classification and testing as well as field logs of the encountered soils.

### 3.4 Laboratory Testing Program

All samples were visually classified in accordance with the ODOT Soil Classification System. All recovered samples of the subsoils were also tested in our laboratory for moisture content (ASTM D 2216).

Laboratory testing was performed in accordance with GB-1 “Plan Subgrades” criteria, including mechanical soil classification consisting of an Atterberg limits test (ASTM D 4318) [for cohesive samples] and a particle size analysis (ASTM D 6913 and D 7928) for at least two samples from each roadway boring within 6 feet of the proposed subgrade.

Dry density determination and unconfined compressive strength tests by the constant rate of strain method (ASTM D 2166) were performed on the recovered Shelby tube samples and selected intact cohesive split-spoon samples. Unconfined compressive strength estimates were

obtained for the remaining intact cohesive samples using a calibrated hand penetrometer. Additionally, one-dimensional consolidation tests (ASTM D 2435) were performed on samples from Borings B-007 (ST-3) and B-008 (ST-3).

Sulfate content determinations (ODOT Supplement 1122) were performed on at least one sample from each roadway boring generally within 3 feet of the proposed subgrade.

These test results are presented on the Logs of Test Borings and laboratory test results attached to this report.

# 4.0 FINDINGS

## 4.1 General Site Conditions

At the time of this investigation and as indicated in Section 2.2, the project vicinity consisted of primarily commercial areas and agricultural land along SR 53. Grades in the project area were relatively flat. Ground surface elevations at the borings along SR 53 generally increased in elevation from south going north to SR 163, with elevations ranging from Elevs. 583± to 589±. Ground surface elevations at the boring locations along East State Road generally increased in elevation from west to east, with elevations ranging from Elevs. 583± to 590±. Ground surface elevations at the boring locations along the SR 2 ramps ranged from Elevs. 584± to 596±. The following table contains a summary of the encountered surface materials, as well as subgrade soils, in each boring.

**Table 4.1. Summary of Encountered Surface Materials and Subgrade Soils**

| Boring Number | Asphalt Thickness (inches) | Concrete Thickness (inches) | Crushed Stone Thickness (inches) | Topsoil Thickness (inches) | Subgrade Soil Type |
|---|---|---|---|---|---|
| B-001 | 6 | | 8 | - | Fill - A-6a |
| B-002 | - | - | - | 9 | A-6a |
| B-003 | - | - | - | 8 | A-6a |
| B-004 | 8 | - | 8 | - | A-6a |
| B-005 | 10 | - | 6 | - | A-6a |
| B-005-1 | - | - | - | - | A-6a |
| B-006 | 6 | 12 | - | - | A-6a |
| B-007 | - | - | - | 3[1] | A-6a |
| B-008 | - | - | - | 6[2] | A-6b |
| B-009 | 12 | 12 | - | - | A-6b |
| B-011 | 4 | 10 | 5 | - | Fill - A-6a |
| B-012 | 11 | - | 3 | - | A-6a |
| B-013 | - | - | - | 10 | A-6b |
| B-014 | - | - | - | 4 | A-7-6 |
| B-015 | - | - | 11 | - | A-6a |
| B-016 | - | - | - | 4 | Fill - A-7-6 |
| B-017 | - | - | - | 4[3] | Fill - A-6a |
| B-018 | - | - | - | 3 | Fill - A-2-6 |
| B-019 | - | - | - | 3 | A-7-6 |
| B-020 | - | - | - | 10 | A-6a |
| B-021 | - | - | - | 2 | A-6b |
| B-022 | - | - | - | 13 | A-6b |
| B-023 | - | - | - | 4 | A-6a |
| B-024 | - | - | - | 4 | A-6a |
| B-025 | - | - | - | 3 | A-6a |

(1) underlain by a 13 inch layer of topsoil mixed with gravel.

(2) Topsoil was mixed with asphalt fragments.

(3) Topsoil was mixed with crushed stone.

Granular and cohesive **fill** materials were encountered underlying the pavement materials to depths generally ranging from approximately 2 to 4 feet below existing grades in Borings B-001, B-011, B-016, B-017 and B-018.

The cohesive fill materials consisted of medium stiff to very stiff silt and clay (A-6a) mixed with some sand and varying amounts of crushed stone/aggregate, or clay (A-7-6) mixed with some silt and crushed stone/aggregate, little sand and trace brick fragments. SPT $N_{60}$-values ranged from 8 to 11 blows per foot (bpf). Unconfined compressive strengths generally ranged from 1,000 to 8,000 pounds per square foot (psf). Moisture contents ranged from 11 to 22 percent.

The granular fill materials consisted of **loose** to medium dense crushed stone (ODOT A-1-b and A-2-6) mixed with sand and varying portions of silt and clay. Within the granular fill materials, SPT $N_{60}$-values generally ranged from 8 to 17 bpf. Moisture contents varied from 4 to 36 percent.

## 4.2 General Soil Conditions

Based on the results of our field and laboratory tests, the subsoils encountered underlying the pavement and fill materials consisted of predominantly very stiff to hard cohesive soils. However, zones of cohesive soils exhibiting medium stiff to stiff consistency were encountered in approximately two-thirds of the borings. Additionally, a couple of borings included zones of **soft** cohesive soils. The lower strength soils were generally encountered in the upper-soil profile, overlying the very stiff to hard cohesive soils but were also encountered as localized layers interbedded within the lower soil profile. These cohesive soils consisted of sandy silt (A-4a), silt and clay (A-6a), silty clay (ODOT A-6b) and clay (ODOT A-7-6).

The majority of the subsoils exhibited generally very stiff to hard consistency. SPT $N_{60}$-values generally varied from 19 to 93 blows per foot (bpf). Unconfined compressive strengths generally ranged from 3,150 to 17,550 psf. However, a lower reading of 1,890 was determined for a sample tested within this zone, possibly due to the brittle nature of the material. Moisture contents generally varied from 7 to 29 percent.

Zones of cohesive soils exhibiting medium stiff to stiff consistency were encountered in Borings B-001, B-004, B-005, B-005-1, B-006, B-007, B-013, B-014, B-015, B-016, B-019, B-020, B-022, B-023, B-024 and B-025. SPT $N_{60}$-values generally varied from 2 to 19 blows per foot (bpf). Unconfined compressive strengths generally ranged from 1,000 to 4,000 psf. Moisture contents generally ranged from 11 to 29 percent.

Zones of cohesive soils exhibiting **soft** constancy were encountered within the subsurface profile as follows:

- In Boring B-014 from 3 to 6 feet with SPT $N_{60}$-values ranging from 2 to 4 bpf and unconfined compressive strengths on the order of 500 psf. Moisture contents were on the order of 30 percent.

- In Boring B-021 underlying the topsoil to a depth of 2 feet with an SPT $N_{60}$-value of 2 bpf, an unconfined compressive strength of 500 psf, and a moisture content of 23 percent.

Cobbles were encountered within the subsurface profile in Borings B-002 and B-003 at depths of approximately 8½ feet and 11 feet, respectively. It should be noted that the existence of cobbles or boulders within the glacial till subsoils is not unusual for this region

## 4.3 Groundwater Conditions

Groundwater was initially encountered during drilling operations in five of the 25 borings at depths ranging from 4½ to 7½ feet below existing grade. Groundwater was observed upon completion of drilling operations in four of those five borings at depths ranging from 5½ to 8 feet. It should be noted that the boreholes were drilled and backfilled within the same day, and stabilized water levels may not have occurred over this limited time period. The depths and elevations at which groundwater was encountered in the borings are summarized in the following table.

**Table 4.3. Groundwater Conditions**

| Boring Number | Groundwater Initially Encountered During Drilling | | Groundwater Observed Upon Completion of Drilling | |
|---|---|---|---|---|
| | Depth (feet) | Elevation (feet) | Depth (feet) | Elevation (feet) |
| B-004 | 4½ | 585 | 6½ | 583 |
| B-009 | 7½ | 583 | 8 | 583 |
| B-014 | 5 | 575 | 5½ | 575 |
| B-020 | 5½ | 583 | 7 | 581 |
| B-024 | 6 | 583 | N.E. | N.E |

N.E. – Not Encountered.

Based on the soil characteristics and groundwater conditions encountered in the borings, it is our opinion that the "normal" groundwater level can generally be expected at depths of approximately 5 feet or greater below existing grades. However, groundwater elevations can fluctuate with seasonal and climatic influences. In particular, "perched" water may be encountered in crushed stone pavement base materials or the existing fill materials that are underlain by relatively impermeable cohesive soils. Additionally, groundwater levels may be affected by water levels in the adjacent swales that are present along the project alignment. Therefore, groundwater conditions may vary at different times of the year from those encountered during our exploration.

## 4.4 Remedial Measures

The GB-1 "Subgrade Analysis" worksheet (V14.5, 01/18/19) indicates options for "planned" subgrade modification of either global stabilization with lime to a depth of 14 inches, or over-excavation of unsuitable subgrade soils and replacement with new granular engineered fill. A summary of the depths of undercut and replacement indicated by GB-1 analyses, as well as recommended extents of the undercut and replacement, are presented in Table 5.1.A of this report.

Review of the ODNR "Ohio Karst Areas" map indicated that the site is in an area of probable karst. Multiple suspected karst features are mapped along the east side of SR 53 on the karst interactive map provided on the ODNR website. These features have been marked as suspect and not field visited. Ground depressions were apparent within the agricultural field located from STA. 86± to STA to 99± during our field reconnaissance visit.

Based on ODOT GDM Section 1204, for use of foundations on ODOT standard drawings for sign-support foundations, the average soil parameters over the length of the drilled shaft foundation should include an undrained shear strength ($S_u$) of at least 2,000 pounds per square foot (psf) for cohesive soils and an internal angle of friction ($\phi$) of at least 30 degrees for granular soils. Standard drawings also reference that the total unit weight of granular soils should also be a minimum of 120 pounds per cubic foot (pcf). Otherwise, Special Foundation Design would be required. Based on the conditions encountered in the test borings performed for this exploration, the minimum design criteria are met and Special Foundation Design would not be required.

We are not privy to grading that may be performed in the areas of the proposed sign-support foundation. It should be noted that the sign-support foundation location at Boring B-005-1 is along a slope. The aforementioned standard drawings indicate that drilled shaft **tip depths should be adjusted where grades are sloped 6 horizontal to 1 vertical (6H:1V) or steeper, which would be the case for the existing conditions at the sign-support foundation location.**

The scope of this study did not include an environmental assessment of the surface or subsurface materials at this site.

## 5.0 ANALYSES AND RECOMMENDATIONS

The following analysis and recommendations are based on our understanding of the proposed construction and on the data obtained during our field exploration. If the project alignment or subgrade depth should change significantly, a review of these recommendations should be made by TTL.

### 5.1 GB-1 "Plan Subgrades" Evaluation

An evaluation of the subgrade soils was completed in general accordance with ODOT Geotechnical Bulletin GB-1 "Plan Subgrades" (July 16, 2021). As part of this evaluation, the ODOT "Subgrade Analysis" worksheet (V14.5, 01/18/19) was completed and is attached to this report.

Subgrade elevations in the southern portion of the project area are generally expected to be approximately 1½ to 2 feet below existing ground surface elevations (represented as a 1.5 to 2 feet cut in the ODOT "Subgrade Analysis" worksheet). For the widening of SR 53, subgrade elevations are anticipated to approximate existing grades at the boring locations (represented as 0.0 feet cut/fill in the ODOT "Subgrade Analysis" worksheet).

Based on GB-1, soils classified as ODOT A-4b, A-2-5, A-5, A-7-5, A-8a, A-8b, or rock have been designated as being problematic with respect to pavement subgrade support. None of these soil types were encountered at planned subgrade elevations in the borings performed for this exploration.

Based on GB-1 criteria, subgrade soils with moisture contents greater than 3 percent above optimum likely indicate the presence of unstable subgrade that may require some form of subgrade modification. Approximately 60 percent of the tested subgrade soil samples were greater than 3 percent above the optimum as determined using GB-1 criteria. Approximately 80 percent of the samples with moisture contents greater than 3 percent above optimum had moisture contents greater than or equal to 5 percent above optimum. Thus, where moisture contents were wet of optimum, they were appreciably wet of optimum. These data indicate that scarification and aeration methods may not be feasible to achieve satisfactory proof rolling and stabilization of the predominantly cohesive subgrades. However, scarification and aeration methods may be utilized in areas where granular subgrades wet of optimum are present, provided weather conditions and construction schedule will allow such soil modification.

The type and thickness of subgrade modification is determined by GB-1 criteria based on the average, low SPT $N_{60}$-value ($N_{60L}$) of the subgrade soils in a particular portion of the project area, hand penetrometer value, soil type, and moisture content. Based on these criteria, 19 of the 22 roadway subgrade borings (85± percent) contained subgrade soils which indicated subgrade modification is likely to be required. Possible alternatives for those areas where

modification of the subgrade soils is indicated could include the following, using GB-1 criteria based on the encountered conditions:

- undercut and replacement with granular engineered fill, or
- global chemical stabilization to a depth of 14 inches using cement or lime.

It is our understanding that recent projects in Northwest Ohio, which included similar cohesive soils to those at this project site, were planned to include global lime stabilization for subgrade preparation. It was indicated that, for some of those projects, suitable strength could not be achieved with lime stabilization mix designs. As such, if it is preferred to use lime, it may be prudent to perform mix designs for the subgrade soils using lime to confirm suitable strength can be achieved prior to commencement of construction. If suitable strength cannot be achieved using lime, mix designs should be performed using cement.

GB-1 indicates that, if it is determined that 30 percent or more of the subgrade area must be stabilized, consideration should be given to stabilizing the entire project (global chemical stabilization). Since 85 percent of the borings indicate potential need for subgrade modification based on GB-1 criteria, global chemical stabilization could be an economical approach for this project. Sulfate content tests for tested subgrade samples ranged from 310 parts per million (ppm) to 530 ppm, which would not preclude the use of global chemical stabilization. The GB-1 analysis spreadsheet indicates that rubblize and roll is not an option for this project.

A summary of the depths of undercut and replacement indicated by GB-1 analyses, as well as recommended extents of the undercut and replacement, are presented in the following table.

**Table 5.1.A. GB-1 Subgrade Analysis Indicated Undercut Depths**

| Boring Number(s) | GB-1 Recommended Depth of Undercut and Replacement with Granular Engineered Fill (inches) | Recommended Subgrade Modification Extents |
|---|---|---|
| B-001 | 12 | SR-2 – Ramp C – Entire Ramp. Begin Work STA 516+51 to POT 524+09. |
| B-004 | 12 | SR-2 Ramp D – Undercut not applicable in area of Boring B-004 since greater than 3 feet of embankment fill to be placed from west end of ramp to STA 529±. |
| B-005 | 15 | SR-2 Ramp D – STA 529 to End Work STA 539+92 |
| B-006 | No treatment indicated by GB-1 | East State Road – Begin Work STA 46+49 to STA 48+00 |

| Table 5.1.A. GB-1 Subgrade Analysis Indicated Undercut Depths | | |
|---|---|---|
| **Boring Number(s)** | **GB-1 Recommended Depth of Undercut and Replacement with Granular Engineered Fill (inches)** | **Recommended Subgrade Modification Extents** |
| B-007 | 18 | Roundabout at SR-53 and East State Road.<br>East State Road – from STA 48+00 to STA 50+00.<br>SR-53 Southbound – from STA 58+00 to STA 60+00. |
| B-008 | No treatment indicated by GB-1 | Roundabout at SR-53 and East State Road East State Road – from STA 50+00 to End Work STA 54+09.<br>SR-53 Northbound – from STA 58+00 to STA 60+00 |
| B-009 | No treatment indicated by GB-1 | East State Road – from STA 50+00 to End Work STA 54+09. |
| B-011 and B-012 | 12 | SR-53 – from Begin Project STA 51+36 to STA 58+00 |
| B-013 through and B-017 | 12 | SR-53 – from STA 60+00 to STA 79+50 |
| B-018 | 18 | SR-53 – from STA 79+50 to STA 84+50 |
| B-019 | 12 | SR-53 – from STA 84+50 to STA 88+50 |
| B-020 and B-021 | 18 | SR-53 – from STA 88+50 to STA 97+50 |
| B-022 | 12 | SR-53 – from STA 97+50 to STA 101+00 |
| B-023 and B-024 | 18 | SR-53 – from STA 101+00 to STA 109+50 |
| B-025 | 42 | SR-53 – from STA 109+50 to End Project STA 111+60. |

Where undercut and replacement is utilized, all fill should consist of ODOT Item 304 Aggregate Base or Item 703.16C, Granular Material Type B or Type C. It is recommended that geotextile fabric (referenced in ODOT Item 204, and specified as ODOT Item 712.09, Type D) be utilized on the subgrade at the bottom of the undercut zone. If particularly unstable subgrades are encountered during construction, or undercuts exceed approximately 18 inches, a geogrid could be used to reduce the total undercut and replacement of the unsuitable soils by 6 inches.

It should be noted that GB-1 analyses are used as a pre-construction tool to plan subgrade modification alternatives. **Actual subgrade modification will depend on field observations of proof-rolling conditions at the time of construction.** Changes in soil moisture content could create more or less favorable subgrade conditions that may result in adjustments to subgrade modification or soil stabilization requirements at the time of construction.

As required by GB-1, sulfate content tests (ODOT Supplement 1122) were performed on a sample within the upper 3 feet of each boring. The sulfate content test results are summarized in the following table:

**Table 5.1.C. Sulfate Content**

| Boring Number | Sulfate Content (mg/kg) | Boring Number | Sulfate Content (mg/kg) |
|---|---|---|---|
| B-001 | 430 | B-015 | 380 |
| B-004 | 470 | B-016 | 450 |
| B-005 | 380 | B-017 | 460 |
| B-006 | 310 | B-018 | 390 |
| | 450 | B-019 | 500 |
| B-007 | 420 | B-020 | 490 |
| B-008 | 420 | B-021 | 480 |
| B-009 | 470 | B-022 | 470 |
| B-011 | 530 | B-023 | 380 |
| B-012 | 520 | B-024 | 410 |
| B-013 | 480 | B-024 | 450 |
| B-014 | 410 | | |

GB-1 indicates that chemical stabilization cannot be utilized when sulfate contents for the majority of the samples exceed 3,000 parts per million (ppm), or individual soil samples exhibit sulfate contents of greater than 5,000 ppm. The sulfate content of the subgrade soils will not preclude use of global chemical stabilization for this project.

## 5.2 Flexible (Asphalt) Pavement Design

Based on the GB-1 analysis, a design CBR value of 6 percent was determined for the project. It should be noted that the CBR determination by the GB-1 spreadsheet is based on the **average** Group Index of all the evaluated samples, which was 11. Group indices for the tested samples ranged from 0 to 17, which would correlate with a CBR value of 3 to 12 percent. Cohesive subgrade soils classified as ODOT A-4a, A-6a, A-6b, or A-7-6 were predominantly present within the upper 3 feet of the subgrade elevation in all borings. The average group index for these samples was 10. Based on the average design value calculations from GB-1, it does not appear to be unconservative to use the GB-1 design CBR value of 6 percent for new pavement sections throughout the project area.

It should also be noted that the design CBR value is based on subgrades compacted to at least 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor) or verified as stable through proof-rolling in accordance with Section 5.3 of this report.

All pavement design and paving operations should conform to ODOT specifications. The pavement and subgrade preparation procedures outlined in this report should result in a reasonably workable and satisfactory pavement. It should be recognized, however, that all pavements need repairs or overlays over time as a result of progressive yielding under repeated loading for a prolonged period.

It is recommended that proof rolling, placement of aggregate base, and placement of asphalt be performed within as short a time period as possible. Exposure of the aggregate base to rain, snow, or freezing conditions may lead to deterioration of the subgrade and/or base materials due to excessive moisture conditions and to difficulties in achieving the required compaction.

## 5.3 Site and Subgrade Preparation

Site and subgrade preparation activities should conform to ODOT Construction and Materials Specifications (CMS) Item 204 specifications. Site preparation activities should include the removal of vegetation, topsoil, root mats, pavements, and other deleterious non-soil materials from all proposed roadway areas. The actual amount of required stripping should be determined in the field by a geotechnical engineer or qualified representative.

Upon completion of the clearing and undercutting activities, all areas that are to receive fill, or that have been excavated to proposed final subgrade elevation, should be inspected by a geotechnical engineer. Pavement subgrades should be proof rolled in accordance with ODOT CMS 204.06.

Any unsuitable materials observed during the inspection and proof-rolling operations should be undercut and replaced with compacted fill, or stabilized in place utilizing conventional remedial measures such as discing, aeration, and recompaction. As stated previously, based on the conditions encountered during our exploration, where subgrade soil moisture contents were wet of optimum, they were significantly wet of optimum. As such, scarification and aeration methods may not be feasible to achieve satisfactory proof rolling and stabilization of the predominantly cohesive subgrades. However, scarification and aeration methods may be utilized in areas where granular subgrades wet of optimum are present, provided weather conditions and construction schedule will allow such soil modification.

The GB-1 analysis indicates options for “planned” subgrade modification of either global stabilization with lime or cement to a depth of 14 inches, or over-excavation of unsuitable

subgrade soils and replacement with new granular engineered fill. A summary of the depths of undercut and replacement indicated by GB-1 analyses, as well as recommended extents of the undercut and replacement, are presented in Table 5.1.A of this report. However, based on the extent of subgrade modification indicated for this project, global chemical stabilization may be the more economical method.

## 5.4 Groundwater Control

Groundwater conditions encountered during our exploration are summarized in Section 4.3.

Based on the soil characteristics and groundwater conditions encountered in the borings, it is our opinion that the "normal" groundwater level can generally be expected at depths of approximately 5 feet or greater below existing grades.

Based on the predominantly clayey soil profile at the site, adequate control of seasonal groundwater seepage, perched water, and surface water run-off into shallow excavations should be achievable by minor dewatering systems, such as pumping from prepared sumps.

## 5.5 Excavations and Slopes

The sides of temporary excavations for construction should be adequately sloped to provide stable sides and safe working conditions. Otherwise, the excavation must be properly braced against lateral movements. In any case, applicable Occupational Safety and Health Administration (OSHA) safety standards must be followed.

Based on the test borings, the soils likely to be encountered in shallow excavations may include:

- OSHA Type A soils (cohesive soils with unconfined compressive strengths of 3,000 pounds per square foot (psf) or greater),
- OSHA Type B soils (cohesive soils with unconfined compressive strengths greater than 1,000 psf but less than 3,000 psf), and
- OSHA Type C soils (cohesive soils with unconfined compressive strengths of 1,000 psf or less, granular soils, as well as existing fill materials).

Temporary excavations in Type A, B, and C soils should be constructed no steeper than ¾ horizontal to 1 vertical (¾H:1V), 1H:1V, and 1½H:1V, respectively. For situations where the excavation extends through a higher strength soil into a lower strength soil, the slope of the entire excavation will be governed by that of the lower strength soils. In all cases, flatter slopes may be required if lower strength soils or adverse seepage conditions are encountered during construction.

## 5.6 Fill

Material for engineered fill or backfill required to achieve design grades should meet ODOT Item 203 "Embankment Fill" placement and compaction requirements. In general, suitable fills may consist of any non-organic soils having a maximum dry density as determined by the Standard Proctor (ASTM D 698) of 90 pounds per cubic foot (pcf) or greater. On-site soils may be used as engineered fill materials provided that they are free of organic matter, debris, excessive moisture, and rock or stone fragments larger than 3 inches in diameter. Depending on seasonal conditions, the on-site soils may be wet of optimum and may require scarification and aeration to achieve satisfactory compaction. If the construction schedule does not allow for scarification and aeration activities, it may be more practical or economical to utilize imported granular fill. To maintain the recommended subgrade support CBR design value of 6 percent, fill placed at subgrade elevations should exhibit a Group Index on the order of 11 or less.

Fill should be placed in uniform layers not more than 8 inches thick (loose measure) and adequately keyed into stripped and scarified soils. All fill placed within pavement areas should be compacted to a dry density consistent with the requirements of ODOT Item 203, based on the maximum dry density as determined by ASTM D 698.

The on-site soils consist of granular and cohesive soils. For the cohesive soils, a sheepsfoot roller should provide the most effective soil compaction. For granular soils, granular fill, or dense-graded aggregate pavement base materials, a vibratory smooth-drum roller would be required to provide effective compaction.

Scarified subgrade soils and all fill material should be within 3 percent of the optimum moisture content to facilitate compaction. Furthermore, fill material should not be frozen or placed on a frozen base. It is recommended that all earthwork and site preparation activities be conducted under adequate specifications and properly monitored in the field by a qualified geotechnical testing firm.

## 5.7 New Embankment Fill

Fill will be placed for along the north side of State Road for the new roundabout at SR 53. However, the fill will nominally be on the order of 3 feet or less. New embankment fill is planned for Ramp C (SB SR 53 to WB SR 2) and Ramp D (WB SR 2 to NR SR 53), with maximum fill sections on the order of 10 to 11 feet at STA 524± along Ramp C and at STA 524+55± to STA 527± along Ramp D. We have assumed that the new fill will consist of cohesive soils from a nearby borrow source.

### 5.7.1 Special Benching and Sidehill Embankment Fills

Where fill will be placed along slopes that are flatter than 4 horizontal to 1 vertical (4H:1V) but steeper than 8H:1V, ODOT Construction and Materials Specifications (CMS) Item 203.05, which describes "standard specification" benching, should be followed.

Embankment fill placement along steeper slopes requires evaluation for the potential need for specifications of ODOT Geotechnical Bulletin GB-2, "Special Benching and Sidehill Embankment Fills," dated July 16, 2021. Special benching is to be used whenever there will be a stability problem with new fill and/or there are weak soils in an existing slope. Special benching is utilized to improve stability in a sidehill fill placed on an existing slope, or to remediate an unstable existing slope. Based on our site reconnaissance, the existing slopes in the project area appear to be performing satisfactorily, and are not in need of remediation due to instability.

Based on the project cross-section drawings, the intersection improvements will generally include fill in areas with relatively flat grades or fill along slopes which include more than 8 feet of plateau at the toe of the new fill. For these areas, only "standard specification" benching would be required.

### 5.7.2 Global Stability

Global stability evaluations for the new embankments were beyond the scope of this exploration. New embankment slopes are generally planned at 4H:1V, which are generally the same as the existing embankment slopes. Based on our site reconnaissance, the existing slopes in the project area appear to be performing satisfactorily, and are not in need of remediation due to instability.

Regardless of overall global slope stability, slopes graded steeper than 3H:1V may be prone to shallow surface sloughing. This type of shallow sliding is generally not problematic (by itself), but left unchecked, it can lead to progressive slope movements that eventually impact overall performance of the embankment.

In addition to slope protection, such as well-established vegetative cover and rock-lined channels in surface run-off collection ditches and swales, we recommend that surface drainage from pavement areas on the crest of the embankment should be directed to catch basins or storm drains and not allowed to sheet flow over the slope.

### 5.7.3 Settlement

Based on the Stage 1 project drawings, the maximum fill thickness is expected to be on the order of 11 feet and is anticipated as part of the Ramp D construction from STA 526± to 527±. Total settlement due to consolidation of the cohesive subgrade soils was calculated to be on the order of 2 to 3 inches.

Based on consolidation test results and correlations with soil index properties, as well as the indicated fill heights and range of compressible cohesive soil layer thicknesses, the time required to achieve 90 percent consolidation was calculated to be on the order of 2 to 6 weeks. Based on our experience with similar soils, the time required for 90 percent consolidation may be on the order of 4 to 6 weeks. It should be noted that, for the maximum embankment height and settlement magnitude indicated above, after 90 percent consolidation, the remaining foundation/embankment settlement would be on the order of ¼ of an inch.

The estimated 4-to 6-week time rate of settlement is based on the "clock" starting at time t=0 when all of the fill is in place (in effect, assuming the embankment load is applied instantly over the area). In reality, construction of the fill is expected to require a few weeks, so some of the consolidation and settlement will be initiated and occurring during the fill placement period, thereby shortening the post-fill-placement waiting period. For this reason, we recommend that settlement plates or cells be installed and monitored/surveyed during and following fill operations to facilitate decisions regarding acceptable timing for final construction and paving.

Settlement platforms shall be fabricated and installed in general accordance with ASTM D 6598. We recommend that each platform be surveyed by the contractor's surveyor three times per week during fill operations and approximately twice per week throughout the monitoring period. Surveys of the platforms will also need to be performed immediately prior to and immediately after installing extensions during fill placement activities. Each settlement monitor survey record should include a record of the top of fill elevation adjacent to the settlement monitor. Vibrating wire settlement cells could be utilized in lieu of the above noted settlement platform.

## 5.8 Sign-Support Drilled Shaft Foundations

A new overhead sign will be installed for the westbound SR 2 ramp to northbound SR 53 (sign as traffic approaches Ramp D at exit 124). Based on the provided drawing, the sign is proposed to be supported on a 42 or 48 inch diameter Shaft with a tip proposed at elevation 565 feet (roughly 18 feet below existing grades).

Based on ODOT Geotechnical Design Manual (GDM) Section 1204, for use of foundations on ODOT standard drawings for sign-support foundations, the average soil parameters over the length of the drilled shaft foundation should include an undrained shear strength (Su) of at least 2,000 pounds per square foot (psf) for cohesive soils and an internal angle of friction ($\phi$) of at least 30 degrees for granular soils. Standard drawings also reference that the total unit weight of granular soils should also be a minimum of 120 pounds per cubic foot (pcf). Otherwise Special Foundation Design would be required.

**Based on the conditions encountered in Boring B-005-1 performed for this exploration, the minimum design criteria are met and Special Foundation Design would not be required.** We are not privy to grading that may be performed in the area of the proposed sign-support foundation. It should be noted that the sign-support foundation location in the area of Boring B-005-1 is along a slope. The aforementioned standard drawings indicate that drilled shaft **tip depths should be adjusted where grades are sloped 6 horizontal to 1 vertical (6H:1V) or steeper, which would be the case for the existing conditions for the sign-support foundation location.**

Incorporating the upper-profile medium stiff to stiff cohesive soils underlain by predominantly very stiff to hard cohesive soils encountered in Boring B-005-1, an average undrained shear strength of approximately 3,000 psf could be considered based on the unconfined compressive strength and hand penetrometer test results. As such, the minimum required design requirement of 2,000 psf is met.

Calculations utilized for our analyses are presented in Appendix A.

Although not included in the reviewed standard drawings, it should be noted that we do not recommend diameters less than 24 inches for drilled shafts. It should be noted that typical construction practice for small diameter drilled shafts no longer includes inspection at the bottom of the pier for bearing due to time and costs associates with casing and safe entry into the drilled foundation. Therefore, confirmation of bearing capacity should include sufficient acquisition of relatively "undisturbed" samples from the drilling operations to evaluate soil strength.

We recommend a minimum 28-day compressive strength for the concrete ($f'_c$) of 4,000 pounds per square inch (psi). Drilled shafts should be constructed in accordance with ODOT Construction and Material Specifications (CMS) Item 524.

It should be noted that actual capacity of drilled shafts is dependent on proper installation methods, and the allowable capacity is based on the assumption that a reasonable standard of care and quality control will be exercised during drilled shaft installation.

Granular materials or soft clays were not encountered in the test borings. Significant groundwater seepage into the open borehole is not expected due to the predominantly cohesive subsoil profile in Boring B-005-1. As such, temporary steel casing is not anticipated to be required for support of the shaft walls or to seal the borehole from groundwater. However, if sand seams or sandier zones are encountered that contain perched or trapped groundwater, casing could be utilized to aid in sealing out water seepage prior to concrete placement. During concrete placement, as the steel casing is withdrawn, sufficient concrete should be maintained above the bottom of the casing to counteract any hydrostatic head and prevent collapse or "necking" of the shaft. Care must be taken during concreting and removal of any temporary casing to prevent the possibility of soil intrusions. The contractor should submit procedures for shaft installation prior to the start of work.

Although not encountered in Boring B-005-1, cobbles were encountered within the subsurface profile in Borings B-002 and B-003 at the SR 2 interchange with SR 53, depths of approximately 8½ feet and 11 feet, respectively. It should be noted that the existence of cobbles or boulders within the glacial till subsoils is not unusual for this region. Therefore, provisions should be made by the contractor to remove any obstructions, cobbles, or boulders if encountered during the drilling operations.

Drilled shafts should be clean and free of all loose material prior to the placement of concrete. A TTL representative should verify that drilled shaft foundations are bearing on competent materials and that the installation procedures meet specifications.

## 6.0 QUALIFICATION OF RECOMMENDATIONS

Our evaluation of embankments, sign-support foundations, as well as pavement design and construction conditions, has been based on the data obtained during our field exploration, as well as the criteria in ODOT Geotechnical Bulletin GB-1 “Plan Subgrades” (July 16, 2021). The general subsurface conditions were based on interpretation of the subsurface data at specific boring locations. Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions at the time of construction are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should observe earthwork and pavement construction to confirm that the conditions anticipated in design are noted. Otherwise, TTL assumes no responsibility for construction compliance with the design concepts, specifications, or recommendations.

The design recommendations in this report have been developed on the basis of the previously described project characteristics and subsurface conditions. If project criteria or locations change, TTL should be permitted to determine whether the recommendations must be modified. The findings of such a review will be presented in a supplemental report.

The nature and extent of variations between the borings may not become evident until the course of construction. If such variations are encountered, it will be necessary to reevaluate the recommendations of this report after on-site observations of the conditions.

Our professional services have been performed, our findings derived, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. TTL is not responsible for the conclusions, opinions, or recommendations of others based on this data.

## Plates

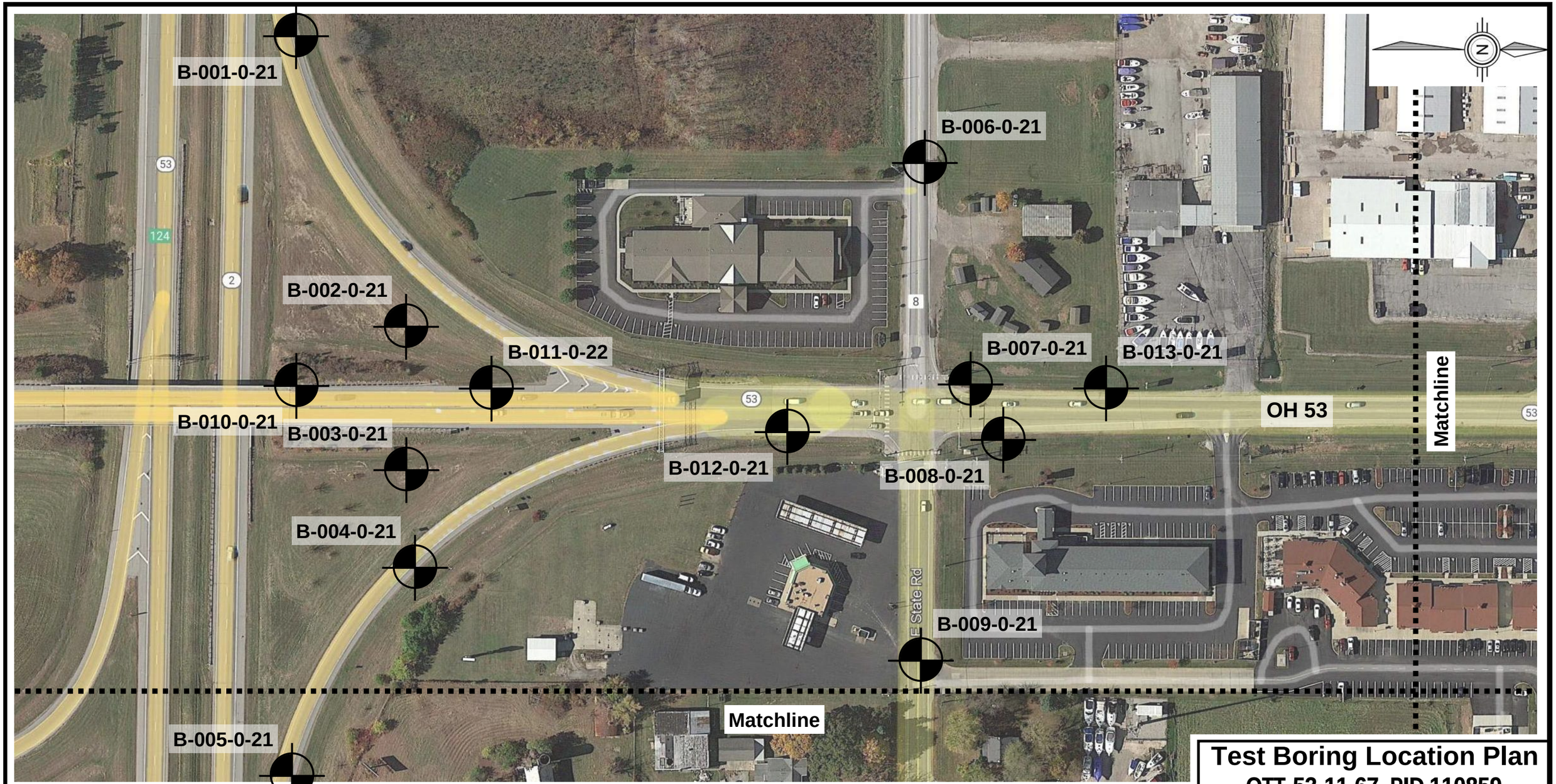

**Notes:** Aerial Basemap obtained From Google Earth and dated 10/25/2015.

# Site Location Map
## OTT-53-11.67, PID 110859
## Portage Township, Ohio

**Tetra Tech, Inc.**

| | |
|---|---|
| DRAWN: | IJH 05/31/22 |
| REVISED: | --- |
| Project No.: | 1902501 |
| Drawing No.: | Plate 1.0 |

TTL associates inc
Environmental, Geotechnical Engineering & Testing




**Legend:**

**B-001-0-21** **Approximate Test Boring Location**

**Notes:** Aerial Basemap obtained From Google Earth and dated 10/25/2015.
Boring B-010-0-21 was not performed. Refer for geotechnical report for additional Information.

0' 100' 200'

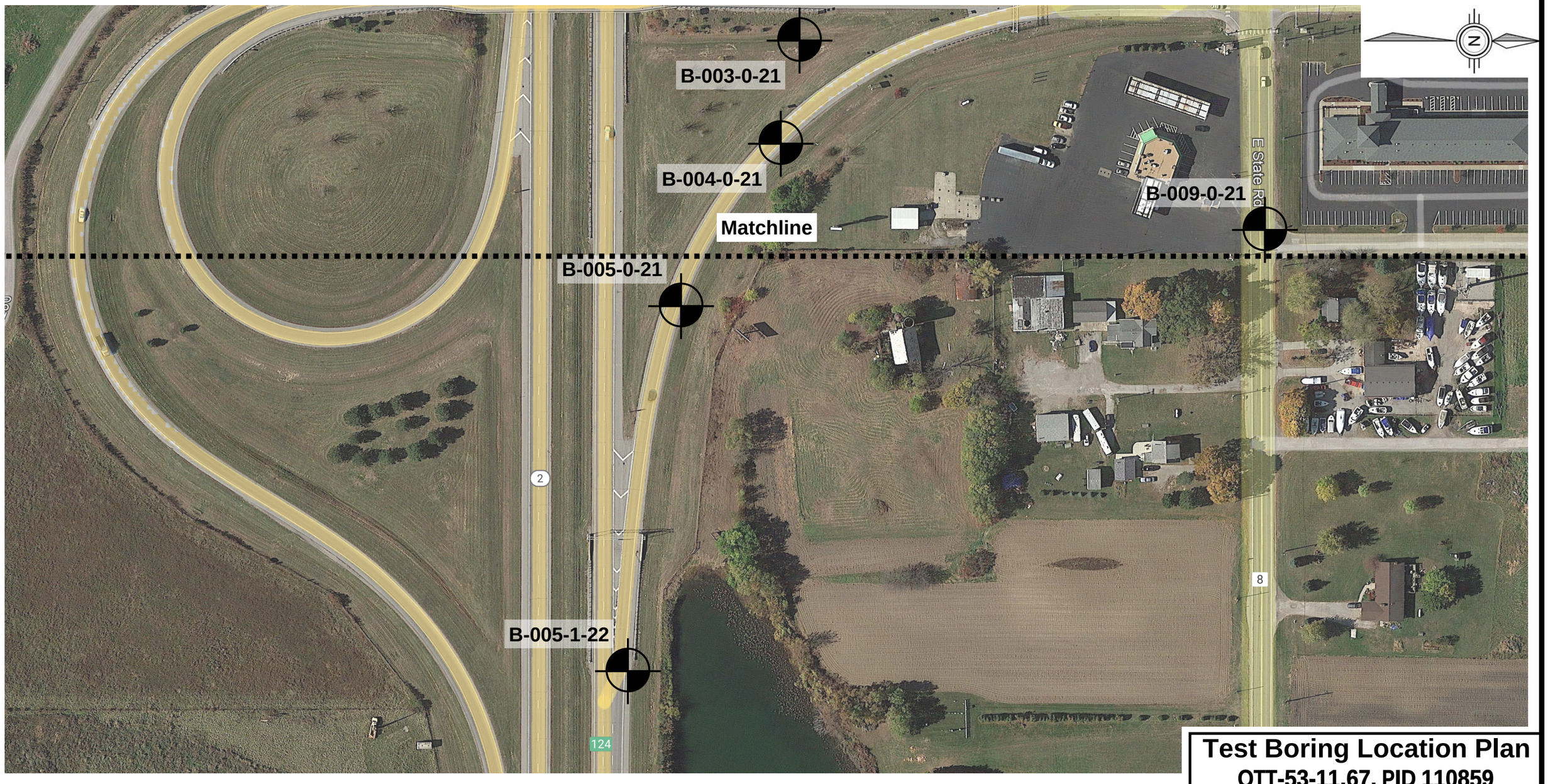
# Test Boring Location Plan

**OTT-53-11.67, PID 110859**
**Portage Township, Ohio**

**Tetra Tech, Inc.**

| | |
|---|---|
| DRAWN: | IJH 05/31/22 |
| REVISED: | --- |
| Project No.: | 1902501 |
| Drawing No.: | Plate 2.1 |

TTL associates inc
Environmental, Geotechnical Engineering & Testing




**Legend:**

B-003-0-21

**Approximate Test Boring Location**

0' 100' 200'

**Notes:** Aerial Basemap obtained From Google Earth and dated 10/25/2015.

# Test Boring Location Plan

## OTT-53-11.67, PID 110859
## Portage Township, Ohio

**Tetra Tech, Inc.**

| | |
|---|---|
| DRAWN: | IJH 02/14/22 |
| REVISED: | --- |
| Project No.: | 1902501 |
| Drawing No.: | Plate 2.2 |

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Environmental, Geotechnical Engineering & Testing


**Legend:**

**B-014-0-21**

**Approximate Test Boring Location**

0' 100' 200'

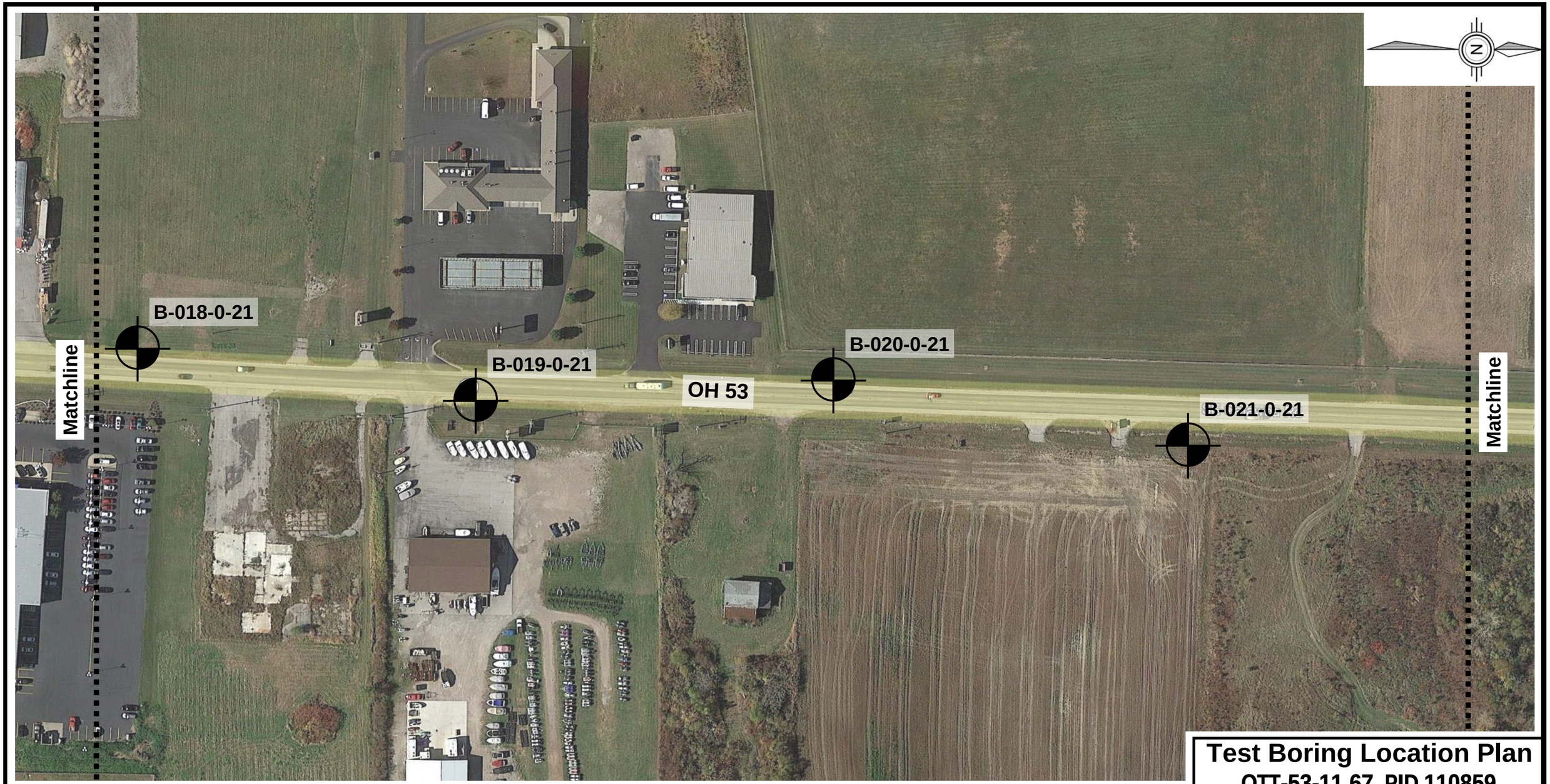
**Notes:** Aerial Basemap obtained From Google Earth and dated 10/25/2015.

# Test Boring Location Plan
## OTT-53-11.67, PID 110859
## Portage Township, Ohio

**Tetra Tech, Inc.**

| | |
|---|---|
| DRAWN: | IJH 05/31/22 |
| REVISED: | --- |
| Project No.: | 1902501 |
| Drawing No.: | Plate 2.3 |

TTL associates inc
Environmental, Geotechnical Engineering & Testing




**Legend:**

**B-018-0-21**

**Approximate Test Boring Location**

0' 100' 200'

**Notes:** Aerial Basemap obtained From Google Earth and dated 10/25/2015.

# Test Boring Location Plan

## OTT-53-11.67, PID 110859
## Portage Township, Ohio

**Tetra Tech, Inc.**

| | |
|---|---|
| DRAWN: | IJH 05/31/22 |
| REVISED: | --- |
| Project No.: | 1902501 |
| Drawing No.: | Plate 2.4 |

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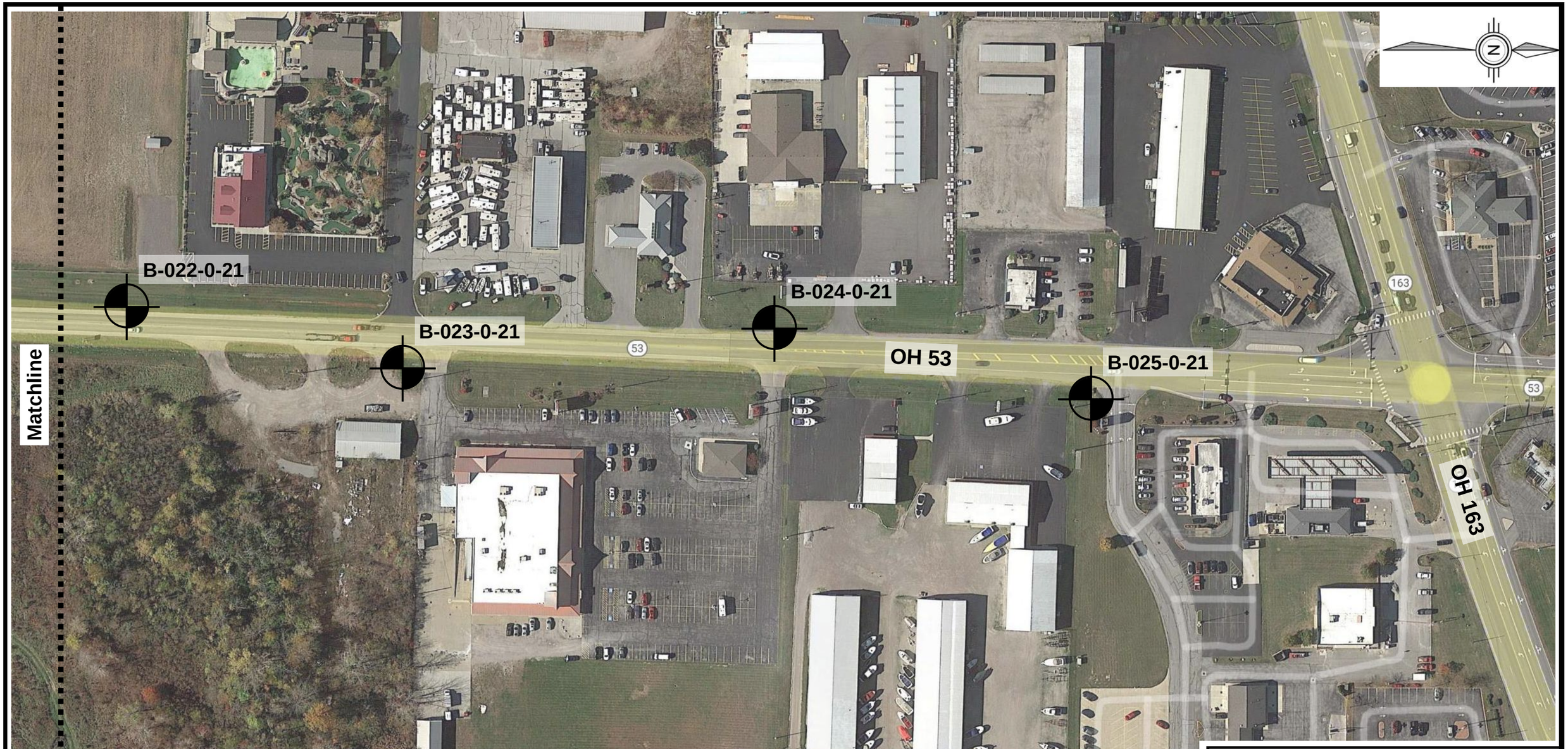


**Legend:**

B-022-0-21

**Approximate Test Boring Location**

0' 100' 200'

**Notes:** Aerial Basemap obtained From Google Earth and dated 10/25/2015.

# Test Boring Location Plan

## OTT-53-11.67, PID 110859

## Portage Township, Ohio

**Tetra Tech, Inc.**

| | |
|---|---|
| DRAWN: | IJH 05/31/22 |
| REVISED: | --- |
| Project No.: | 1902501 |
| Drawing No.: | Plate 2.5 |

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## Figures

**Logs of Test Borings**
**Legend Key**
**Grain Size Distribution Curves**
**Undisturbed Sample Unconfined Compressive Strength Test Results**
**Undisturbed Sample One-Dimensional Consolidation Test Results**

| | | | |
|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: GEOPROBE 7822DT | STATION / OFFSET: 51+14, 474' LT. |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: AUTOMATIC HAMMER | ALIGNMENT: SR-53 |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/16/22 | ELEVATION: 584.4 (NAVD88) EOB: 8.5 ft. |
| START: 1/4/22 END: 1/4/22 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90* | LAT / LONG: 41.506192, -82.861249 |

EXPLORATION ID B-001-0-21

PAGE 1 OF 1

| MATERIAL DESCRIPTION AND NOTES | ELEV. 584.4 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASPHALT - 6 INCHES | 583.9 | | | | | | | | | | | | | | | | | | |
| AGGREGATE BASE - 8 INCHES | 583.2 | | | | | | | | | | | | | | | | | | |
| STIFF, BROWN/GRAY, **SILT AND CLAY**, SOME SAND, LITTLE CRUSHED STONE, MOIST FILL | 581.4 | 1 | 3<br>3<br>4 | 11 | 83 | SS-1 | 2.00 | 19 | 8 | 15 | 19 | 39 | 24 | 13 | 11 | 11 | A-6a (5) | 430 | |
| HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | | 2 | | | | | | | | | | | | | | | | | |
| @4': GRAY/BROWN, SOME SAND, LITTLE GRAVEL, TRACE CALCITE STAIN | | 3 | 6<br>12<br>14 | 39 | 100 | SS-2 | >4.5 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |
| | | 4 | | | | | | | | | | | | | | | | | |
| | | 5 | 15<br>20<br>20 | 60 | 89 | SS-3 | >4.5 | 12 | 6 | 14 | 18 | 50 | 27 | 16 | 11 | 12 | A-6a (7) | - | |
| | | 6 | 20<br>20<br>27 | 71 | 100 | SS-4 | >4.5 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |
| | 575.9 EOB | 8 | 24<br>30<br>32 | 93 | 89 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | - | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.25 BAG ASPHALT PATCH; AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: GEOPROBE 7822DT | STATION / OFFSET: 52+62, 93' LT. | EXPLORATION ID B-002-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: AUTOMATIC HAMMER | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/16/22 | ELEVATION: 585.3 (NAVD88) EOB: 15.0 ft. | PAGE 1 OF 1 |
| START: 1/4/22 END: 1/4/22 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90* | LAT / LONG: 41.506589, -82.859866 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 585.3 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 9 INCHES | 584.5 | | | | | | | | | | | | | | | | | | |
| HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | | 1 | 9 9 9 | 27 | 83 | SS-1 | >4.5 | - | - | - | - | - | - | - | - | 12 | A-6a (V) | 550 | |
| @3': SOME SAND, LITTLE IRON OXIDE STAIN SEAM, MOIST QU - 78.6 PSI = 11,320PSF | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 10 16 16 | 48 | 94 | SS-2 | >4.5 | 9 | 9 | 15 | 21 | 46 | 25 | 14 | 11 | 11 | A-6a (7) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| @6': TRACE CALCITE STAIN SEAM | | 6 | 8 17 26 | 65 | 44 | SS-3 | >4.5 | - | - | - | - | - | - | - | - | 7 | A-6a (V) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |
| | | 8 | | | | | | | | | | | | | | | | | |
| @8.5': POSSIBLE COBBLES | | 9 | 23 33 50/5" | - | 94 | SS-4 | >4.5 | - | - | - | - | - | - | - | - | 7 | A-6a (V) | - | |
| | | 10 | | | | | | | | | | | | | | | | | |
| @11': LITTLE SAND, QU - 121.9 PSI = 17550 PSF | | 11 | 30 30 24 | 81 | 100 | SS-5 | >4.5 | 5 | 8 | 8 | 21 | 58 | 28 | 17 | 11 | 10 | A-6a (8) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 14 23 25 | 72 | 100 | SS-6 | >4.5 | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| | 570.3 | 15 EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 1 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: GEOPROBE 7822DT | STATION / OFFSET: 52+86, 59' RT. | EXPLORATION ID B-003-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: AUTOMATIC HAMMER | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/16/22 | ELEVATION: 587.5 (NAVD88) EOB: 15.0 ft. | PAGE 1 OF 1 |
| START: 1/4/22 END: 1/4/22 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90* | LAT / LONG: 41.506642, -82.859273 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 587.5 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 8 INCHES | 586.8 | | | | | | | | | | | | | | | | | | |
| HARD, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | | 1 | 7 7 7 | 21 | 89 | SS-1 | >4.5 | 6 | 10 | 18 | 21 | 45 | 26 | 15 | 11 | 14 | A-6a (7) | 490 | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 7 11 16 | 41 | 100 | SS-2 | >4.5 | 6 | 11 | 20 | 26 | 37 | 24 | 13 | 11 | 13 | A-6a (6) | - | |
| | | 5 | | | | | | | | | | | | | | | | | |
| @6': LITTLE SAND QU - 34.0 PSI = 4900 PSF | | 6 | 18 20 20 | 60 | 100 | SS-3 | >4.5 | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |
| | | 7 | | | | | | | | | | | | | | | | | |
| @8': GRAY, TRACE CALCITE STAIN SEAM | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 16 26 41 | 101 | 94 | SS-4 | >4.5 | - | - | - | - | - | - | - | - | 7 | A-6a (V) | - | |
| | | 10 | | | | | | | | | | | | | | | | | |
| @11': TRACE SHALE FRAGMENTS (POSSIBLE COBBLES) | | 11 | 36 50/5" | - | 91 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 8 | A-6a (V) | - | |
| | | 12 | | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | | |
| | | 14 | 15 18 23 | 62 | 100 | SS-6 | >4.5 | - | - | - | - | - | - | - | - | 10 | A-6a (V) | - | |
| | 572.5 | EOB 15 | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 1 BAG BENTONITE CHIPS

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 52+74, 193' RT. | EXPLORATION ID B-004-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 589.7 (NAVD88) EOB: 15.0 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT / ST | ENERGY RATIO (%): 66 | LAT / LONG: 41.506612, -82.858807 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 589.7 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASPHALT - 8 INCHES | 589.0 | | | | | | | | | | | | | | | | | | |
| AGGREGATE BASE - 8 INCHES | 588.4 | | | | | | | | | | | | | | | | | | |
| HARD, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, TRACE ORGANICS, MOIST | | | 6 4 4 | 9 | 100 | SS-1 | >4.5 | 6 | 7 | 19 | 25 | 43 | 28 | 16 | 12 | 16 | A-6a (7) | 470 | |
| @3.5': STIFF, LITTLE SAND, TRACE CALCITE STAIN SEAM, MOIST | | W 585.2 | 3 3 6 | 10 | 100 | SS-2 | 1.25 | - | - | - | - | - | - | - | - | 16 | A-6a (V) | - | |
| @6': HARD, SOME SAND, LITTLE GRAVEL | | | 13 13 13 | 29 | 100 | SS-3 | 4.25 | 16 | 10 | 19 | 28 | 27 | 28 | 17 | 11 | 14 | A-6a (4) | - | |
| | 581.0 | | | | 0 | ST-4 | - | - | - | - | - | - | - | - | - | - | A-3a (V) | - | |
| VERY DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE GRAVEL, TRACE CLAY, WET | | | | | | | | | | | | | | | | | | | |
| @11': (FREE WATER NOTED IN JAR) | | | 43 50/1" | - | 86 | SS-5 | - | - | - | - | - | - | - | - | - | 12 | A-3a (V) | - | |
| @13.5': (FREE WATER NOTED IN JAR) | | | 50/1" | - | 100 | SS-6 | - | - | - | - | - | - | - | - | - | 13 | A-3a (V) | - | |
| | 574.7 | EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.25 BAG ASPHALT PATCH; AUGER CUTTINGS MIXED WITH 1 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | |
|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 51+22, 452' RT. |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 584.5 (NAVD88) EOB: 8.5 ft. |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.506188, -82.857870 |

EXPLORATION ID B-005-0-21

PAGE 1 OF 1

| MATERIAL DESCRIPTION AND NOTES | ELEV. 584.5 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASPHALT - 10 INCHES | 583.7 | | | | | | | | | | | | | | | | | | |
| AGGREGATE BASE - 6 INCHES | 583.2 | | | | | | | | | | | | | | | | | | |
| STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST | 582.0 | 1 | 6<br>2<br>4 | 7 | 100 | SS-1 | 1.50 | - | - | - | - | - | - | - | - | 19 | A-6a (V) | 380 | |
| VERY STIFF, BROWN/GRAY, **SILT AND CLAY**, LITTLE SAND, LITTLE GRAVEL, MOIST<br><br>@4': HARD | 578.8 | 2<br>3<br>4 | 5<br>5<br>7 | 13 | 100 | SS-2 | 2.50 | 11 | 6 | 13 | 27 | 43 | 32 | 19 | 13 | 21 | A-6a (8) | - | |
| VERY STIFF, BROWN/GRAY, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, TRACE CALCITE STAIN SEAM, MOIST<br><br>@7': HARD, BROWN | 576.0 | 5<br>6<br>7 | 7<br>12<br>12 | 26 | 100 | SS-3 | 4.50 | - | - | - | - | - | - | - | - | 20 | A-6a (V) | - | |
| | | 8 | 8<br>18<br>18 | 40 | 100 | SS-4 | 3.50 | 6 | 2 | 9 | 24 | 59 | 43 | 23 | 20 | 23 | A-7-6 (13) | - | |
| | | EOB | 13<br>18<br>23 | 45 | 100 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 17 | A-7-6 (V) | - | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.25 BAG ASPHALT PATCH; AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / JW | DRILL RIG: CME 550X ATV | STATION / OFFSET: 532+97, 6' RT. | EXPLORATION ID B-005-1-22 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-2 RAMP D | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 584.7 (NAVD88) EOB: 25.0 ft. | PAGE 1 OF 2 |
| START: 11/17/22 END: 11/17/22 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 78.1 | LAT / LONG: 41.506028, -82.850106 | |

| ***MATERIAL DESCRIPTION AND NOTES*** | ELEV. 584.7 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MEDIUM STIFF TO STIFF, GRAY, **SILT AND CLAY**, SOME GRAVEL, SOME SAND, MOIST | | | | | | | | | | | | | | | | | | |
| @2': LITTLE SAND | | 1 | 2 4 3 | 9 | 78 | SS-1 | 0.50 | 29 | 11 | 9 | 17 | 34 | 29 | 17 | 12 | 19 | A-6a (4) | |
| | | 2 | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | |
| | | 4 | 2 3 5 | 10 | 72 | SS-2 | 1.50 | - | - | - | - | - | - | - | - | 22 | A-6a (V) | |
| | | 5 | | | | | | | | | | | | | | | | |
| | 578.7 | 6 | | | | | | | | | | | | | | | | |
| HARD, GRAY/BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE CALCITE STAIN SEAM, MOIST Qu = 62.4 PSI = 8,985 PSF | | 7 | 2 7 10 | 22 | 83 | SS-3 | 4.50 | - | - | - | - | - | - | - | - | 16 | A-6b (V) | |
| | | 8 | | | | | | | | | | | | | | | | |
| | | 9 | 5 8 10 | 23 | 89 | SS-4 | 4.50 | - | - | - | - | - | - | - | - | 16 | A-6b (V) | |
| | | 10 | | | | | | | | | | | | | | | | |
| @11': STIFF, Qu= 90.4 PSI = 13,015 PSF | | 11 | 3 6 9 | 20 | 78 | SS-5 | 4.50 | 6 | 7 | 10 | 19 | 58 | 35 | 19 | 16 | 16 | A-6b (10) | |
| @12.5': VERY STIFF, BROWN, TRACE IRON OXIDE STAIN SEAM | | 12 | | | | | | | | | | | | | | | | |
| | | 13 | | | | | | | | | | | | | | | | |
| | | 14 | 3 8 10 | 23 | 89 | SS-6 | 4.50 | - | - | - | - | - | - | - | - | 16 | A-6b (V) | |
| | | 15 | | | | | | | | | | | | | | | | |

| PID: 110859 | SFN: | PROJECT: OTT-53-11.67 | STATION / OFFSET: 532+97, 6' RT. | START: 11/17/22 | END: 11/17/22 | PG 2 OF 2 | B-005-1-22 |
|---|---|---|---|---|---|---|---|

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HARD, GRAY/BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE CALCITE STAIN SEAM, MOIST Qu = 62.4 PSI = 8,985 PSF *(continued)* | 568.7 | | 2 5 8 | 17 | 83 | SS-7 | 4.50 | - | - | - | - | - | - | - | - | 13 | A-6b (V) | |
| @16': STIFF, BROWN/GRAY, Qu = 50.1 PSI = 7,210 PSF | | 17 | | | | | | | | | | | | | | | | |
| | | 18 | | | | | | | | | | | | | | | | |
| @18.5': VERY STIFF, GRAY/BROWN | | 19 | 5 7 10 | 22 | 89 | SS-8 | 4.25 | - | - | - | - | - | - | - | - | 15 | A-6b (V) | |
| | | 20 | | | | | | | | | | | | | | | | |
| | 563.7 | 21 | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST | | 22 | 2 3 5 | 10 | 89 | SS-9 | 3.25 | - | - | - | - | - | - | - | - | 14 | A-6b (V) | |
| | | 23 | | | | | | | | | | | | | | | | |
| | 561.2 | | | | | | | | | | | | | | | | | |
| MEDIUM STIFF TO STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST Qu = 16.5 PSI = 2,375 PSF | | 24 | 2 4 5 | 12 | 83 | SS-10 | 1.00 | 9 | 8 | 8 | 19 | 56 | 27 | 16 | 11 | 15 | A-6a (8) | |
| | 559.7 | EOB 25 | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 1 BAG BENTONITE CHIPS

| | | | |
|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: GEOPROBE 7822DT | STATION / OFFSET: 58+84, 298' LT. |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: AUTOMATIC HAMMER | ALIGNMENT: SR-53 |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/16/22 | ELEVATION: 582.6 (NAVD88) EOB: 9.0 ft. |
| START: 1/3/22 END: 1/3/22 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90* | LAT / LONG: 41.508306, -82.860578 |

EXPLORATION ID B-006-0-21

PAGE 1 OF 1

| MATERIAL DESCRIPTION AND NOTES | ELEV. 582.6 | 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 - 6 INCHES | 582.1 | | | | | | | | | | | | | | | | | | |
| CONCRETE - 12 INCHES | 581.1 | 1 | | | | | | | | | | | | | | | | | |
| HARD, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE CALCITE STAIN SEAM, MOIST | 579.6 | 2 | 5 6 5 | 17 | 89 | SS-1 | >4.5 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | - | |
| STIFF, GRAY, **SILTY CLAY**, TRACE SAND, TRACE GRAVEL | 578.1 | 3 4 | 2 2 2 | 6 | 89 | SS-2 | 1.75 | 3 | 2 | 7 | 22 | 66 | 37 | 21 | 16 | 24 | A-6b (10) | 310 | |
| STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST | 576.6 | 5 6 | 3 3 3 | 9 | 72 | SS-3 | 2.00 | - | - | - | - | - | - | - | - | 23 | A-6a (V) | 450 | |
| HARD, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL | | 7 | 3 3 3 | 9 | 78 | SS-4 | >4.5 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | - | |
| @7.5': GRAY/BROWN, SOME SAND, TRACE CALCITE STAIN SEAM, MOIST | 573.6 | 8 | 3 5 7 | 18 | 28 | SS-5 | >4.5 | 6 | 11 | 10 | 23 | 50 | 35 | 20 | 15 | 16 | A-6a (10) | - | |
| | EOB | 9 | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.25 BAG ASPHALT PATCH; AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | |
|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: GEOPROBE 7822DT | STATION / OFFSET: 59+47, 29' LT. |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: AUTOMATIC HAMMER | ALIGNMENT: SR-53 |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/16/22 | ELEVATION: 583.4 (NAVD88) EOB: 10.0 ft. |
| START: 1/4/22 END: 1/4/22 | SAMPLING METHOD: SPT / ST | ENERGY RATIO (%): 90* | LAT / LONG: 41.508457, -82.859594 |

EXPLORATION ID B-007-0-21

PAGE 1 OF 1

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 3 INCHES | 583.4 | | | | | | | | | | | | | | | | | | |
| TOPSOIL AND GRAVEL - 13 INCHES | 583.1 | | | | | | | | | | | | | | | | | | |
| | 582.1 | 1 | | | | | | | | | | | | | | | | | |
| STIFF, GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, LITTLE CALCITE STAIN SEAM, MOIST | | 2 | 5 2 2 | 6 | 56 | SS-1 | 1.50 | - | - | - | - | - | - | - | - | 13 | A-6a (V) | 420 | |
| | 580.4 | 3 | | | | | | | | | | | | | | | | | |
| STIFF, GRAY, **CLAY**, SOME SILT, SOME SAND, TRACE GRAVEL, MOIST (NOTED AS AUGER SAMPLE) | | 4 | 2 3 3 | 9 | 0 | SS-2 | - | 8 | 4 | 14 | 23 | 51 | 45 | 23 | 22 | 26 | A-7-6 (14) | - | |
| | 578.4 | 5 | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN/GRAY, **CLAY**, LITTLE SILT, LITTLE SAND, TRACE IRON OXIDE STAIN SEAM QU -13.1 PSI = 1890 PSF | | 6 | | | 63 | ST-3 | 2.50 | 5 | 2 | 9 | 15 | 69 | 49 | 24 | 25 | 26 | A-7-6 (16) | - | |
| @8': HARD, GRAY/BROWN | | 7 | | | | | | | | | | | | | | | | | |
| | | 8 | | | | | | | | | | | | | | | | | |
| | | 9 | 5 7 9 | 24 | 100 | SS-4 | >4.5 | - | - | - | - | - | - | - | - | 15 | A-7-6 (V) | - | |
| | 573.4 | EOB 10 | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 59+73, 31' RT. | EXPLORATION ID B-008-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 584.2 (NAVD88) EOB: 10.0 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.508537, -82.859364 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL AND BROKEN ASPHALT - 6 INCHES | 584.2<br>583.7 | | | | | | | | | | | | | | | | | | |
| HARD, GRAY, **SILTY CLAY**, LITTLE GRAVEL, LITTLE SAND, TRACE CALCITE STAIN SEAM, MOIST | | 1<br>2 | 4<br>7<br>7 | 15 | 100 | SS-1 | 4.25 | 18 | 6 | 8 | 18 | 50 | 39 | 20 | 19 | 20 | A-6b (10) | 420 | |
| | | 3 | | | | | | | | | | | | | | | | | |
| @3.5': VERY STIFF | | 4<br>5 | 3<br>5<br>7 | 13 | 100 | SS-2 | 2.75 | - | - | - | - | - | - | - | - | 25 | A-6b (V) | - | |
| | 578.2 | 6 | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN/GRAY, **CLAY**, SOME SAND, LITTLE SILT, LITTLE GRAVEL, MOIST (SOIL IN UPPER PORTION OF TUBE DISTURBED)<br>@6.5': LITTLE SAND, TRACE GRAVEL, QU - 21.9 PSI = 3150 PSF | | 7<br>8 | | | 75 | ST-3 | 3.25 | 1 | 2 | 10 | 19 | 68 | 41 | 23 | 18 | 23 | A-7-6 (11) | - | |
| @8.5': GRAY/BROWN, TRACE IRON OXIDE STAIN SEAM | | 9 | 5<br>5<br>8 | 14 | 100 | SS-4 | 4.00 | - | - | - | - | - | - | - | - | 19 | A-7-6 (V) | - | |
| | 574.2 | EOB 10 | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: GEOPROBE 7822DT | STATION / OFFSET: 58+68, 352' RT. | EXPLORATION ID B-009-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: AUTOMATIC HAMMER | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/16/22 | ELEVATION: 590.4 (NAVD88) EOB: 9.5 ft. | PAGE 1 OF 1 |
| START: 1/3/22 END: 1/3/22 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90* | LAT / LONG: 41.508250, -82.858215 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 590.4 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASPHALT - 12 INCHES | 589.4 | | | | | | | | | | | | | | | | | | |
| CONCRETE - 12 INCHES | 588.4 | | | | | | | | | | | | | | | | | | |
| HARD, GRAY/BROWN, **SILTY CLAY**, LITTLE SAND, LITTLE GRAVEL, TRACE CALCITE STAIN SEAM, TRACE IRON OXIDE STAIN SEAM, MOIST | 585.4 | | 3 5 7 | 18 | 78 | SS-1 | >4.5 | 10 | 6 | 12 | 20 | 52 | 39 | 22 | 17 | 21 | A-6b (10) | 470 | |
| | | | 5 9 13 | 33 | 83 | SS-2 | >4.5 | - | - | - | - | - | - | - | - | 14 | A-6b (V) | - | |
| HARD, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, MOIST | | | 5 11 13 | 36 | 94 | SS-3 | >4.5 | 4 | 6 | 14 | 30 | 46 | 33 | 19 | 14 | 15 | A-6a (10) | - | |
| @6.5': VERY STIFF | | W 582.9 | 10 8 9 | 26 | 89 | SS-4 | 2.00 | - | - | - | - | - | - | - | - | 16 | A-6a (V) | - | |
| @8.5': HARD, GRAY/BROWN | 580.9 | EOB | 13 13 13 | 39 | 89 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 15 | A-6a (V) | - | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: GEOPROBE 7822DT | STATION / OFFSET: 53+86, 23' LT. | EXPLORATION ID B-011-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: AUTOMATIC HAMMER | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/16/22 | ELEVATION: 596.1 (NAVD88) EOB: 8.5 ft. | PAGE 1 OF 1 |
| START: 1/4/22 END: 1/4/22 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90* | LAT / LONG: 41.506861, -82.859589 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 596.1 | | | | | | | | | | | | | | | | | | |
| ASPHALT - 4 INCHES | 595.8 | | | | | | | | | | | | | | | | | | |
| CONCRETE - 10 INCHES | 594.9 | | | | | | | | | | | | | | | | | | |
| AGGREGATE BASE - 5 INCHES | 594.5 | | | | | | | | | | | | | | | | | | |
| MEDIUM STIFF, BROWN, **SILT AND CLAY**, SOME SAND, TRACE CRUSHED STONE, MOIST FILL | 593.6 | 1–2 | 2<br>3<br>4 | 11 | 44 | SS-1 | 0.50 | 5 | 9 | 17 | 23 | 46 | 28 | 17 | 11 | 17 | A-6a (7) | 530 | |
| MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, DAMP FILL, (DRILLER NOTED "PUSHED STONE" AT THIS INTERVAL) | 592.1 | 3 | 4<br>4<br>7 | 17 | 11 | SS-2 | - | - | - | - | - | - | - | - | - | 4 | A-1-b (V) | - | |
| HARD, GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, MOIST<br><br>@5.2': TRACE CALCITE STAIN SEAM | | 4–5 | 8<br>8<br>9 | 26 | 100 | SS-3 | >4.5 | 3 | 5 | 16 | 27 | 49 | 34 | 20 | 14 | 19 | A-6a (10) | - | |
| | | 6 | 9<br>13<br>13 | 39 | 100 | SS-4 | >4.5 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | - | |
| | | 7–8 | 11<br>11<br>11 | 33 | 100 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 21 | A-6a (V) | - | |
| | 587.6 | EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.25 BAG ASPHALT PATCH; AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 57+17, 30' RT. | EXPLORATION ID B-012-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 586.2 (NAVD88) EOB: 8.5 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.507838, -82.859383 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 586.2 | 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 - 11 INCHES | 585.3 | | | | | | | | | | | | | | | | | | |
| AGGREGATE BASE - 3 INCHES | 585.0 | | | | | | | | | | | | | | | | | | |
| HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST | | 1 | 4 2 3 | 6 | 100 | SS-1 | >4.5 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | 520 | |
| @2.8': TRACE CALCITE STAIN SEAM, TRACE IRON OXIDE STAIN SEAM | | 2 3 | 8 10 12 | 24 | 100 | SS-2 | >4.5 | 4 | 6 | 13 | 25 | 52 | 29 | 17 | 12 | 15 | A-6a (9) | - | |
| @4': HARD, SOME SAND | | 4 5 | 10 21 30 | 56 | 100 | SS-3 | >4.5 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |
| @5.8': TRACE CALCITE STAIN SEAM | | 6 | 9 18 24 | 46 | 100 | SS-4 | >4.5 | 7 | 8 | 16 | 27 | 42 | 33 | 19 | 14 | 14 | A-6a (8) | - | |
| @7': BROWN | 577.7 | 7 8 EOB | 15 21 27 | 53 | 94 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: GEOPROBE 7822DT | STATION / OFFSET: 61+50, 24' LT. | EXPLORATION ID B-013-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: AUTOMATIC HAMMER | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/16/22 | ELEVATION: 581.0 (NAVD88) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 1/4/22 END: 1/4/22 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 90* | LAT / LONG: 41.508903, -82.859575 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 581.0 | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 10 INCHES | 580.2 | | | | | | | | | | | | | | | | | | |
| STIFF, BROWN/GRAY, **SILTY CLAY**, TRACE SAND, TRACE GRAVEL, TRACE ORGANICS, MOIST | 577.5 | 1 | 2 3 5 | 12 | 83 | SS-1 | 2.00 | - | - | - | - | - | - | - | - | 23 | A-6b (V) | 480 | |
| | | 2 | 2 3 4 | 11 | 89 | SS-2 | 1.75 | 0 | 2 | 6 | 24 | 68 | 40 | 23 | 17 | 26 | A-6b (11) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| STIFF, BROWN, **CLAY**, SOME SILT, TRACE SAND, MOIST | 576.2 | 4 | 2 3 4 | 11 | 89 | SS-3 | 2.00 | 0 | 2 | 4 | 21 | 73 | 46 | 25 | 21 | 25 | A-7-6 (14) | - | |
| HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST<br>@6': TRACE IRON OXIDE STAIN SEAM | 573.5 | 5 | 6 7 7 | 21 | 94 | SS-4 | 4.00 | - | - | - | - | - | - | - | - | 21 | A-6a (V) | - | |
| | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 7 9 11 | 30 | 94 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |
| | | EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 66+01, 25' LT. | EXPLORATION ID B-014-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 580.0 (NAVD88) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.510142, -82.859567 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 4 INCHES | 580.0<br>579.7 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN/GRAY, **CLAY**, LITTLE SILT, LITTLE SAND, TRACE GRAVEL, TRACE WOOD, MOIST | | 1 | 2<br>3<br>4 | 8 | 94 | SS-1 | 3.50 | 5 | 5 | 6 | 18 | 66 | 46 | 23 | 23 | 25 | A-7-6 (14) | 410 | |
| | 578.0 | 2 | | | | | | | | | | | | | | | | | |
| STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE ORGANICS, MOIST | 577.0 | | 3<br>4<br>5 | 10 | 89 | SS-2 | 2.00 | - | - | - | - | - | - | - | - | 29 | A-6a (V) | - | |
| SOFT, GRAY, **CLAY**, SOME SILT, TRACE SAND, MOIST | | 3 | 1<br>1<br>1 | 2 | 67 | SS-3 | 0.25 | 0 | 0 | 4 | 21 | 75 | 53 | 26 | 27 | 30 | A-7-6 (17) | - | |
| @5': SOFT | | W 575.0<br>4<br>5 | 2<br>2<br>2 | 4 | 83 | SS-4 | 0.25 | - | - | - | - | - | - | - | - | 30 | A-7-6 (V) | - | |
| | 574.0 | 6 | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY/BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST | 572.5 | 7 | 2<br>3<br>4 | 8 | 89 | SS-5 | 3.50 | - | - | - | - | - | - | - | - | 29 | A-6a (V) | - | |
| | | EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 69+84, 18' RT. | EXPLORATION ID B-015-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 581.2 (NAVD88) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.511309, -82.859351 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 581.2 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CRUSHED STONE AGGREGATE - 11 INCHES | 580.3 | 1 | 10 9 8 | 19 | 100 | SS-1 | 1.50 | - | - | - | - | - | - | - | - | 13 | A-6a (V) | - | |
| STIFF, GRAY, **SILT AND CLAY**, SOME SAND, TRACE CRUSHED STONE, TRACE CALCITE STAIN SEAM, MOIST FILL | 579.4 | 2 | 7 7 6 | 14 | 100 | SS-2 | 2.50 | 0 | 1 | 4 | 20 | 75 | 50 | 25 | 25 | 27 | A-7-6 (16) | 380 | |
| VERY STIFF, BROWN/GRAY, **CLAY**, SOME SILT, TRACE SAND, MOIST | 578.2 | 3 | 3 3 4 | 8 | 100 | SS-3 | 1.50 | - | - | - | - | - | - | - | - | 26 | A-6a (V) | - | |
| STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE ORGANICS, TRACE CALCITE STAIN SEAM, MOIST<br>@4.5': BROWN/GRAY | 575.2 | 4 | 4 4 4 | 9 | 100 | SS-4 | 1.50 | - | - | - | - | - | - | - | - | 27 | A-6a (V) | - | |
| VERY STIFF TO HARD, BROWN/GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, TRACE ORGANICS, TRACE CALCITE STAIN SEAM, MOIST | 573.7 | 5 | 4 6 7 | 14 | 100 | SS-5 | 4.00 | 2 | 8 | 14 | 20 | 56 | 31 | 20 | 11 | 19 | A-6a (8) | - | |
| EOB | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 74+16, 19' LT. | EXPLORATION ID B-016-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 580.0 (NAVD88) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.512379, -82.859448 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 580.0 | | | | | | | | | | | | | | | | | | |
| TOPSOIL - 4 INCHES | 579.7 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, DARK GRAY, **CLAY**, SOME SILT, SOME CRUSHED STONE, LITTLE SAND, TRACE BRICK FRAGMENTS, TRACE CALCITE STAIN SEAM, MOIST FILL | | 1 | 3 4 4 | 9 | 78 | SS-1 | 4.00 | 22 | 6 | 10 | 22 | 40 | 41 | 22 | 19 | 22 | A-7-6 (9) | 450 | |
| | 577.5 | 2 | 3 3 4 | 8 | 78 | SS-2 | 3.75 | - | - | - | - | - | - | - | - | 22 | A-7-6 (V) | - | |
| STIFF, GRAY, **CLAY**, LITTLE SILT, TRACE SAND, TRACE GRAVEL, TRACE BRICK FRAGMENTS, TRACE CALCITE STAIN SEAM, MOIST<br>@3.3': BROWN/GRAY | | 3 | 1 2 3 | 6 | 89 | SS-3 | 1.50 | - | - | - | - | - | - | - | - | 27 | A-7-6 (V) | - | |
| @4.5': GRAY | | 4 5 | 2 4 4 | 9 | 100 | SS-4 | 1.50 | 6 | 4 | 5 | 16 | 69 | 46 | 24 | 22 | 28 | A-7-6 (14) | - | |
| | 573.6 | 6 | 4 6 8 | 15 | 100 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 23 | A-6a (V) | - | |
| HARD, GRAY/BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | 572.5 | 7 EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 77+55, 22' RT. | EXPLORATION ID B-017-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 584.4 (NAVD88) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.513413, -82.859174 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL WITH CRUSHED STONE - 4 INCHES | 584.1 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY, **SILT AND CLAY**, SOME SAND, SOME CRUSHED STONE, MOIST FILL | 584.4 | 1 | 3 4 5 | 10 | 100 | SS-1 | 3.75 | 23 | 12 | 11 | 30 | 24 | 32 | 21 | 11 | 16 | A-6a (4) | 460 | |
| HARD, BROWN/GRAY, **CLAY**, SOME SILT, TRACE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | 582.4 | 2 | 8 10 12 | 24 | 100 | SS-2 | >4.5 | - | - | - | - | - | - | - | - | 20 | A-7-6 (V) | - | |
| | | 3 | | | | | | | | | | | | | | | | | |
| | | 4 | 4 4 7 | 12 | 100 | SS-3 | 4.00 | 1 | 1 | 5 | 20 | 73 | 43 | 23 | 20 | 21 | A-7-6 (13) | - | |
| @4.8': TRACE ORGANICS<br>@ 5': GRAY/BROWN | | 5 | 4 4 7 | 12 | 100 | SS-4 | 4.25 | - | - | - | - | - | - | - | - | 21 | A-7-6 (V) | - | |
| @6': BROWN/GRAY, TRACE CALCITE STAIN SEAM | | 6 | | | | | | | | | | | | | | | | | |
| | 576.9 | 7 EOB | 10 12 13 | 28 | 100 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 24 | A-7-6 (V) | - | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

| | | | |
|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 82+31, 27' LT. |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 584.0 (NAVD88) EOB: 7.5 ft. |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.514604, -82.859263 |

EXPLORATION ID B-018-0-21

PAGE 1 OF 1

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 3 INCHES | 584.0<br>583.7 | | | | | | | | | | | | | | | | | | |
| LOOSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND, SILT, AND CLAY**, MOIST FILL | | 1 | 4<br>4<br>3 | 8 | 72 | SS-1 | - | - | - | - | - | - | - | - | - | 36 | A-2-6 (V) | - | |
| | | 2 | 4<br>4<br>4 | 9 | 17 | SS-2 | - | 47 | 12 | 9 | 23 | 9 | 39 | 22 | 17 | 14 | A-2-6 (1) | 390 | |
| | 581.0 | 3 | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY/BROWN, **CLAY**, LITTLE SILT, TRACE SAND, TRACE GRAVEL, MOIST | | 4 | 2<br>2<br>2 | 4 | 78 | SS-3 | 3.25 | 1 | 3 | 5 | 17 | 74 | 45 | 24 | 21 | 24 | A-7-6 (13) | - | |
| | 579.2 | 5 | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY/BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST<br>@5': HARD, BROWN, LITTLE SAND | | 6 | 3<br>6<br>9 | 17 | 94 | SS-4 | 3.00 | - | - | - | - | - | - | - | - | 11 | A-6a (V) | - | |
| | | 7 | 14<br>16<br>22 | 42 | 100 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 15 | A-6a (V) | - | |
| @7.3': TRACE SHALE FRAGMENTS | 576.5 | EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 86+10, 25' RT. | EXPLORATION ID B-019-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 586.4 (NAVD88) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.515760, -82.859004 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 3 INCHES | 586.1 | | | | | | | | | | | | | | | | | | |
| STIFF, GRAY, **CLAY**, SOME GRAVEL, SOME SILT, LITTLE SAND, TRACE ORGANICS, MOIST | 585.0 | 1 | 4 4 4 | 9 | 78 | SS-1 | 1.25 | 26 | 7 | 10 | 20 | 37 | 41 | 22 | 19 | 25 | A-7-6 (8) | 500 | |
| VERY STIFF, BROWN/GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | 583.4 | 2 | 9 5 5 | 11 | 94 | SS-2 | 3.00 | 4 | 3 | 8 | 20 | 65 | 39 | 22 | 17 | 23 | A-6b (11) | - | |
| VERY STIFF, GRAY/BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | | 3 | 2 3 4 | 8 | 89 | SS-3 | 2.50 | - | - | - | - | - | - | - | - | 22 | A-6a (V) | - | |
| | | 4 | | | | | | | | | | | | | | | | | |
| | | 5 | 5 5 5 | 11 | 89 | SS-4 | 3.00 | - | - | - | - | - | - | - | - | 22 | A-6a (V) | - | |
| | | 6 | | | | | | | | | | | | | | | | | |
| | | 7 | 5 5 4 | 10 | 89 | SS-5 | 2.50 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | - | |
| | 578.9 | EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 91+11, 24' LT. | EXPLORATION ID B-020-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 588.0 (NAVD88) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.517020, -82.859131 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 10 INCHES | 588.0 | | | | | | | | | | | | | | | | | | |
| | 587.2 | | 1 2 3 | 6 | 89 | SS-1 | 0.75 | 7 | 3 | 7 | 19 | 64 | 38 | 23 | 15 | 28 | A-6a (10) | 490 | |
| MEDIUM STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE ORGANICS, MOIST | | 1 | | | | | | | | | | | | | | | | | |
| | 585.5 | 2 | 4 5 6 | 12 | 83 | SS-2 | 3.25 | 1 | 4 | 7 | 18 | 70 | 48 | 25 | 23 | 25 | A-7-6 (15) | - | |
| VERY STIFF, GRAY, **CLAY**, LITTLE SILT, LITTLE SAND, TRACE GRAVEL, TRACE ORGANICS, MOIST | 585.0 | 3 | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | | | 3 3 3 | 7 | 83 | SS-3 | 3.00 | - | - | - | - | - | - | - | - | 21 | A-6a (V) | - | |
| | 583.5 | 4 | | | | | | | | | | | | | | | | | |
| HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | 582.5 | 5 | 7 7 7 | 15 | 89 | SS-4 | >4.5 | - | - | - | - | - | - | - | - | 15 | A-6a (V) | - | |
| | W 582.5 | | | | | | | | | | | | | | | | | | |
| MEDIUM STIFF TO STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM | | 6 | | | | | | | | | | | | | | | | | |
| | 580.5 | 7 | 4 4 4 | 9 | 89 | SS-5 | 1.00 | - | - | - | - | - | - | - | - | 29 | A-6a (V) | - | |
| | EOB | | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 94+82, 51' RT. | EXPLORATION ID B-021-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 589.6 (NAVD88) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.518161, -82.858813 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. 589.6 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 2 INCHES | 589.4 | | | | | | | | | | | | | | | | | | |
| SOFT, BROWN, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, TRACE ORGANICS, MOIST | 587.8 | 1 | 0 1 1 | 2 | 56 | SS-1 | 0.50 | 13 | 8 | 12 | 30 | 37 | 38 | 20 | 18 | 23 | A-6b (10) | 480 | |
| HARD, GRAY/BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, TRACE CALCITE STAIN SEAM, MOIST | | 2 | 10 5 5 | 11 | 89 | SS-2 | >4.5 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | - | |
| | | 3 | 3 5 7 | 13 | 83 | SS-3 | >4.5 | 5 | 7 | 13 | 24 | 51 | 34 | 20 | 14 | 16 | A-6a (10) | - | |
| @4.5': BROWN, TRACE IRON OXIDE STAIN SEAM | | 5 | 5 7 10 | 19 | 83 | SS-4 | >4.5 | - | - | - | - | - | - | - | - | 16 | A-6a (V) | - | |
| @6': LITTLE SAND | | 6 7 | 10 14 18 | 35 | 94 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 15 | A-6a (V) | - | |
| | 582.1 | EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:51 - S:\PROJECTS\1902501.GPJ

| | | | |
|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 99+26, 22' LT. |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 588.2 (NAVD88) EOB: 7.5 ft. |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.519381, -82.859019 |

EXPLORATION ID: B-022-0-21

PAGE: 1 OF 1

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 13 INCHES | 588.2 | | | | | | | | | | | | | | | | | | |
| | 587.1 | 1 | 2 4 4 | 9 | 100 | SS-1 | 2.00 | - | - | - | - | - | - | - | - | 20 | A-6b (V) | 470 | |
| VERY STIFF, GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE ORGANICS, MOIST<br>@1.5': BROWN/GRAY, TRACE IRON OXIDE STAIN SEAM | | 2 | 3 4 4 | 9 | 100 | SS-2 | 4.00 | 4 | 4 | 14 | 27 | 51 | 38 | 22 | 16 | 22 | A-6b (10) | - | |
| @3': GRAY/BROWN | | 3 | | | | | | | | | | | | | | | | | |
| | 583.7 | 4 | 2 2 3 | 6 | 100 | SS-3 | 2.50 | - | - | - | - | - | - | - | - | 21 | A-6b (V) | - | |
| STIFF, BROWN/GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, MOIST | | 5 | 3 4 4 | 9 | 100 | SS-4 | 1.25 | 2 | 9 | 19 | 26 | 44 | 35 | 20 | 15 | 23 | A-6a (9) | - | |
| | 582.2 | 6 | | | | | | | | | | | | | | | | | |
| HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | | 7 | 6 8 10 | 20 | 100 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 15 | A-6a (V) | - | |
| | 580.7 | EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 102+89, 14' RT. | EXPLORATION ID B-023-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 589.4 (NAVD88) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.520376, -82.858818 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 4 INCHES | 589.1 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, GRAY, **SILT AND CLAY**, SOME SAND, LITTLLE GRAVEL, MOIST | 588.4 | 1 | 2 3 2 | 6 | 78 | SS-1 | 2.50 | 18 | 7 | 15 | 28 | 32 | 32 | 21 | 11 | 17 | A-6a (5) | - | |
| VERY STIFF, BROWN/GRAY, **CLAY**, SOME SILT, LITLTE SAND, TRACE GRAVEL, TRACE ORGANICS, MOIST | | 2 | 3 3 4 | 8 | 78 | SS-2 | 2.50 | 4 | 3 | 12 | 25 | 56 | 43 | 23 | 20 | 24 | A-7-6 (13) | 380 | |
| @3.2': BROWN | 585.1 | 3 4 | 2 3 4 | 8 | 89 | SS-3 | 3.00 | - | - | - | - | - | - | - | - | 17 | A-7-6 (V) | - | |
| MEDIUM STIFF, GRAY/BROWN, **SILT AND CLAY**, LITLE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | 583.4 | 5 6 | 3 5 7 | 13 | 100 | SS-4 | 0.75 | - | - | - | - | - | - | - | - | 24 | A-6a (V) | - | |
| HARD, GRAY/BROWN, **SILT AND CLAY**, LITLE SAND, TRACE GRAVEL, MOIST | 581.9 | 7 | 6 7 7 | 15 | 100 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 16 | A-6a (V) | - | |
| | | EOB | | | | | | | | | | | | | | | | | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 107+52, 27' LT. | EXPLORATION ID B-024-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 589.2 (NAVD88) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.521643, -82.858928 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 4 INCHES | 589.2<br>588.9 | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, TRACE ORGANICS, MOIST | | 1 | 1<br>1<br>2 | 3 | 67 | SS-1 | 2.50 | 4 | 4 | 15 | 26 | 51 | 29 | 18 | 11 | 17 | A-6a (8) | 410 | |
| @2': STIFF, BROWN/GRAY, SOME SAND, LITTLE GRAVEL | | 2 | 3<br>3<br>4 | 8 | 44 | SS-2 | 1.50 | 14 | 6 | 15 | 23 | 42 | 29 | 18 | 11 | 20 | A-6a (6) | - | |
| @3.5': HARD, BROWN, LITTLE SAND, TRACE GRAVEL, TRACE CALCITE STAIN SEAM | 584.7 | 3<br>4 | 3<br>5<br>10 | 17 | 78 | SS-3 | >4.5 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - | |
| HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | 583.2 | 5 | 13<br>15<br>17 | 35 | 100 | SS-4 | 4.25 | - | - | - | - | - | - | - | - | 17 | A-4a (V) | - | |
| HARD, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | 581.7 | W 583.2<br>6<br>7<br>EOB | 10<br>20<br>20 | 44 | 100 | SS-5 | >4.5 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | - | |

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: OTT-53-11.67 | DRILLING FIRM / OPERATOR: TTL / CW | DRILL RIG: CME 75 TRUCK 844 | STATION / OFFSET: 111+52, 45' RT. | EXPLORATION ID B-025-0-21 |
| TYPE: ROADWAY | SAMPLING FIRM / LOGGER: TTL / KKC | HAMMER: CME AUTOMATIC | ALIGNMENT: SR-53 | |
| PID: 110859 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 3/15/21 | ELEVATION: 586.0 (NAVD88) EOB: 7.5 ft. | PAGE 1 OF 1 |
| START: 12/28/21 END: 12/28/21 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 66 | LAT / LONG: 41.522733, -82.858602 | |

| MATERIAL DESCRIPTION AND NOTES | ELEV. | DEPTHS | SPT/ RQD | $N_{60}$ | REC (%) | SAMPLE ID | HP (tsf) | GRADATION (%) GR | CS | FS | SI | CL | ATTERBERG LL | PL | PI | WC | ODOT CLASS (GI) | SO4 ppm | BACK FILL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOPSOIL - 3 INCHES | 586.0<br>585.7 | | | | | | | | | | | | | | | | | | |
| HARD, GRAY/BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, TRACE CALCITE STAIN SEAM, TRACE ORGANICS, MOIST | | 1 | 2 2 4 | 7 | 78 | SS-1 | 4.25 | - | - | - | - | - | - | - | - | 16 | A-6a (V) | 450 | |
| | | 2 | 3 4 5 | 10 | 83 | SS-2 | 4.00 | - | - | - | - | - | - | - | - | 18 | A-6a (V) | - | |
| | 582.5 | 3 | | | | | | | | | | | | | | | | | |
| MEDIUM STIFF, BROWN/GRAY, **SILT AND CLAY**, LITTLE SAND, LITTLE GRAVEL, TRACE IRON OXIDE STAIN SEAM, MOIST | | 4 | 2 1 1 | 2 | 78 | SS-3 | 1.00 | 12 | 6 | 13 | 22 | 47 | 32 | 19 | 13 | 21 | A-6a (8) | - | |
| @4.5': Some sand | | 5 | 2 1 2 | 3 | 78 | SS-4 | 1.00 | 11 | 7 | 13 | 24 | 45 | 32 | 19 | 13 | 22 | A-6a (8) | - | |
| | | 6 | | | | | | | | | | | | | | | | | |
| | 578.5 | 7 | 2 2 2 | 4 | 100 | SS-5 | 0.50 | - | - | - | - | - | - | - | - | 19 | A-6a (V) | - | |
| | | EOB | | | | | | | | | | | | | | | | | |

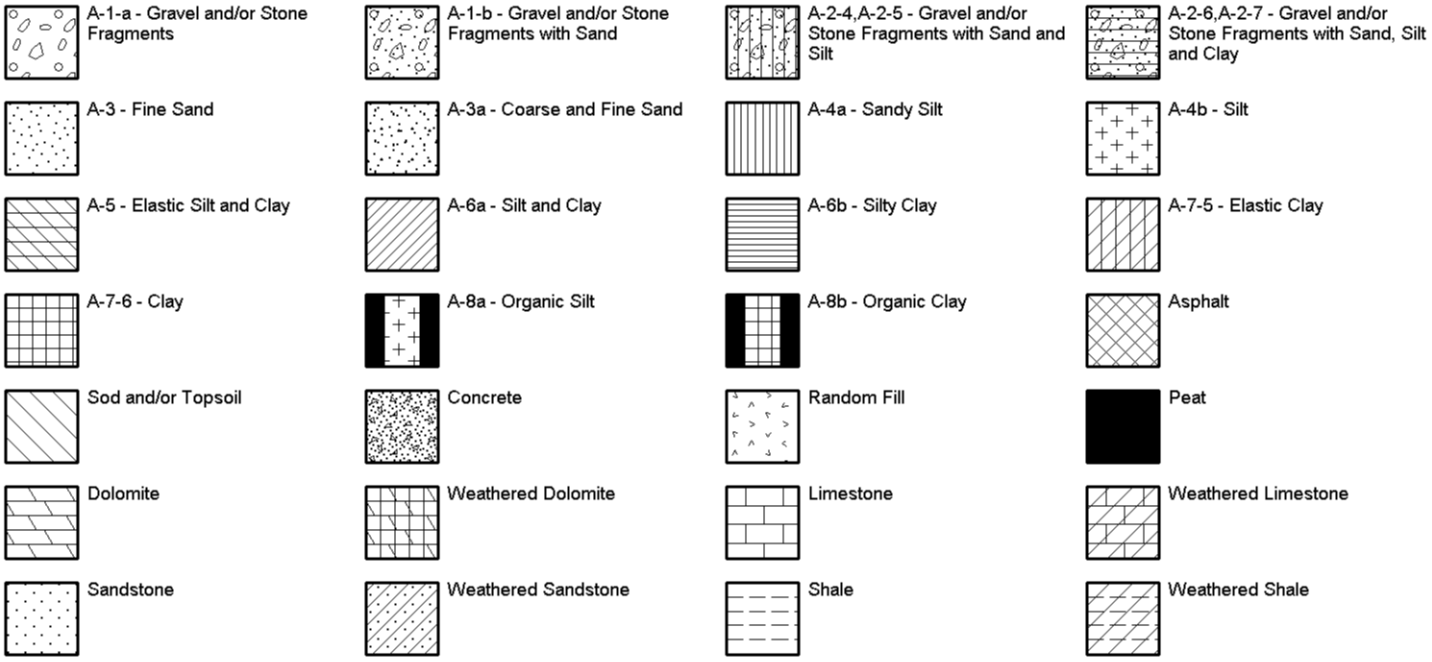
NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 0.5 BAG BENTONITE CHIPS

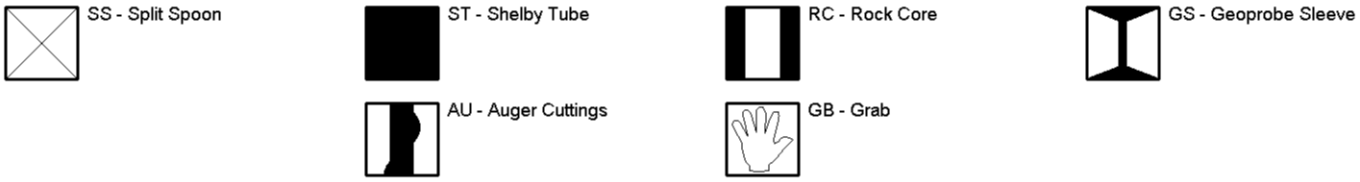
STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 6/6/22 15:52 - S:\PROJECTS\1902501.GPJ

# LEGEND KEY

## Ohio Department of Transportation Soil Symbols




## Sample Symbols




Notes:

1. Exploratory borings B-001-0-22 through B-025-0-22 were drilled during the period from December 28, 2021 through January 4, 2022 One (1) supplemental test boring, designated as Borings B-005-1-22, was drilled on November 17, 2022. The test borings were advanced using 3¼-inch diameter hollow-stem augers.

2. These logs are subject to the limitations, conclusions, and recommendations in the report and should not be interpreted separate from the report.

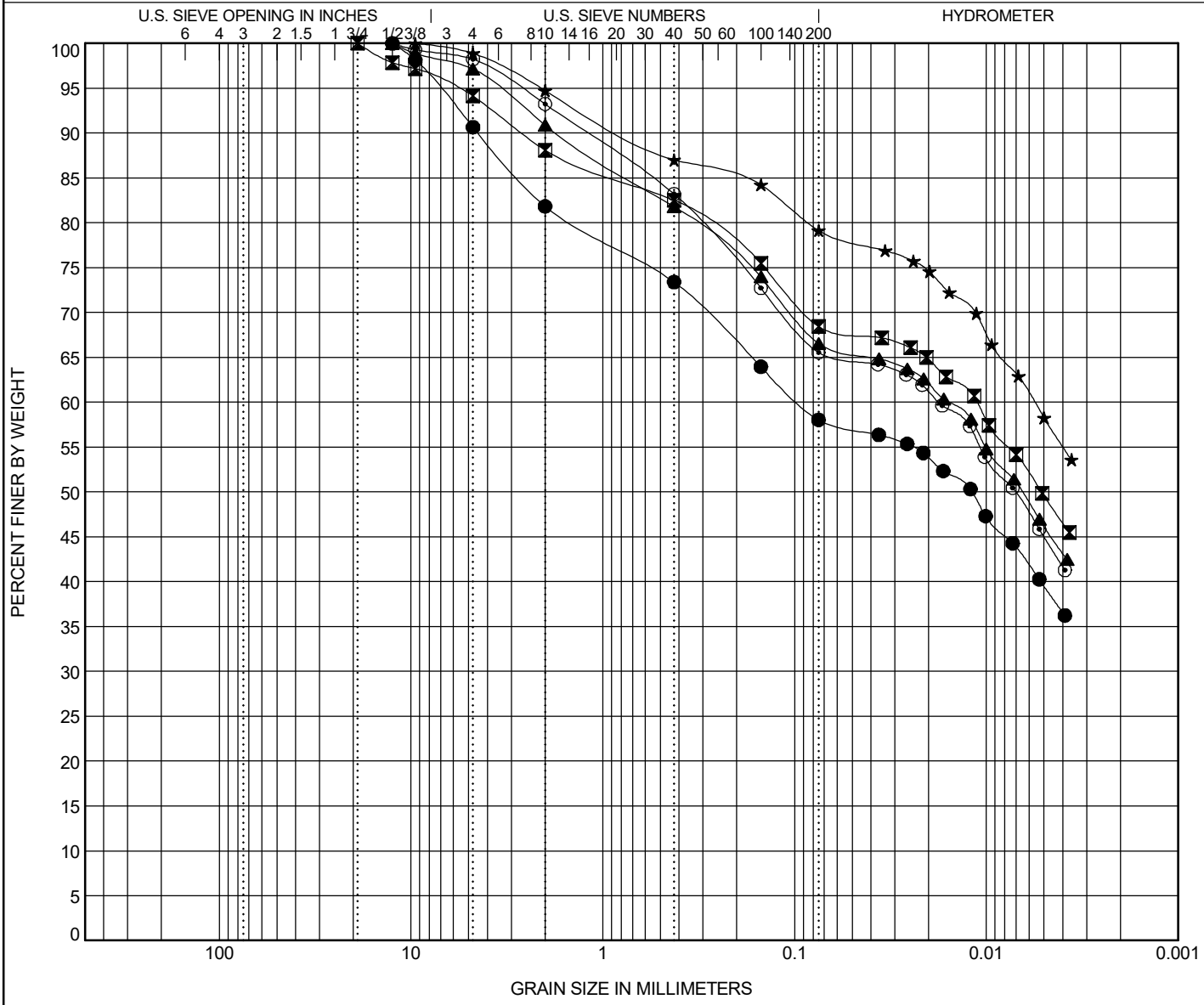
3. Latitude, Longitude, and ground surface elevation for all borings were initially surveyed by TTL via a hand-held GPS device. The accuracy from the handheld GPS device was generally found to be approximately 2 to 6 inches horizontal, and approximately 4 to 12 inches vertical. Stationing, offsets and ground surface elevations were subsequently provided by Tetra Tech based on field survey (expected to be more accurate) for all of the borings, except Borings B-013, B-014, B-16, B-18, B-20 and B-25. Stationing and offsets of Borings B-013, B-014, B-16, B-18, B-20 and B-25 were estimated by TTL from provided Stage 1 plans.

# GRAIN SIZE DISTRIBUTION

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| COBBLES | GRAVEL | SAND | | SILT | CLAY |
|---|---|---|---|---|---|
| | | coarse | fine | | |

| Specimen Identification | | | ODOT (Modified AASHTO) ~ USCS Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | B-001-0-21 | 1.0 | **A-6a ~ SANDY LEAN CLAY(CL)** | **24** | **13** | **11** |
| ⊠ | B-001-0-21 | 4.0 | **A-6a ~ SANDY LEAN CLAY(CL)** | **27** | **16** | **11** |
| ▲ | B-002-0-21 | 3.5 | **A-6a ~ SANDY LEAN CLAY(CL)** | **25** | **14** | **11** |
| ★ | B-002-0-21 | 11.0 | **A-6a ~ LEAN CLAY with SAND(CL)** | **28** | **17** | **11** |
| ⊙ | B-003-0-21 | 1.0 | **A-6a ~ SANDY LEAN CLAY(CL)** | **26** | **15** | **11** |

| Specimen Identification | | | D90 | D50 | D30 | D10 | %G | %CS | %FS | %M | %C | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-001-0-21 | 1.0 | **4.452** | **0.012** | | | **19** | **8** | **15** | **19** | **39** | | |
| ⊠ | B-001-0-21 | 4.0 | **2.625** | **0.005** | | | **12** | **6** | **14** | **18** | **50** | | |
| ▲ | B-002-0-21 | 3.5 | **1.715** | **0.007** | | | **9** | **9** | **15** | **21** | **46** | | |
| ★ | B-002-0-21 | 11.0 | **0.773** | | | | **5** | **8** | **8** | **21** | **58** | | |
| ⊙ | B-003-0-21 | 1.0 | **1.21** | **0.007** | | | **6** | **10** | **18** | **21** | **45** | | |

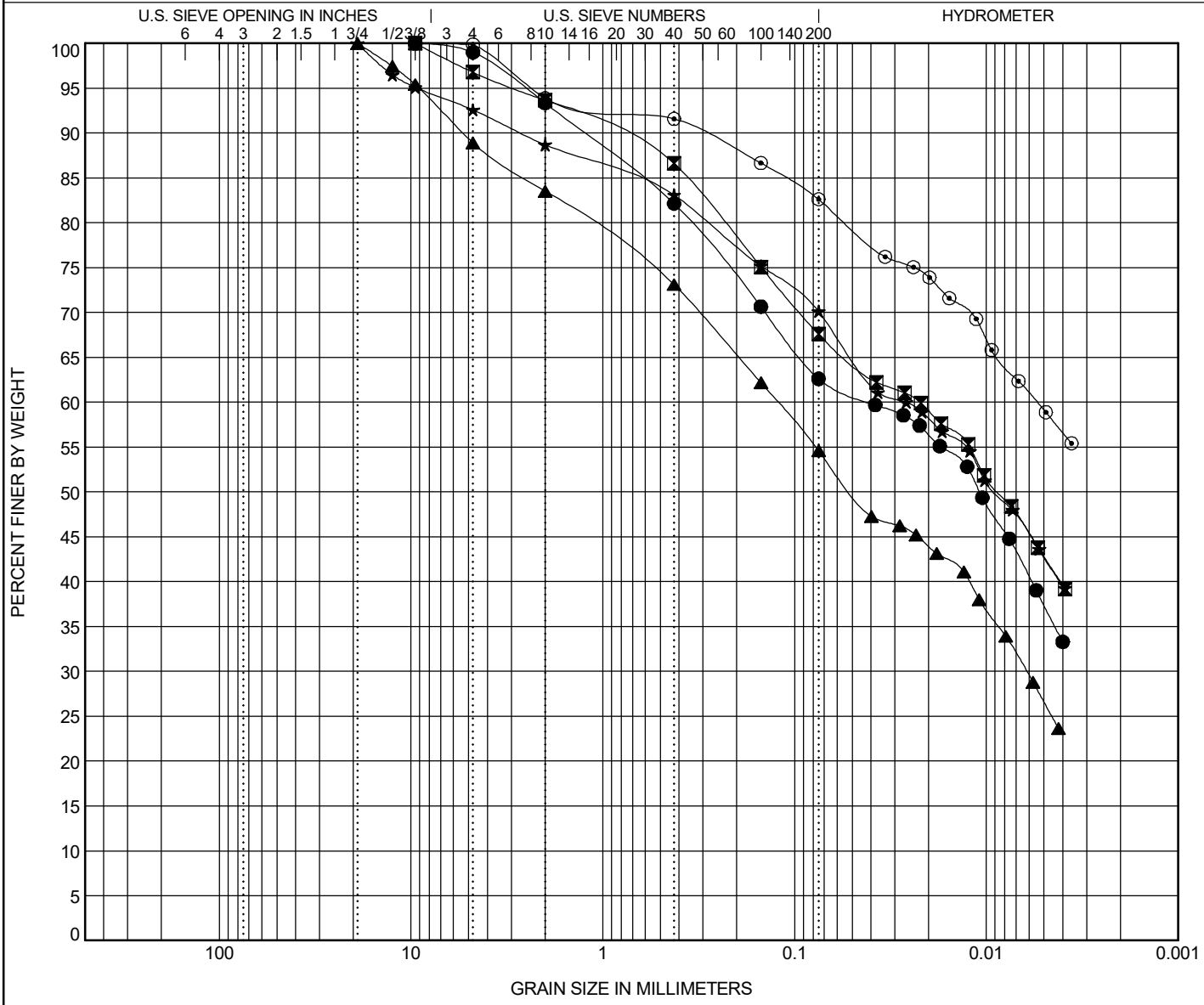
GRAIN SIZE - OH DOT.GDT - 6/2/22 10:35 - S:\PROJECTS\1902501.GPJ

# GRAIN SIZE DISTRIBUTION

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| COBBLES | GRAVEL | SAND | | SILT | CLAY |
|---|---|---|---|---|---|
| | | coarse | fine | | |

| Specimen Identification | | | ODOT (Modified AASHTO) ~ USCS Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | B-003-0-21 | 3.5 | A-6a ~ SANDY LEAN CLAY(CL) | 24 | 13 | 11 |
| ⊠ | B-004-0-21 | 1.0 | A-6a ~ SANDY LEAN CLAY(CL) | 28 | 16 | 12 |
| ▲ | B-004-0-21 | 6.0 | A-6a ~ SANDY LEAN CLAY(CL) | 28 | 17 | 11 |
| ★ | B-005-0-21 | 2.5 | A-6a ~ LEAN CLAY with SAND(CL) | 32 | 19 | 13 |
| ⊙ | B-005-0-21 | 5.5 | A-7-6 ~ LEAN CLAY with SAND(CL) | 43 | 23 | 20 |

| Specimen Identification | | | D90 | D50 | D30 | D10 | %G | %CS | %FS | %M | %C | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-003-0-21 | 3.5 | 1.257 | 0.011 | | | 6 | 11 | 20 | 26 | 37 | | |
| ⊠ | B-004-0-21 | 1.0 | 0.892 | 0.009 | | | 6 | 7 | 19 | 25 | 43 | | |
| ▲ | B-004-0-21 | 6.0 | 5.332 | 0.05 | 0.006 | | 16 | 10 | 19 | 28 | 27 | | |
| ★ | B-005-0-21 | 2.5 | 2.667 | 0.009 | | | 11 | 6 | 13 | 27 | 43 | | |
| ⊙ | B-005-0-21 | 5.5 | 0.304 | | | | 6 | 2 | 9 | 24 | 59 | | |

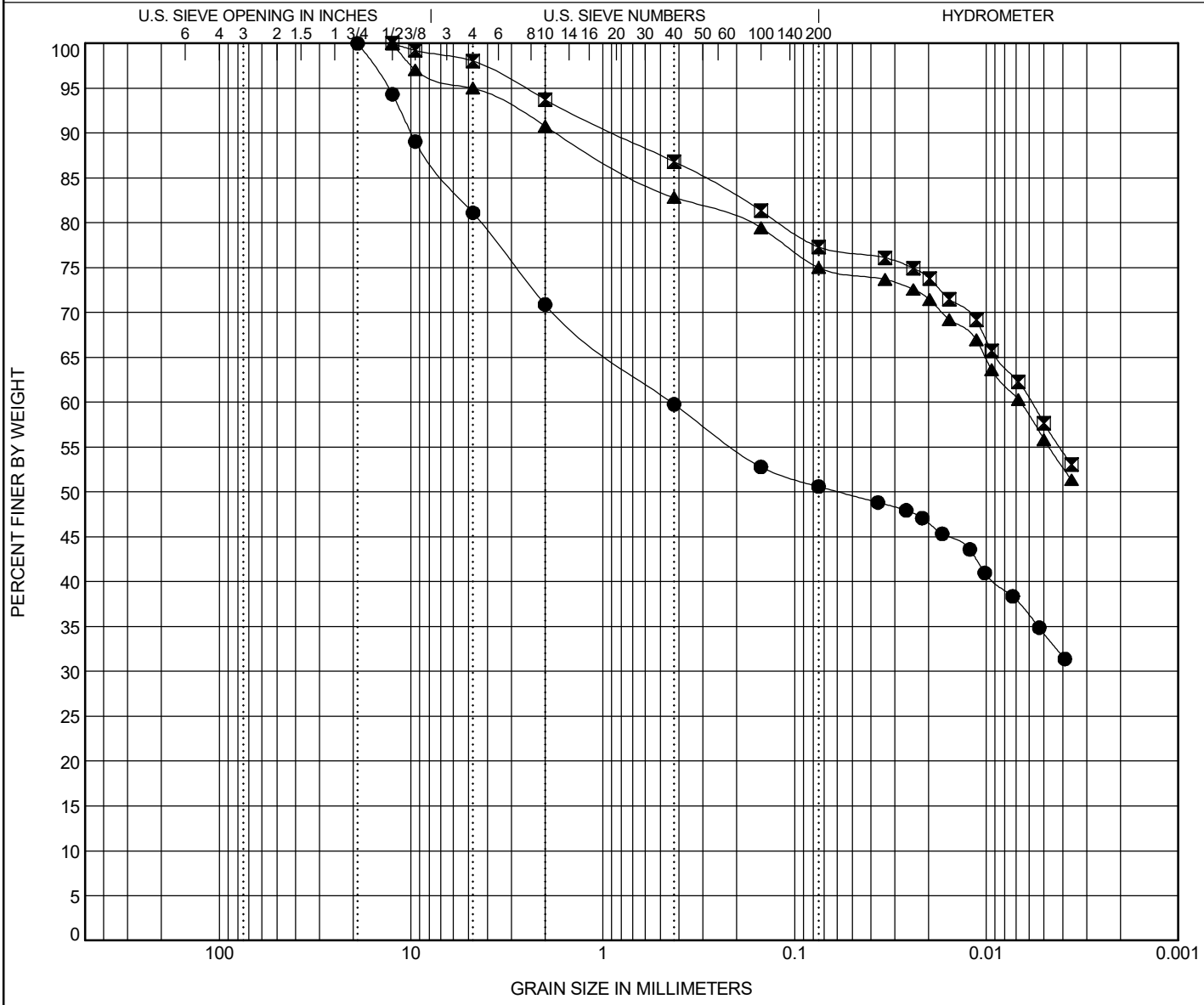
GRAIN SIZE - OH DOT.GDT - 6/2/22 10:36 - S:\PROJECTS\1902501.GPJ

# GRAIN SIZE DISTRIBUTION

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| COBBLES | GRAVEL | SAND | | SILT | CLAY |
|---|---|---|---|---|---|
| | | coarse | fine | | |

| | Specimen Identification | | ODOT (Modified AASHTO) ~ USCS Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | **B-005-1-22** | **1.0** | **A-6a ~ SANDY LEAN CLAY with GRAVEL(CL)** | **29** | **17** | **12** |
| ⊠ | **B-005-1-22** | **11.0** | **A-6b ~ LEAN CLAY with SAND(CL)** | **35** | **19** | **16** |
| ▲ | **B-005-1-22** | **23.5** | **A-6a ~ LEAN CLAY with SAND(CL)** | **27** | **16** | **11** |
| | | | | | | |
| | | | | | | |

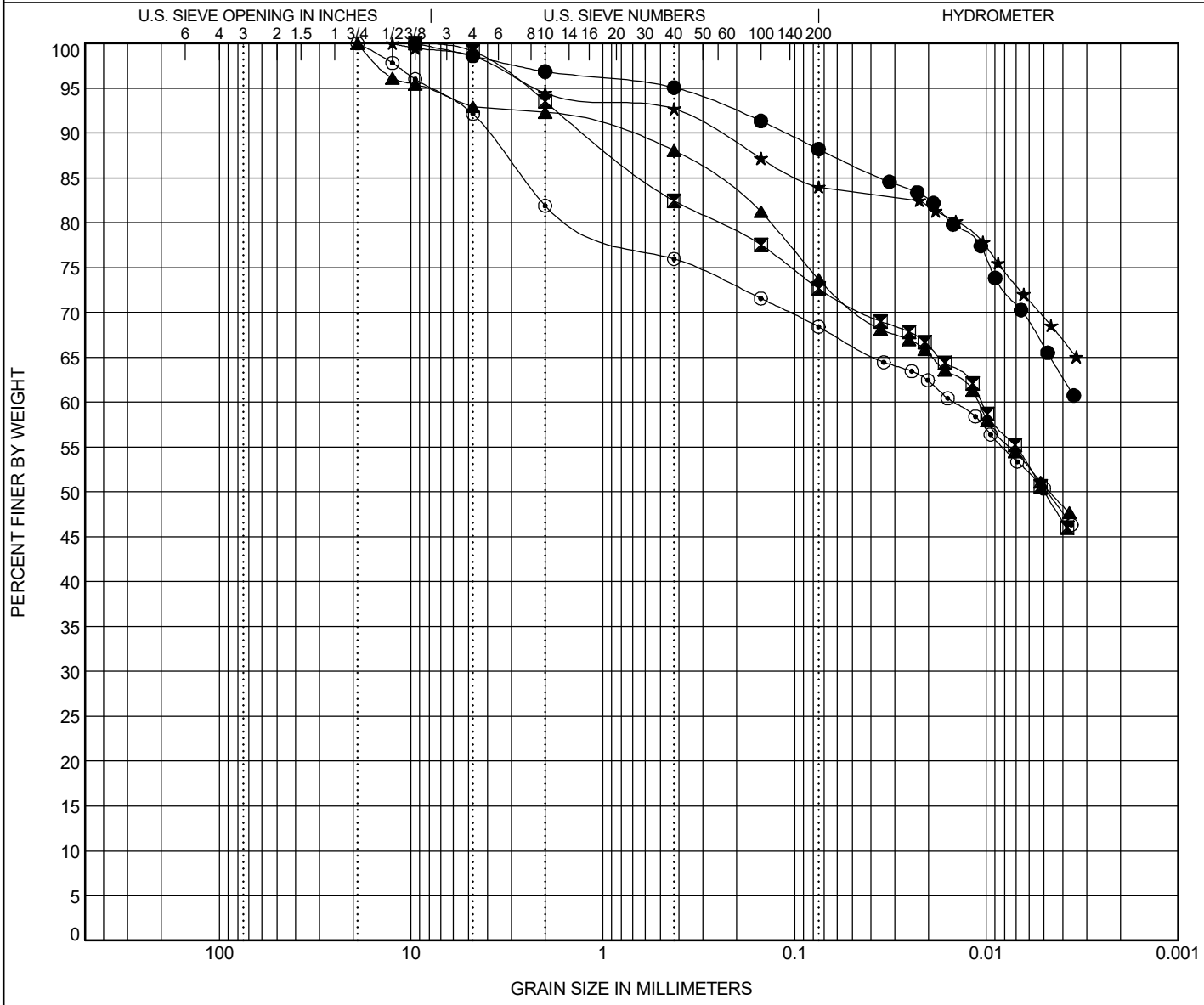
| | Specimen Identification | | D90 | D50 | D30 | D10 | %G | %CS | %FS | %M | %C | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B-005-1-22** | **1.0** | **9.972** | **0.059** | | | **29** | **11** | **9** | **17** | **34** | | |
| ⊠ | **B-005-1-22** | **11.0** | **0.863** | | | | **6** | **7** | **10** | **19** | **58** | | |
| ▲ | **B-005-1-22** | **23.5** | **1.716** | | | | **9** | **8** | **8** | **19** | **56** | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

# GRAIN SIZE DISTRIBUTION

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| COBBLES | GRAVEL | SAND | | SILT | CLAY |
|---|---|---|---|---|---|
| | | coarse | fine | | |

| Specimen Identification | | | ODOT (Modified AASHTO) ~ USCS Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | B-006-0-21 | 3.0 | **A-6b ~ LEAN CLAY(CL)** | **37** | **21** | **16** |
| ⊠ | B-006-0-21 | 7.5 | **A-6a ~ LEAN CLAY with SAND(CL)** | **35** | **20** | **15** |
| ▲ | B-007-0-21 | 3.5 | **A-7-6 ~ LEAN CLAY with SAND(CL)** | **45** | **23** | **22** |
| ★ | B-007-0-21 | 5.0 | **A-7-6 ~ LEAN CLAY with SAND(CL)** | **49** | **24** | **25** |
| ⊙ | B-008-0-21 | 1.0 | **A-6b ~ SANDY LEAN CLAY(CL)** | **39** | **20** | **19** |

| Specimen Identification | | | D90 | D50 | D30 | D10 | %G | %CS | %FS | %M | %C | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-006-0-21 | 3.0 | **0.111** | | | | **3** | **2** | **7** | **22** | **66** | | |
| ⊠ | B-006-0-21 | 7.5 | **1.22** | **0.005** | | | **6** | **11** | **10** | **23** | **50** | | |
| ▲ | B-007-0-21 | 3.5 | **0.86** | **0.005** | | | **8** | **4** | **14** | **23** | **51** | | |
| ★ | B-007-0-21 | 5.0 | **0.255** | | | | **5** | **2** | **9** | **15** | **69** | | |
| ⊙ | B-008-0-21 | 1.0 | **3.964** | **0.005** | | | **18** | **6** | **8** | **18** | **50** | | |

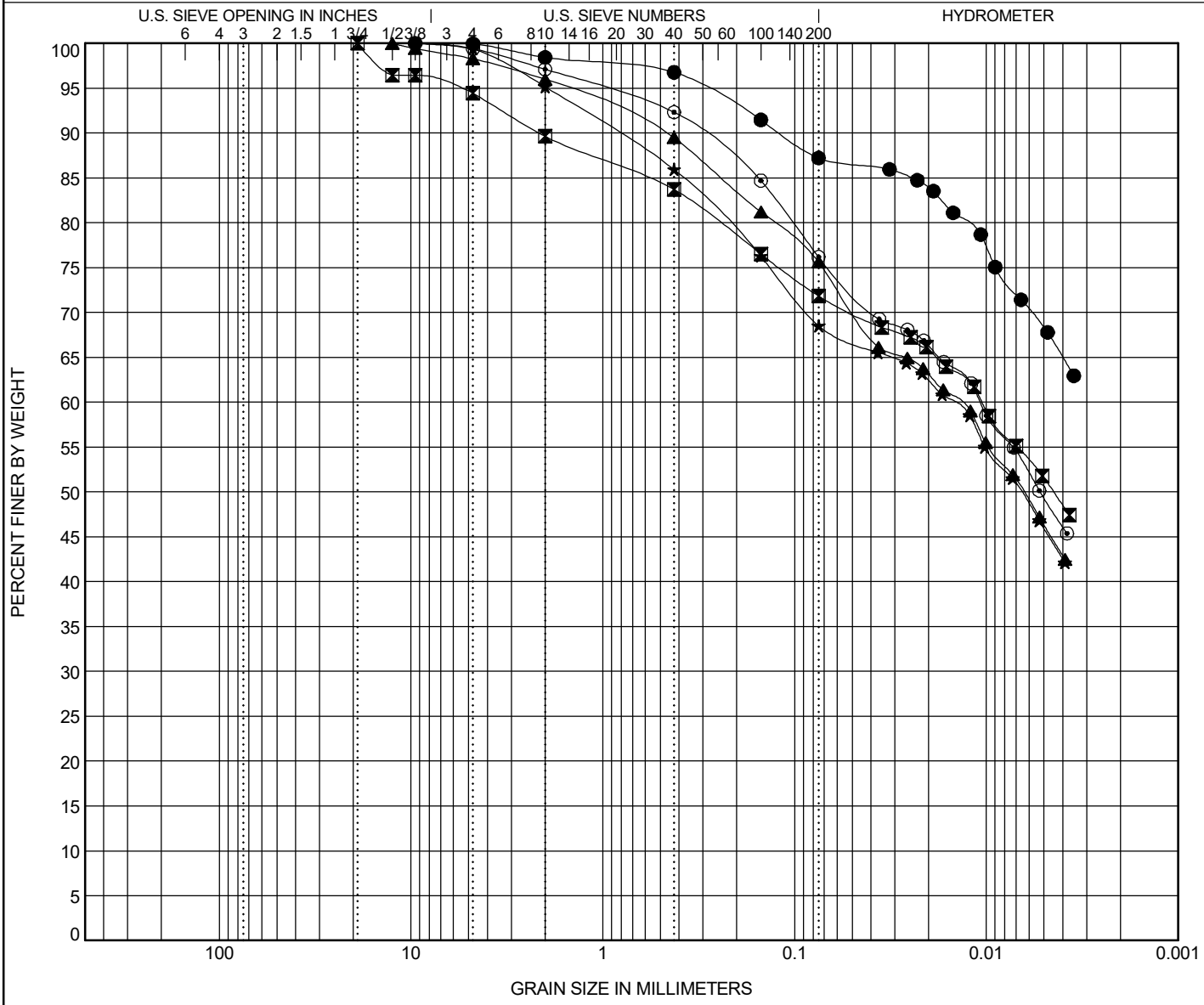
GRAIN SIZE - OH DOT.GDT - 6/2/22 10:36 - S:\PROJECTS\1902501.GPJ

# GRAIN SIZE DISTRIBUTION

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| COBBLES | GRAVEL | SAND | | SILT | CLAY |
|---|---|---|---|---|---|
| | | coarse | fine | | |

| Specimen Identification | | | ODOT (Modified AASHTO) ~ USCS Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | B-008-0-21 | 6.0 | **A-7-6 ~ LEAN CLAY(CL)** | **41** | **23** | **18** |
| ⊠ | B-009-0-21 | 2.0 | **A-6b ~ LEAN CLAY with SAND(CL)** | **39** | **22** | **17** |
| ▲ | B-009-0-21 | 5.0 | **A-6a ~ LEAN CLAY with SAND(CL)** | **33** | **19** | **14** |
| ★ | B-011-0-21 | 1.0 | **A-6a ~ SANDY LEAN CLAY(CL)** | **28** | **17** | **11** |
| ⊙ | B-011-0-21 | 4.0 | **A-6a ~ LEAN CLAY with SAND(CL)** | **34** | **20** | **14** |

| Specimen Identification | | | D90 | D50 | D30 | D10 | %G | %CS | %FS | %M | %C | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-008-0-21 | 6.0 | **0.118** | | | | **1** | **2** | **10** | **19** | **68** | | |
| ⊠ | B-009-0-21 | 2.0 | **2.135** | **0.004** | | | **10** | **6** | **12** | **20** | **52** | | |
| ▲ | B-009-0-21 | 5.0 | **0.478** | **0.006** | | | **4** | **6** | **14** | **30** | **46** | | |
| ★ | B-011-0-21 | 1.0 | **0.837** | **0.007** | | | **5** | **9** | **17** | **23** | **46** | | |
| ⊙ | B-011-0-21 | 4.0 | **0.309** | **0.005** | | | **3** | **5** | **16** | **27** | **49** | | |

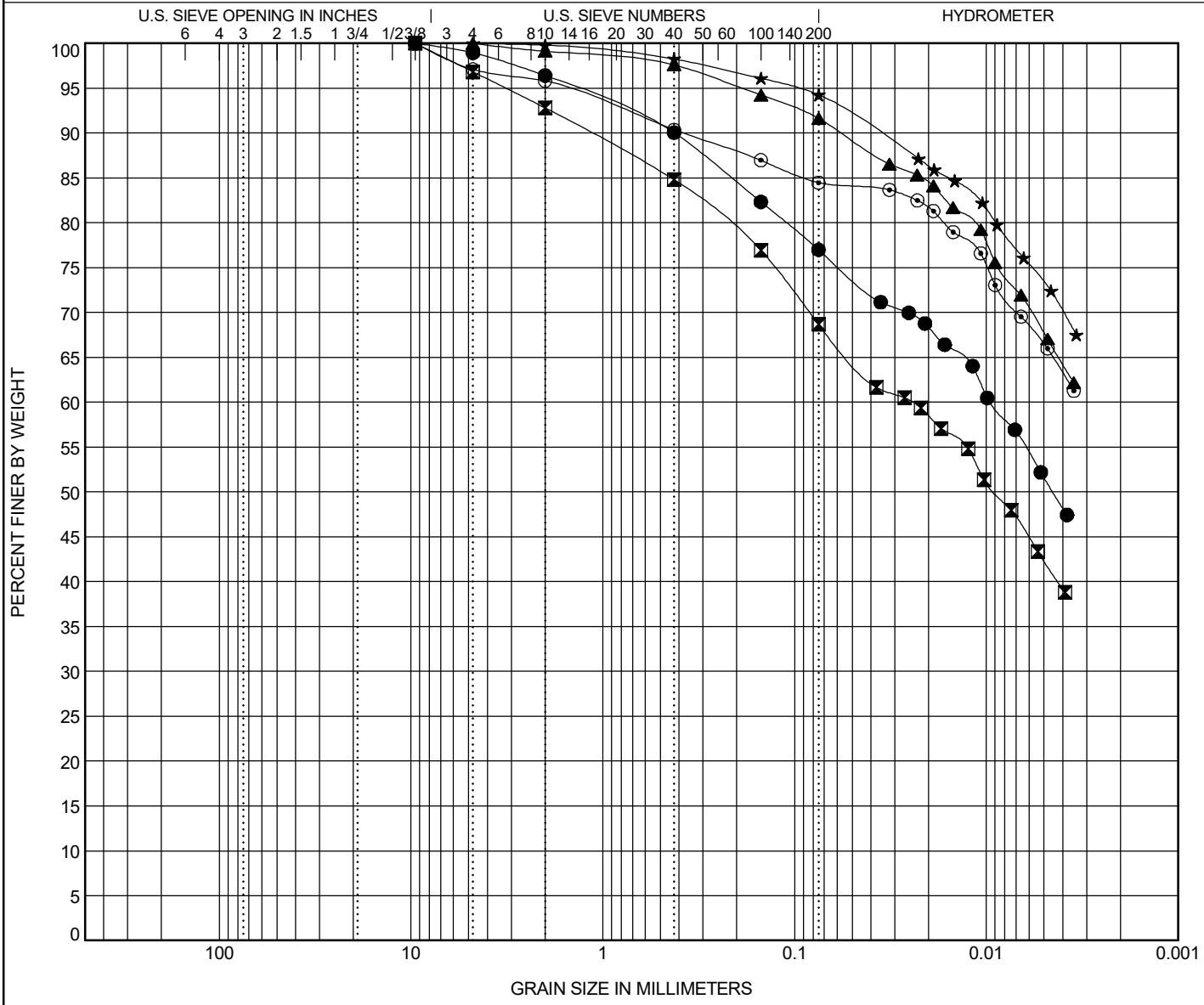
GRAIN SIZE - OH DOT.GDT - 6/2/22 10:36 - S:\PROJECTS\1902501.GPJ

# GRAIN SIZE DISTRIBUTION

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| COBBLES | GRAVEL | SAND | | SILT | CLAY |
|---|---|---|---|---|---|
| | | coarse | fine | | |

| Specimen Identification | | | ODOT (Modified AASHTO) ~ USCS Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | B-012-0-21 | 2.5 | **A-6a ~ LEAN CLAY with SAND(CL)** | **29** | **17** | **12** |
| ⊠ | B-012-0-21 | 5.5 | **A-6a ~ SANDY LEAN CLAY(CL)** | **33** | **19** | **14** |
| ▲ | B-013-0-21 | 1.5 | **A-6b ~ LEAN CLAY(CL)** | **40** | **23** | **17** |
| ★ | B-013-0-21 | 3.0 | **A-7-6 ~ LEAN CLAY(CL)** | **46** | **25** | **21** |
| ⊙ | B-014-0-21 | 0.0 | **A-7-6 ~ LEAN CLAY with SAND(CL)** | **46** | **23** | **23** |

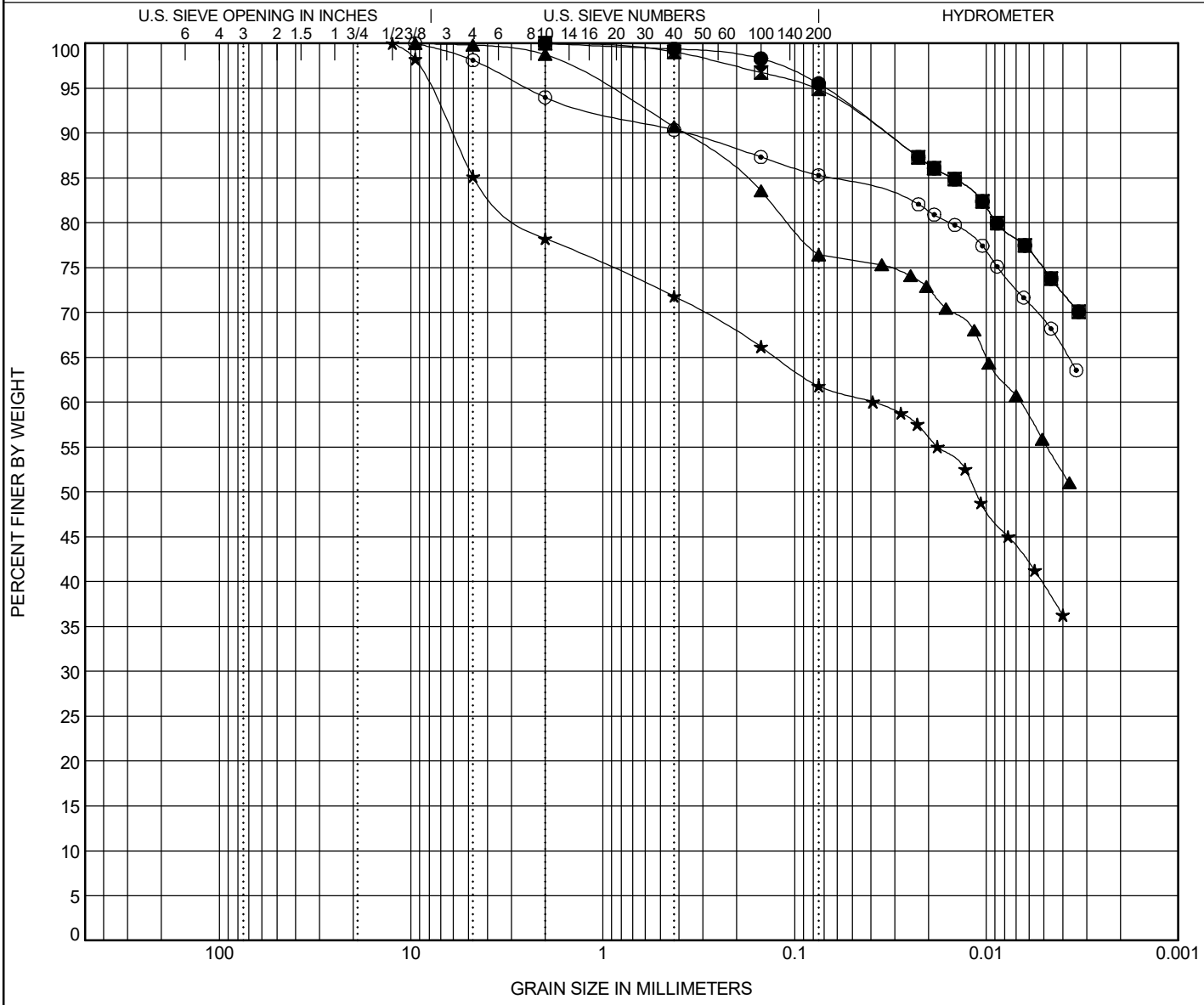
| Specimen Identification | | | D90 | D50 | D30 | D10 | %G | %CS | %FS | %M | %C | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-012-0-21 | 2.5 | **0.422** | **0.005** | | | **4** | **6** | **13** | **25** | **52** | | |
| ⊠ | B-012-0-21 | 5.5 | **1.16** | **0.009** | | | **7** | **8** | **16** | **27** | **42** | | |
| ▲ | B-013-0-21 | 1.5 | **0.057** | | | | **0** | **2** | **6** | **24** | **68** | | |
| ★ | B-013-0-21 | 3.0 | **0.036** | | | | **0** | **2** | **4** | **21** | **73** | | |
| ⊙ | B-014-0-21 | 0.0 | **0.379** | | | | **5** | **5** | **6** | **18** | **66** | | |

# GRAIN SIZE DISTRIBUTION

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| COBBLES | GRAVEL | SAND | | SILT | CLAY |
|---|---|---|---|---|---|
| | | coarse | fine | | |

| Specimen Identification | | | ODOT (Modified AASHTO) ~ USCS Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | B-014-0-21 | 3.0 | A-7-6 ~ FAT CLAY(CH) | 53 | 26 | 27 |
| ⊠ | B-015-0-21 | 1.5 | A-7-6 ~ FAT CLAY(CH) | 50 | 25 | 25 |
| ▲ | B-015-0-21 | 6.0 | A-6a ~ LEAN CLAY with SAND(CL) | 31 | 20 | 11 |
| ★ | B-016-0-21 | 0.0 | A-7-6 ~ SANDY LEAN CLAY(CL) | 41 | 22 | 19 |
| ⊙ | B-016-0-21 | 4.5 | A-7-6 ~ LEAN CLAY(CL) | 46 | 24 | 22 |

| Specimen Identification | | | D90 | D50 | D30 | D10 | %G | %CS | %FS | %M | %C | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-014-0-21 | 3.0 | 0.033 | | | | 0 | 0 | 4 | 21 | 75 | | |
| ⊠ | B-015-0-21 | 1.5 | 0.034 | | | | 0 | 1 | 4 | 20 | 75 | | |
| ▲ | B-015-0-21 | 6.0 | 0.383 | | | | 2 | 8 | 14 | 20 | 56 | | |
| ★ | B-016-0-21 | 0.0 | 6.14 | 0.011 | | | 22 | 6 | 10 | 22 | 40 | | |
| ⊙ | B-016-0-21 | 4.5 | 0.374 | | | | 6 | 4 | 5 | 16 | 69 | | |

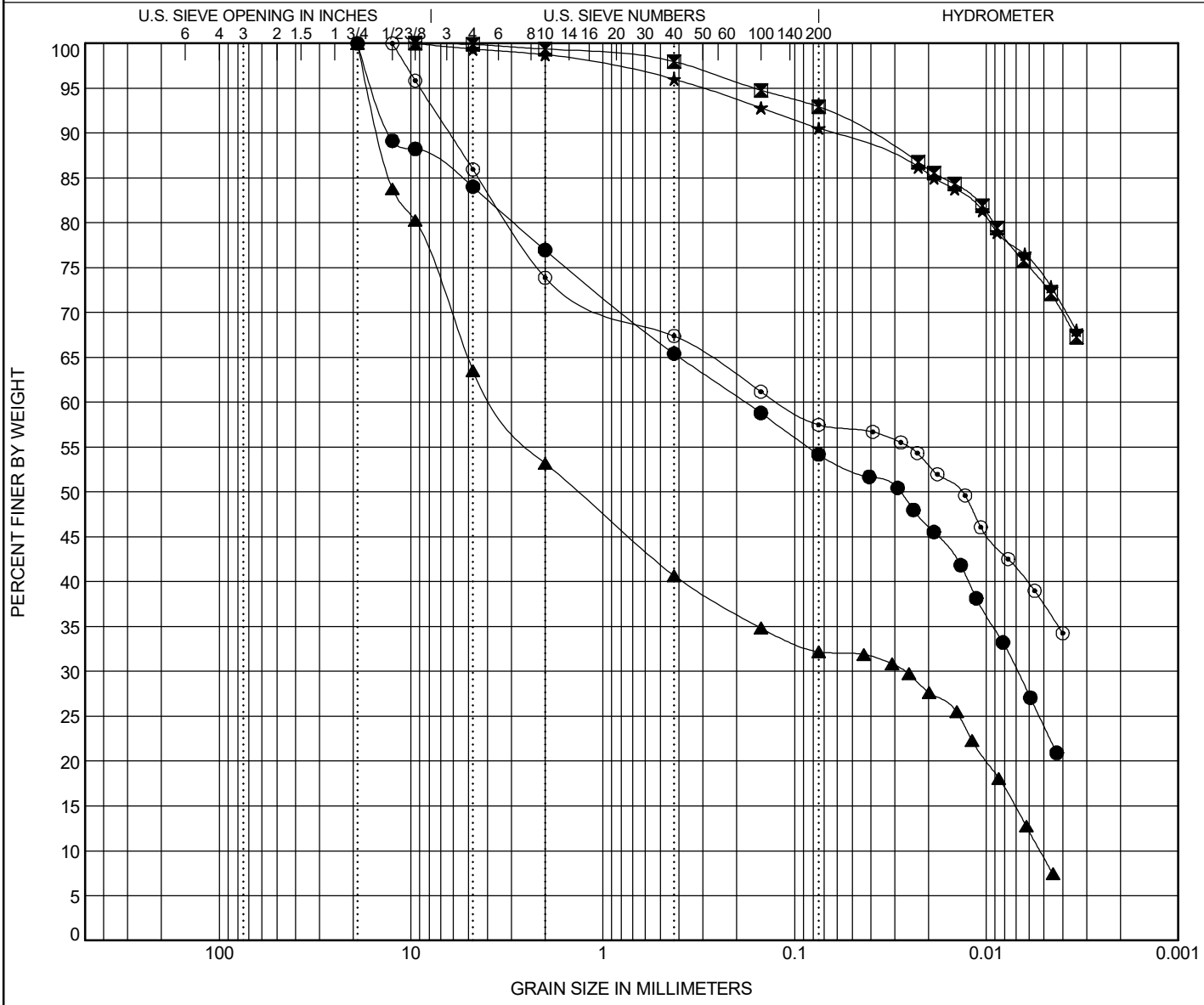
GRAIN SIZE - OH DOT.GDT - 6/2/22 10:36 - S:\PROJECTS\1902501.GPJ

# GRAIN SIZE DISTRIBUTION

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| COBBLES | GRAVEL | SAND | | SILT | CLAY |
|---|---|---|---|---|---|
| | | coarse | fine | | |

| Specimen Identification | | | ODOT (Modified AASHTO) ~ USCS Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | B-017-0-21 | 0.0 | A-6a ~ SANDY LEAN CLAY with GRAVEL(CL) | 32 | 21 | 11 |
| ⊠ | B-017-0-21 | 3.0 | A-7-6 ~ LEAN CLAY(CL) | 43 | 23 | 20 |
| ▲ | B-018-0-21 | 1.5 | A-2-6 ~ CLAYEY GRAVEL with SAND(GC) | 39 | 22 | 17 |
| ★ | B-018-0-21 | 3.0 | A-7-6 ~ LEAN CLAY(CL) | 45 | 24 | 21 |
| ⊙ | B-019-0-21 | 0.0 | A-7-6 ~ SANDY LEAN CLAY(CL) | 41 | 22 | 19 |

| Specimen Identification | | | D90 | D50 | D30 | D10 | %G | %CS | %FS | %M | %C | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-017-0-21 | 0.0 | 12.92 | 0.028 | 0.007 | | 23 | 12 | 11 | 30 | 24 | | |
| ⊠ | B-017-0-21 | 3.0 | 0.042 | | | | 1 | 1 | 5 | 20 | 73 | | |
| ▲ | B-018-0-21 | 1.5 | 14.675 | 1.347 | 0.027 | 0.005 | 47 | 12 | 9 | 23 | 9 | 0.04 | 674.12 |
| ★ | B-018-0-21 | 3.0 | 0.064 | | | | 1 | 3 | 5 | 17 | 74 | | |
| ⊙ | B-019-0-21 | 0.0 | 6.306 | 0.014 | | | 26 | 7 | 10 | 20 | 37 | | |

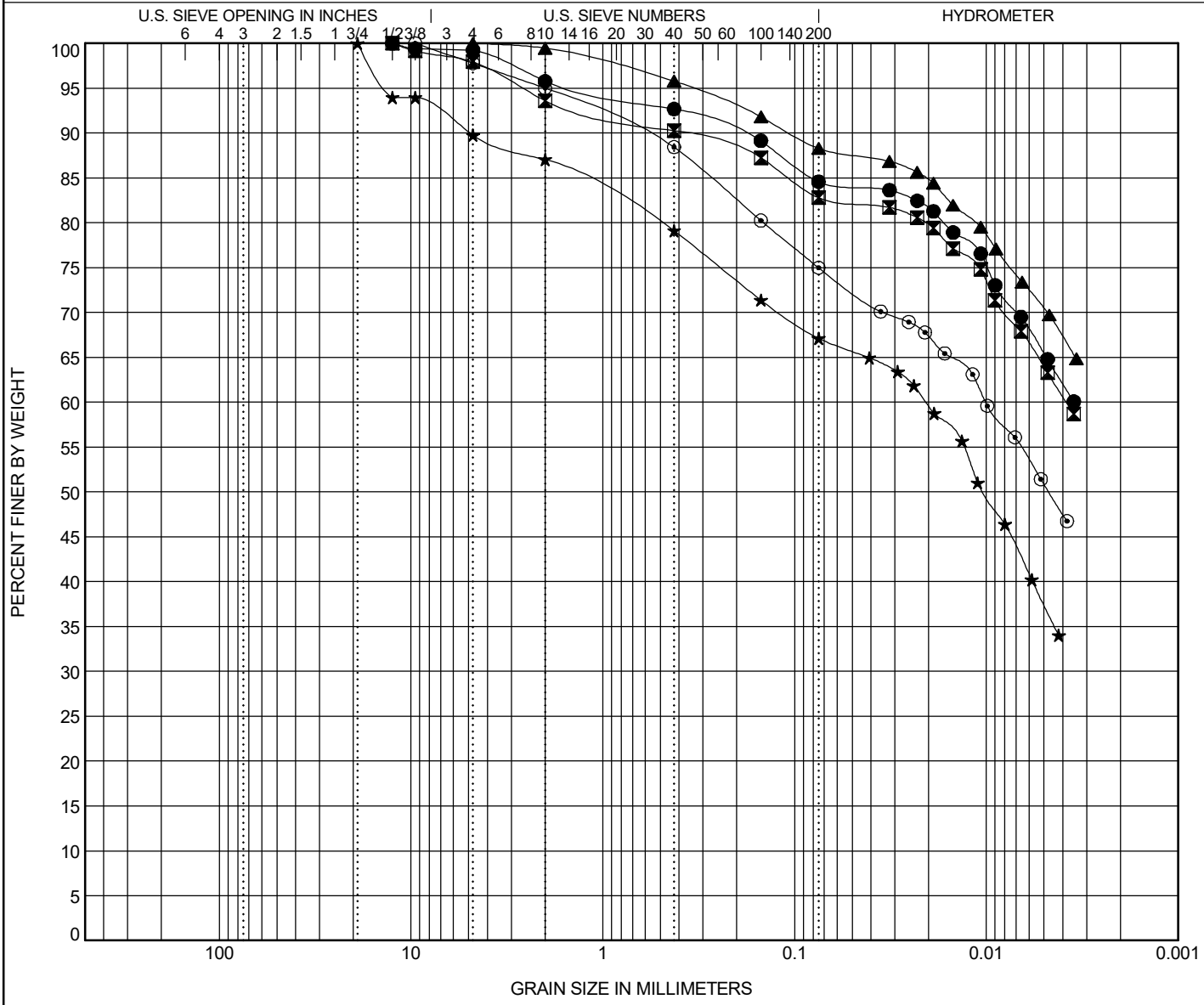
GRAIN SIZE - OH DOT.GDT - 6/2/22 10:36 - S:\PROJECTS\1902501.GPJ

# GRAIN SIZE DISTRIBUTION

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| COBBLES | GRAVEL | SAND | | SILT | CLAY |
|---|---|---|---|---|---|
| | | coarse | fine | | |

| Specimen Identification | | | ODOT (Modified AASHTO) ~ USCS Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | B-019-0-21 | 1.5 | A-6b ~ LEAN CLAY with SAND(CL) | 39 | 22 | 17 |
| ⊠ | B-020-0-21 | 0.0 | A-6a ~ LEAN CLAY with SAND(CL) | 38 | 23 | 15 |
| ▲ | B-020-0-21 | 1.5 | A-7-6 ~ LEAN CLAY(CL) | 48 | 25 | 23 |
| ★ | B-021-0-21 | 0.0 | A-6b ~ SANDY LEAN CLAY(CL) | 38 | 20 | 18 |
| ⊙ | B-021-0-21 | 3.0 | A-6a ~ LEAN CLAY with SAND(CL) | 34 | 20 | 14 |

| Specimen Identification | | | D90 | D50 | D30 | D10 | %G | %CS | %FS | %M | %C | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-019-0-21 | 1.5 | 0.193 | | | | 4 | 3 | 8 | 20 | 65 | | |
| ⊠ | B-020-0-21 | 0.0 | 0.385 | | | | 7 | 3 | 7 | 19 | 64 | | |
| ▲ | B-020-0-21 | 1.5 | 0.105 | | | | 1 | 4 | 7 | 18 | 70 | | |
| ★ | B-021-0-21 | 0.0 | 4.932 | 0.01 | | | 13 | 8 | 12 | 30 | 37 | | |
| ⊙ | B-021-0-21 | 3.0 | 0.613 | 0.005 | | | 5 | 7 | 13 | 24 | 51 | | |

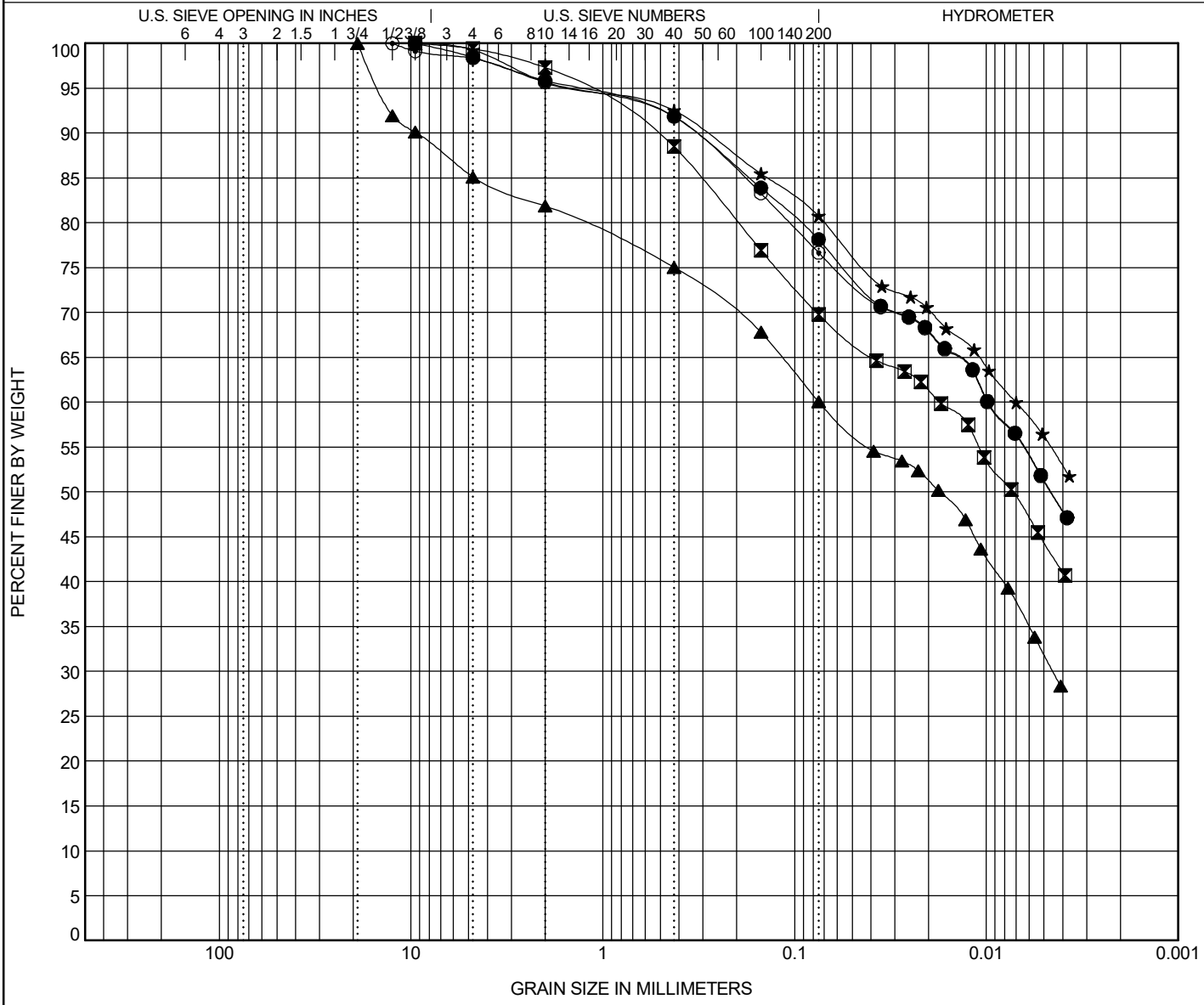
GRAIN SIZE - OH DOT.GDT - 6/2/22 10:37 - S:\PROJECTS\1902501.GPJ

# GRAIN SIZE DISTRIBUTION

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| COBBLES | GRAVEL | SAND | | SILT | CLAY |
|---|---|---|---|---|---|
| | | coarse | fine | | |

| Specimen Identification | | | ODOT (Modified AASHTO) ~ USCS Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | B-022-0-21 | 1.5 | **A-6b ~ LEAN CLAY with SAND(CL)** | **38** | **22** | **16** |
| ⊠ | B-022-0-21 | 4.5 | **A-6a ~ SANDY LEAN CLAY(CL)** | **35** | **20** | **15** |
| ▲ | B-023-0-21 | 0.0 | **A-6a ~ SANDY LEAN CLAY(CL)** | **32** | **21** | **11** |
| ★ | B-023-0-21 | 1.5 | **A-7-6 ~ LEAN CLAY with SAND(CL)** | **43** | **23** | **20** |
| ⊙ | B-024-0-21 | 0.0 | **A-6a ~ LEAN CLAY with SAND(CL)** | **29** | **18** | **11** |

| Specimen Identification | | | D90 | D50 | D30 | D10 | %G | %CS | %FS | %M | %C | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-022-0-21 | 1.5 | **0.333** | **0.005** | | | **4** | **4** | **14** | **27** | **51** | | |
| ⊠ | B-022-0-21 | 4.5 | **0.553** | **0.007** | | | **2** | **9** | **19** | **26** | **44** | | |
| ▲ | B-023-0-21 | 0.0 | **9.351** | **0.017** | **0.005** | | **18** | **7** | **15** | **28** | **32** | | |
| ★ | B-023-0-21 | 1.5 | **0.292** | | | | **4** | **3** | **12** | **25** | **56** | | |
| ⊙ | B-024-0-21 | 0.0 | **0.339** | **0.005** | | | **4** | **4** | **15** | **26** | **51** | | |

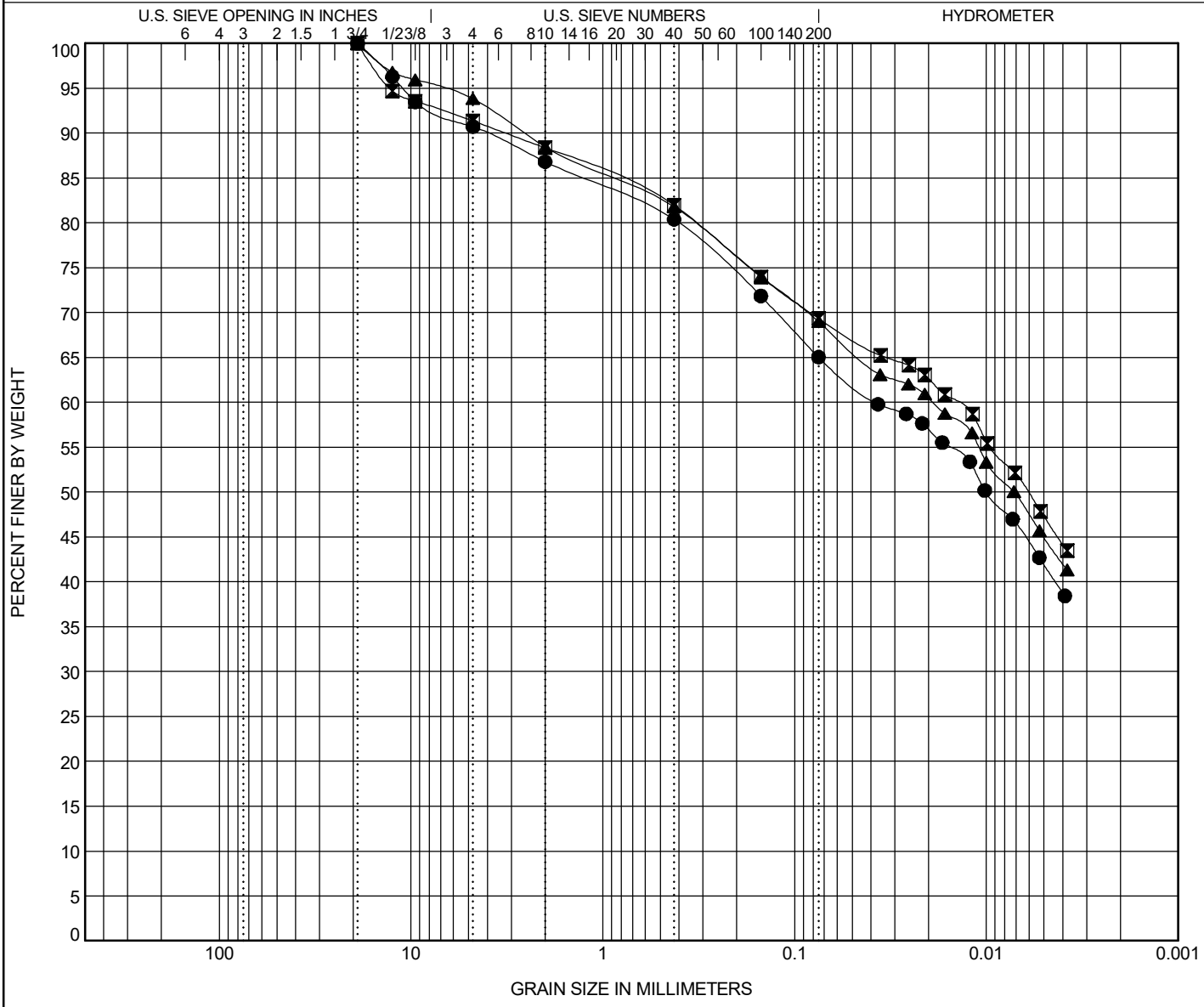
GRAIN SIZE - OH DOT.GDT - 6/2/22 10:37 - S:\PROJECTS\1902501.GPJ

# GRAIN SIZE DISTRIBUTION

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| COBBLES | GRAVEL | SAND | | SILT | CLAY |
|---|---|---|---|---|---|
| | | coarse | fine | | |

| | Specimen Identification | | ODOT (Modified AASHTO) ~ USCS Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | **B-024-0-21** | **1.5** | **A-6a ~ SANDY LEAN CLAY(CL)** | **29** | **18** | **11** |
| ⊠ | **B-025-0-21** | **3.0** | **A-6a ~ SANDY LEAN CLAY(CL)** | **32** | **19** | **13** |
| ▲ | **B-025-0-21** | **4.5** | **A-6a ~ SANDY LEAN CLAY(CL)** | **32** | **19** | **13** |
| | | | | | | |
| | | | | | | |

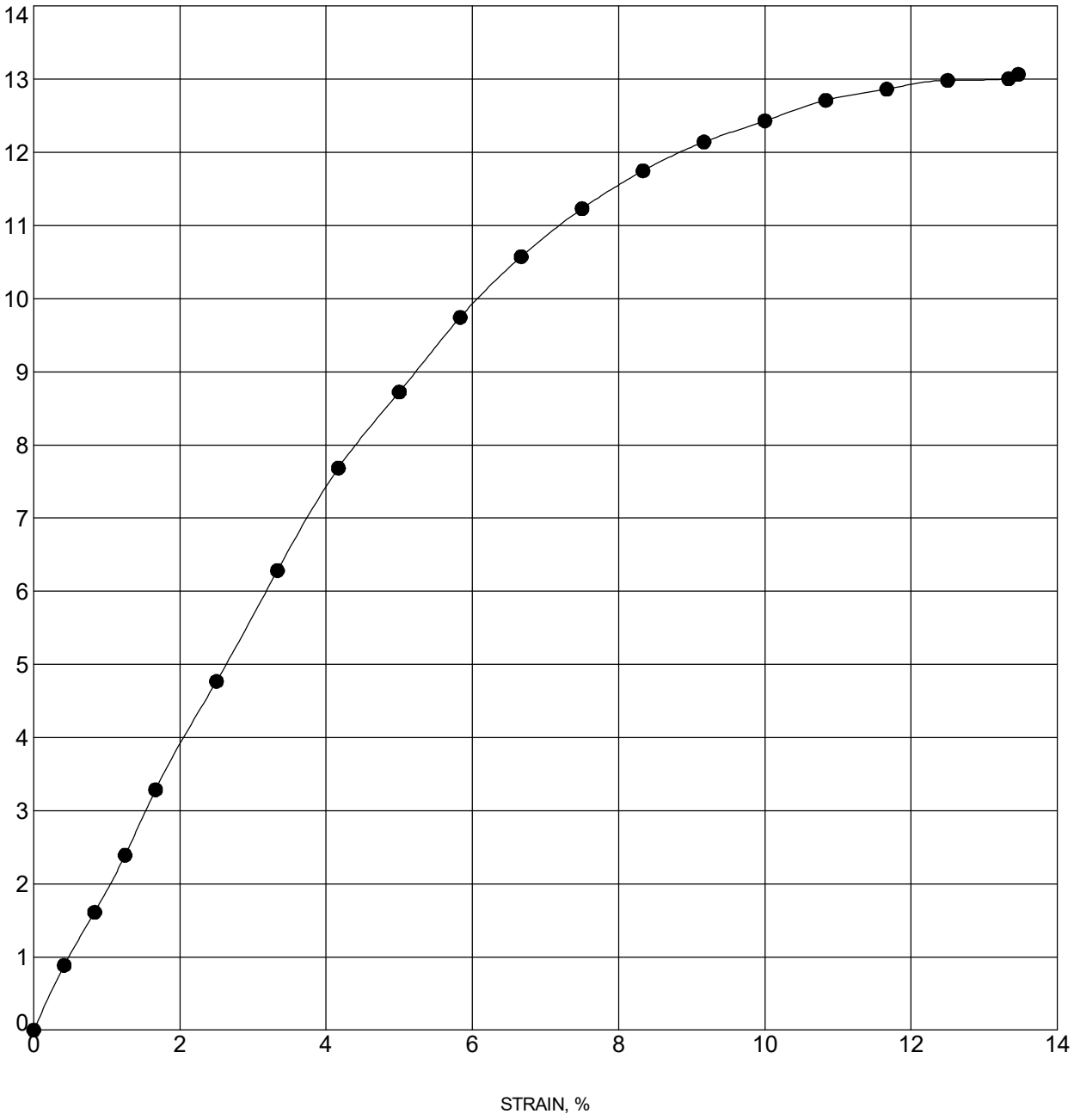
| | Specimen Identification | | D90 | D50 | D30 | D10 | %G | %CS | %FS | %M | %C | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B-024-0-21** | **1.5** | **4.051** | **0.01** | | | **14** | **6** | **15** | **23** | **42** | | |
| ⊠ | **B-025-0-21** | **3.0** | **3.192** | **0.006** | | | **12** | **6** | **13** | **22** | **47** | | |
| ▲ | **B-025-0-21** | **4.5** | **2.556** | **0.007** | | | **11** | **7** | **13** | **24** | **45** | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

# UNCONFINED COMPRESSION TEST

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY



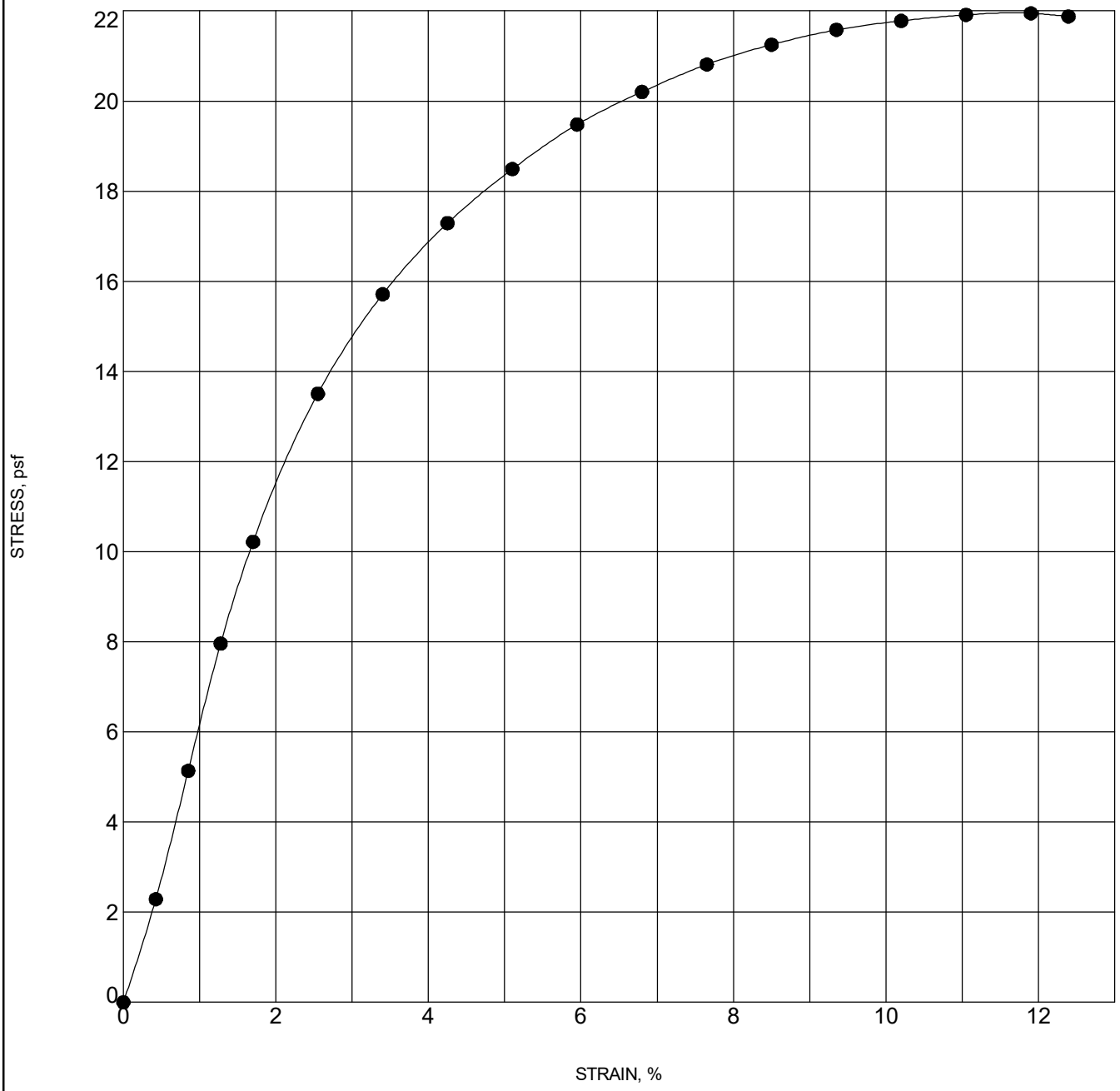

| Specimen Identification | Classification | $\gamma_d$ | MC% |
|---|---|---|---|
| ● **B-007-0-21 5.0** | **A-7-6** | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# UNCONFINED COMPRESSION TEST

**OHIO DEPARTMENT OF TRANSPORTION**
**OFFICE OF GEOTECHNICAL ENGINEERING**

**PROJECT** OTT-53-11.67 **PID** 110859

**OGE NUMBER** N/A **PROJECT TYPE** ROADWAY




| Specimen Identification | Classification | $\gamma_d$ | MC% |
|---|---|---|---|
| ● **B-008-0-21 6.0** | **A-7-6** | **102** | **23** |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Project No.: 1902501
Date: 1/13/2022
Client: ODOT
Project: OTT-53-11.67
Ottawa County, OH
Boring No.: B-007-0-21
Sample No.: ST-3
Depth: 5.0 - 7.0'

Initial H= 1 inches

| Pressure tsf | Final Height (in) | Initial Height (in) | DH | Average H (in) | e | t50 (min) | Ave P (tsf) | Cv (in2/s) | Cv (ft2/d) |
|---|---|---|---|---|---|---|---|---|---|
| 0.125 | 1.00000 | 1.00000 | 0.00000 | 1.0000 | 0.695 | | | | |
| 0.25 | 0.99115 | 1.00000 | 0.00885 | 0.9956 | 0.680 | 1.2 | 0.125 | 0.000670 | 0.402 |
| 0.5 | 0.98570 | 0.99115 | 0.01430 | 0.9884 | 0.671 | 1.5 | 0.375 | 0.000546 | 0.327 |
| 1 | 0.97140 | 0.98570 | 0.02860 | 0.9786 | 0.647 | 7.0 | 0.75 | 0.000112 | 0.067 |
| 2 | 0.95410 | 0.97140 | 0.04590 | 0.9628 | 0.618 | 10.1 | 1.5 | 0.000076 | 0.045 |
| 4 | 0.92840 | 0.95410 | 0.07160 | 0.9413 | 0.574 | 17.4 | 3 | 0.000042 | 0.025 |
| 8 | 0.90220 | 0.92840 | 0.09780 | 0.9153 | 0.530 | 14.4 | 6 | 0.000048 | 0.029 |
| 16 | 0.86650 | 0.90220 | 0.13350 | 0.8844 | 0.469 | 15.8 | 12 | 0.000041 | 0.024 |
| 4 | 0.87900 | 0.86650 | 0.12100 | 0.8728 | 0.490 | | 10 | | |
| 1 | 0.89860 | 0.87900 | 0.10140 | 0.8888 | 0.523 | | 2.5 | | |
| 0.25 | 0.91270 | 0.89860 | 0.08730 | 0.9057 | 0.547 | | 0.625 | | |

Estimated Cc: 0.201
Estimated Cr: 0.043

Soil Description: Brown CLAY, Little Silt, Little Sand, Trace Gravel A-7-6 (16)
Specific Gravity: 2.66
Liquid Limit: 49
Plastic Limit: 24
Plasticity Index: 25

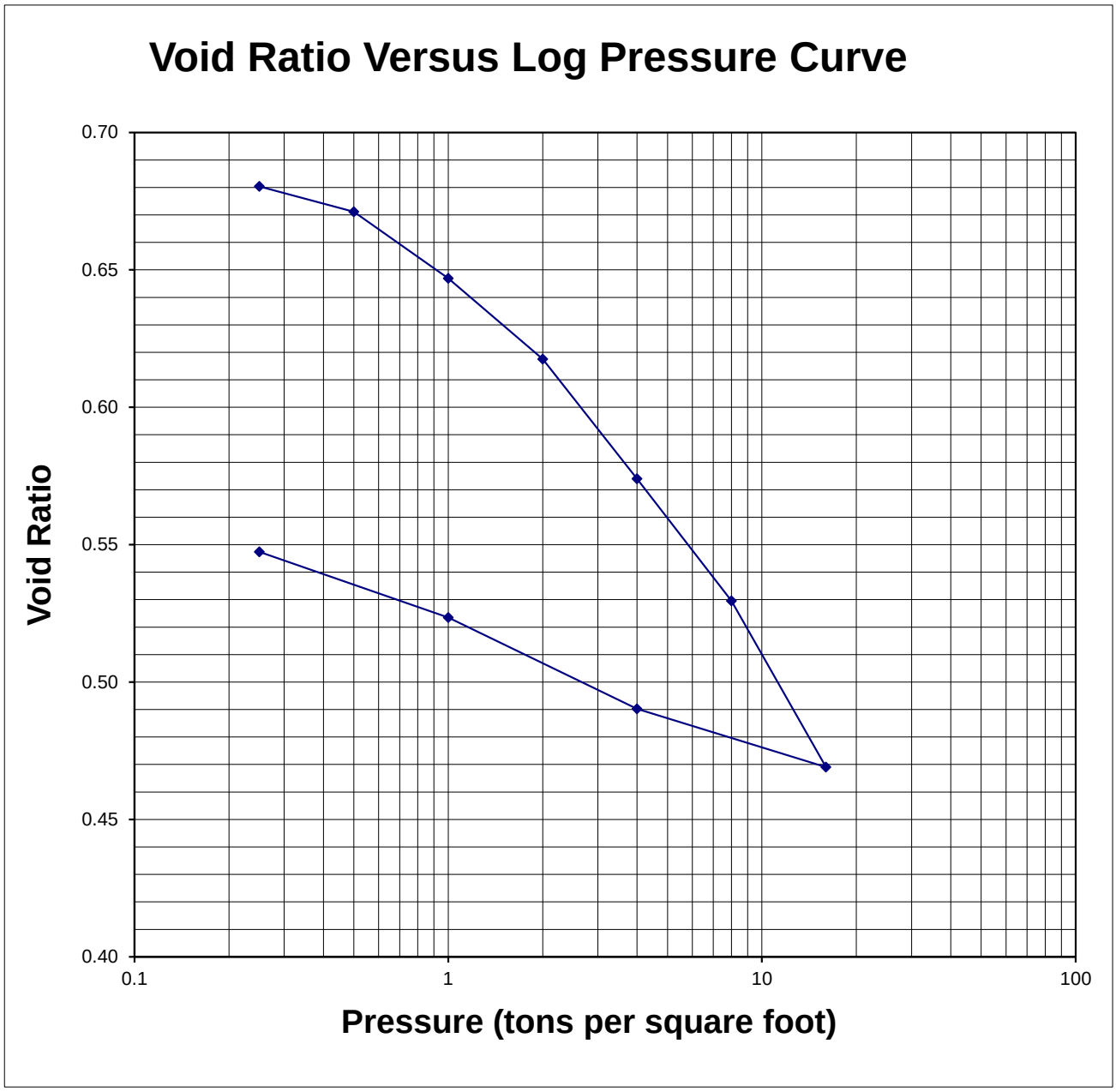
Initial Water Content: 27.3 %
Inital Dry Density: 98.0 pcf
Initial Void Ratio: 0.695
Initial Degree of Saturation: 104.5 %

Final Water Content: 25.6 %
Final Dry Density: 107.4 pcf
Final Void Ratio: 0.547
Final Degree of Saturation 124.7 %

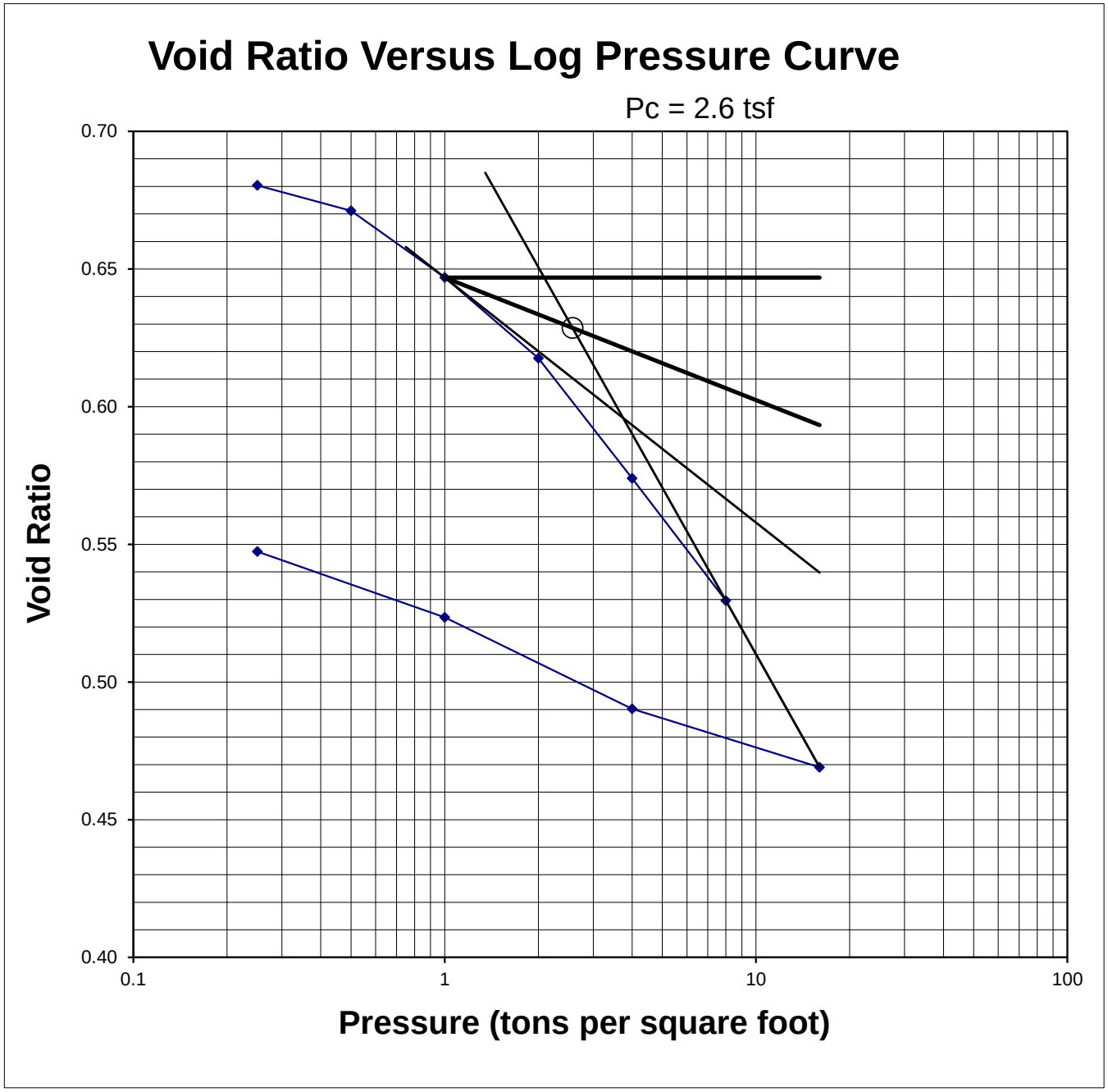
Estimated Preconsolidation Pressure: 2.6 tsf

The sample for the test was trimmed from a Shelby tube sample using a cutting shoe. Test Method B was used with the specimen inundated during testing. Coefficients of consolidation were computed by log of time method.

Project No.: 1902501
Date: 1/13/2022
Client: ODOT
Project: OTT-53-11.67
Ottawa County, OH
Boring No.: B-007-0-21
Sample No.: ST-3
Depth: 5.0 - 7.0'



Project No.: 1902501
Date: 1/13/2022
Client: ODOT
Project: OTT-53-11.67
Ottawa County, OH
Boring No.: B-007-0-21
Sample No.: ST-3
Depth: 5.0 - 7.0'



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-007-0-21 Depth: 5.0 - 7.0'

0.25 tsf Load

initial height= 1 inches

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: 0.00300

2) 0.5 to 2.0: 0.00390

3) 1.0 to 4.0: 0.00480

Do Avg 1&2: 0.00345

Do Avg 1-3: 0.00390

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.39610 | | | | |
| 0.25 | 0.38830 | 0.00780 | 0.00340 | 0.00440 | 0.99560 |
| 0.5 | 0.38760 | 0.00850 | 0.00340 | 0.00510 | 0.99490 |
| 1 | 0.38690 | 0.00920 | 0.00340 | 0.00580 | 0.99420 |
| 2 | 0.38640 | 0.00970 | 0.00340 | 0.00630 | 0.99370 |
| 4 | 0.38590 | 0.01020 | 0.00340 | 0.00680 | 0.99320 |
| 9 | 0.38550 | 0.01060 | 0.00340 | 0.00720 | 0.99280 |
| 16 | 0.38500 | 0.01110 | 0.00340 | 0.00770 | 0.99230 |
| 25 | 0.38480 | 0.01130 | 0.00340 | 0.00790 | 0.99210 |
| 30 | 0.38470 | 0.01140 | 0.00340 | 0.00800 | 0.99200 |
| 60 | 0.38410 | 0.01200 | 0.00340 | 0.00860 | 0.99140 |
| 120 | 0.38400 | 0.01210 | 0.00340 | 0.00870 | 0.99130 |
| 180 | 0.38395 | 0.01215 | 0.00340 | 0.00875 | 0.99125 |
| 240 | 0.38385 | 0.01225 | 0.00340 | 0.00885 | 0.99115 |

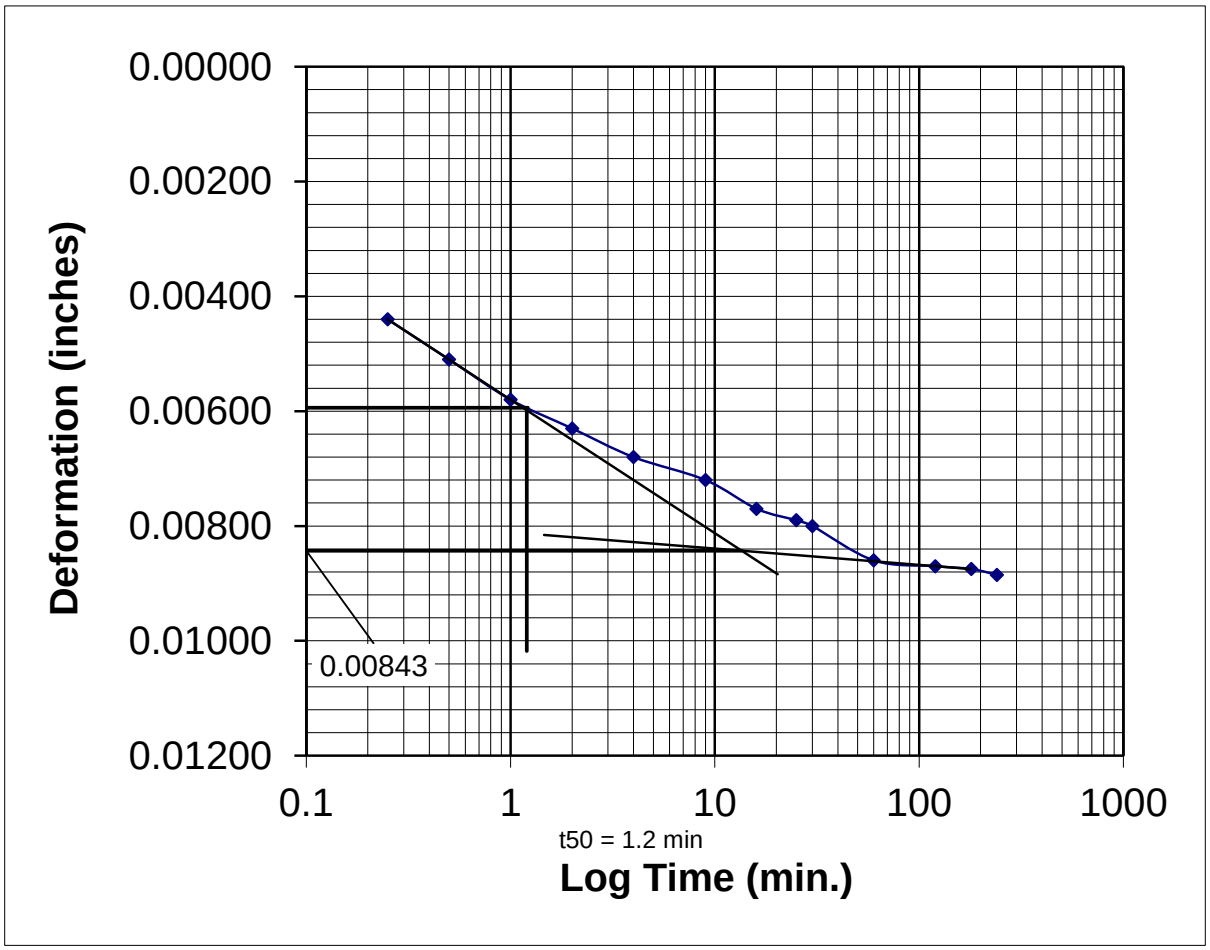
**Use Do=** 0.00345

**D100=** 0.00843

**D50= D100+0.5(Do-D100)**

**D50=** 0.00594

**t50 =** 1.2 min.



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-007-0-21 Depth: 5.0 - 7.0'

0.5 tsf Load

initial height= 0.99115 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.38385 | | | | |
| 0.25 | 0.38110 | 0.00275 | 0.00150 | 0.00125 | 0.98990 |
| 0.5 | 0.38060 | 0.00325 | 0.00150 | 0.00175 | 0.98940 |
| 1 | 0.38000 | 0.00385 | 0.00150 | 0.00235 | 0.98880 |
| 2 | 0.37950 | 0.00435 | 0.00150 | 0.00285 | 0.98830 |
| 4 | 0.37900 | 0.00485 | 0.00150 | 0.00335 | 0.98780 |
| 9 | 0.37860 | 0.00525 | 0.00150 | 0.00375 | 0.98740 |
| 16 | 0.37830 | 0.00555 | 0.00150 | 0.00405 | 0.98710 |
| 25 | 0.37810 | 0.00575 | 0.00150 | 0.00425 | 0.98690 |
| 30 | 0.37790 | 0.00595 | 0.00150 | 0.00445 | 0.98670 |
| 60 | 0.37760 | 0.00625 | 0.00150 | 0.00475 | 0.98640 |
| 120 | 0.37730 | 0.00655 | 0.00150 | 0.00505 | 0.98610 |
| 180 | 0.37700 | 0.00685 | 0.00150 | 0.00535 | 0.98580 |
| 240 | 0.37690 | 0.00695 | 0.00150 | 0.00545 | 0.98570 |

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: 0.00015

2) 0.5 to 2.0: 0.00065

3) 1.0 to 4.0: 0.00135

Do Avg 1&2: 0.00040

Do Avg 1-3: 0.00072

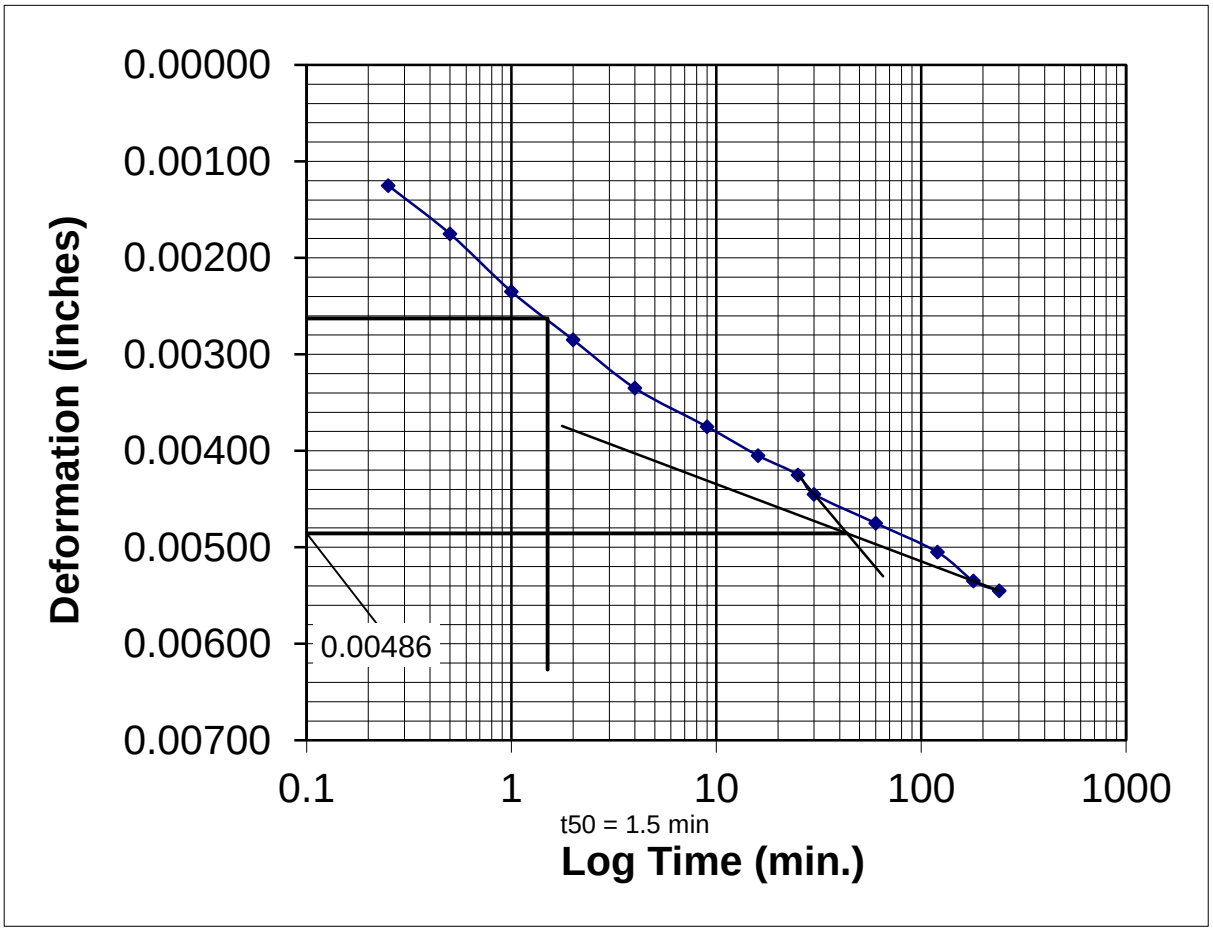
**Use Do=** 0.00040

**D100=** 0.00486

**D50= D100+0.5(Do-D100)**

**D50=** 0.00263

**t50 =** 1.5 min.



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-007-0-21 Depth: 5.0 - 7.0'

1.0 tsf Load

initial height= 0.9857 inches

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: 0.00400

2) 0.5 to 2.0: 0.00410

3) 1.0 to 4.0: 0.00470

Do Avg 1&2: 0.00405

Do Avg 1-3: 0.00427

**Use Do=** 0.00405

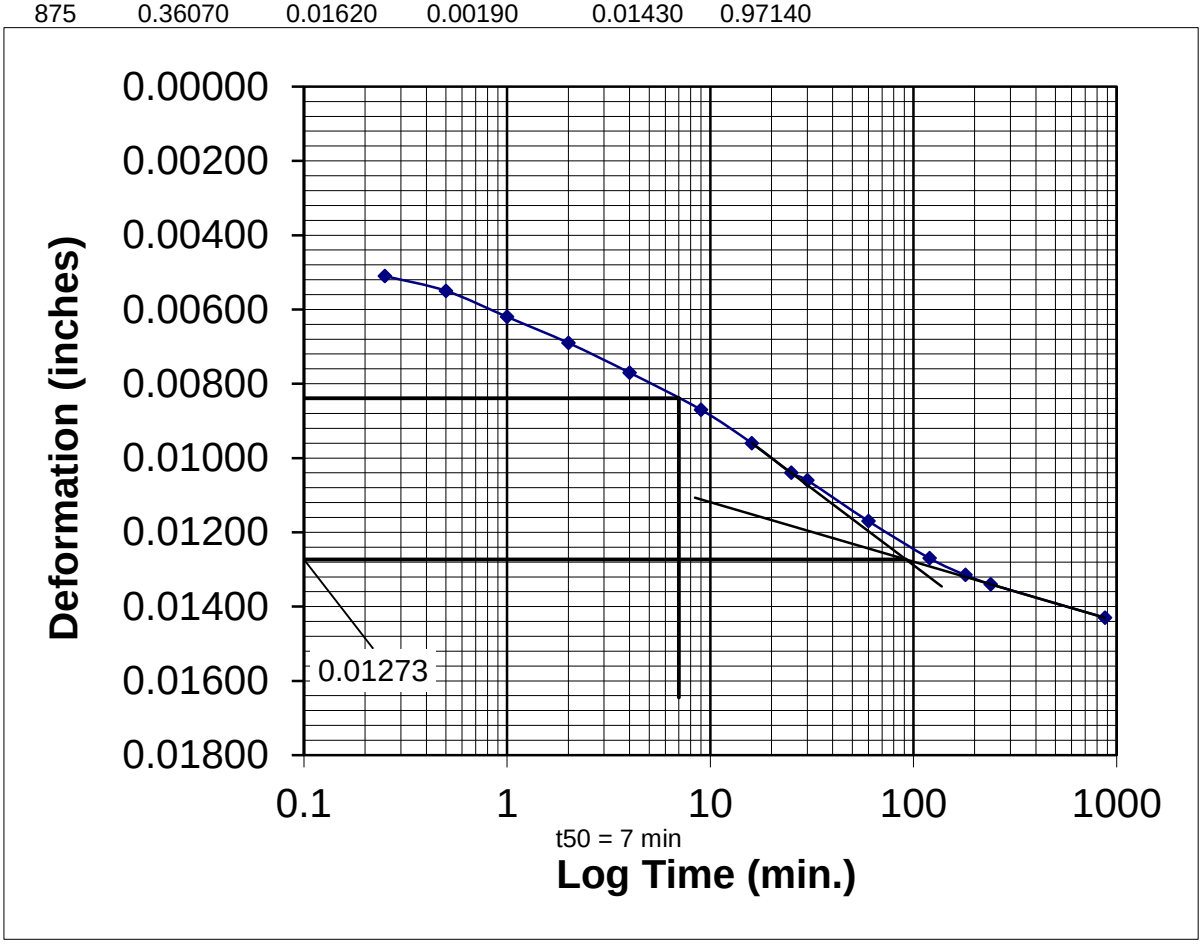
**D100=** 0.01273

**D50= D100+0.5(Do-D100)**

**D50=** 0.00839

**t50 =** 7.0 min.

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.37690 | | | | |
| 0.25 | 0.36990 | 0.00700 | 0.00190 | 0.00510 | 0.98060 |
| 0.5 | 0.36950 | 0.00740 | 0.00190 | 0.00550 | 0.98020 |
| 1 | 0.36880 | 0.00810 | 0.00190 | 0.00620 | 0.97950 |
| 2 | 0.36810 | 0.00880 | 0.00190 | 0.00690 | 0.97880 |
| 4 | 0.36730 | 0.00960 | 0.00190 | 0.00770 | 0.97800 |
| 9 | 0.36630 | 0.01060 | 0.00190 | 0.00870 | 0.97700 |
| 16 | 0.36540 | 0.01150 | 0.00190 | 0.00960 | 0.97610 |
| 25 | 0.36460 | 0.01230 | 0.00190 | 0.01040 | 0.97530 |
| 30 | 0.36440 | 0.01250 | 0.00190 | 0.01060 | 0.97510 |
| 60 | 0.36330 | 0.01360 | 0.00190 | 0.01170 | 0.97400 |
| 120 | 0.36230 | 0.01460 | 0.00190 | 0.01270 | 0.97300 |
| 180 | 0.36185 | 0.01505 | 0.00190 | 0.01315 | 0.97255 |
| 240 | 0.36160 | 0.01530 | 0.00190 | 0.01340 | 0.97230 |
| 875 | 0.36070 | 0.01620 | 0.00190 | 0.01430 | 0.97140 |



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-007-0-21 Depth: 5.0 - 7.0'

2.0 tsf Load

initial height= 0.9714 inches

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: 0.00100

2) 0.5 to 2.0: 0.00130

3) 1.0 to 4.0: 0.00170

Do Avg 1&2: 0.00115

Do Avg 1-3: 0.00133

**Use Do=** 0.00115

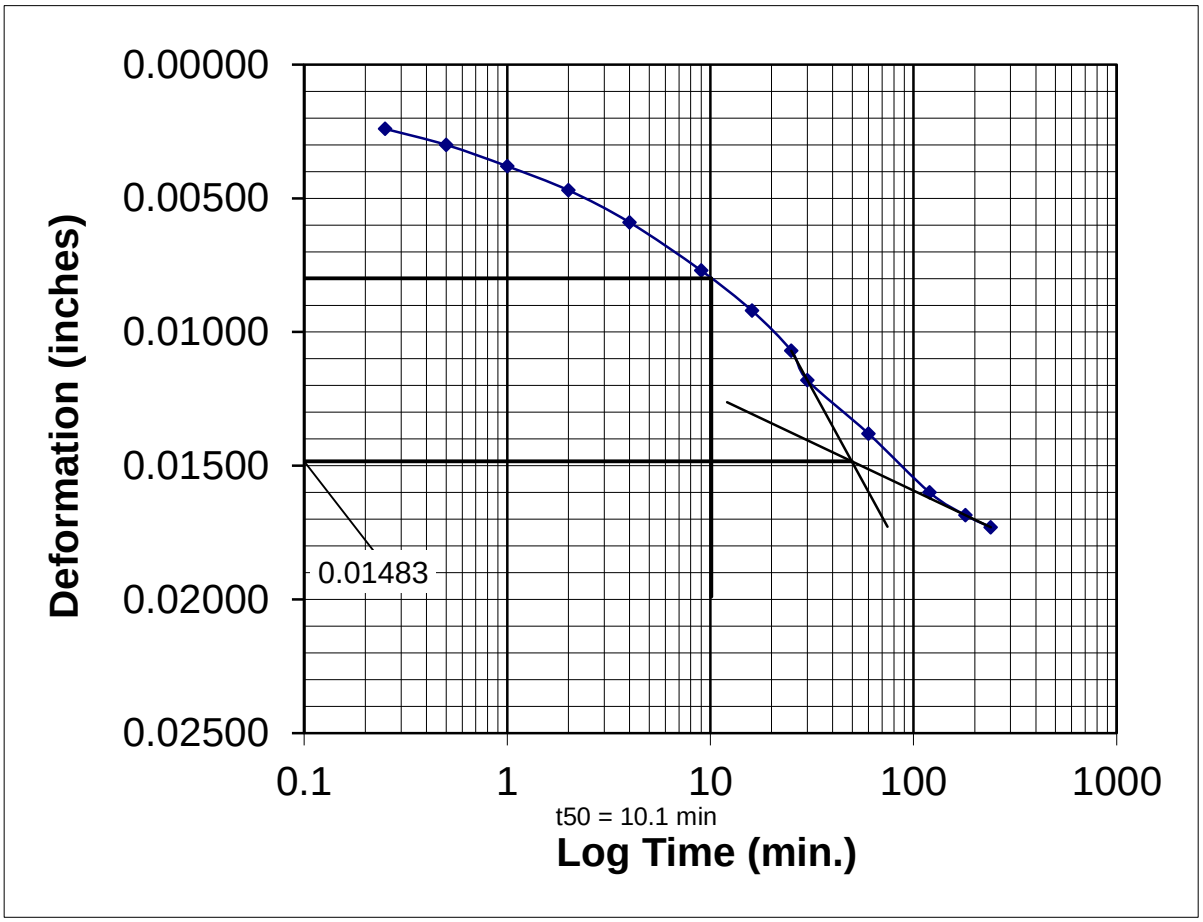
**D100=** 0.01483

**D50= D100+0.5(Do-D100)**

**D50=** 0.00799

**t50 =** 10.1 min.

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.36070 | | | | |
| 0.25 | 0.35620 | 0.00450 | 0.00210 | 0.00240 | 0.96900 |
| 0.5 | 0.35560 | 0.00510 | 0.00210 | 0.00300 | 0.96840 |
| 1 | 0.35480 | 0.00590 | 0.00210 | 0.00380 | 0.96760 |
| 2 | 0.35390 | 0.00680 | 0.00210 | 0.00470 | 0.96670 |
| 4 | 0.35270 | 0.00800 | 0.00210 | 0.00590 | 0.96550 |
| 9 | 0.35090 | 0.00980 | 0.00210 | 0.00770 | 0.96370 |
| 16 | 0.34940 | 0.01130 | 0.00210 | 0.00920 | 0.96220 |
| 25 | 0.34790 | 0.01280 | 0.00210 | 0.01070 | 0.96070 |
| 30 | 0.34680 | 0.01390 | 0.00210 | 0.01180 | 0.95960 |
| 60 | 0.34480 | 0.01590 | 0.00210 | 0.01380 | 0.95760 |
| 120 | 0.34260 | 0.01810 | 0.00210 | 0.01600 | 0.95540 |
| 180 | 0.34175 | 0.01895 | 0.00210 | 0.01685 | 0.95455 |
| 240 | 0.34130 | 0.01940 | 0.00210 | 0.01730 | 0.95410 |



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-007-0-21 Depth: 5.0 - 7.0'

4.0 tsf Load

initial height= 0.9541 inches

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: 0.00110

2) 0.5 to 2.0: 0.00140

3) 1.0 to 4.0: 0.00145

Do Avg 1&2: 0.00125

Do Avg 1-3: 0.00132

**Use Do=** 0.00125

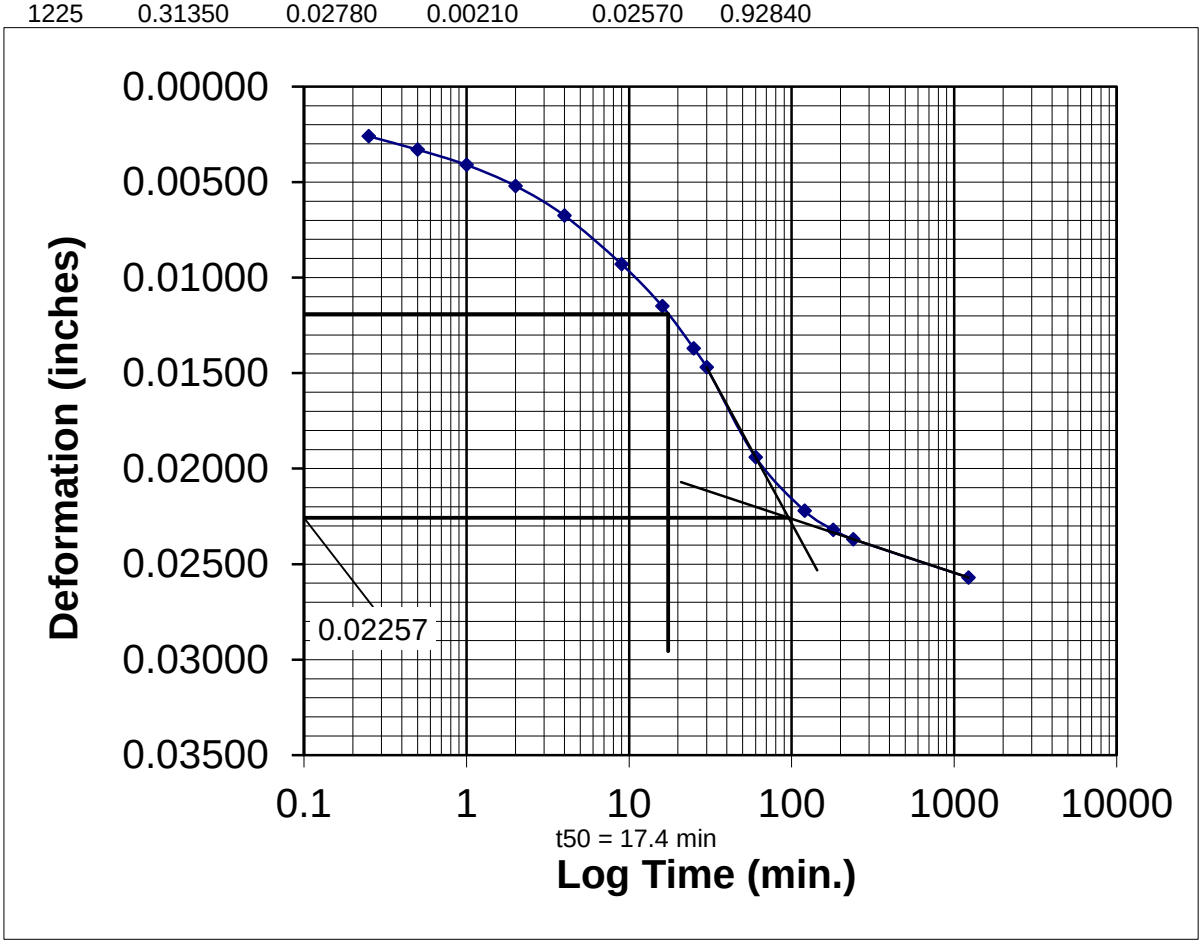
**D100=** 0.02257

**D50= D100+0.5(Do-D100)**

**D50=** 0.01191

**t50 =** 17.4 min.

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.34130 | | | | |
| 0.25 | 0.33660 | 0.00470 | 0.00210 | 0.00260 | 0.95150 |
| 0.5 | 0.33590 | 0.00540 | 0.00210 | 0.00330 | 0.95080 |
| 1 | 0.33510 | 0.00620 | 0.00210 | 0.00410 | 0.95000 |
| 2 | 0.33400 | 0.00730 | 0.00210 | 0.00520 | 0.94890 |
| 4 | 0.33245 | 0.00885 | 0.00210 | 0.00675 | 0.94735 |
| 9 | 0.32990 | 0.01140 | 0.00210 | 0.00930 | 0.94480 |
| 16 | 0.32770 | 0.01360 | 0.00210 | 0.01150 | 0.94260 |
| 25 | 0.32550 | 0.01580 | 0.00210 | 0.01370 | 0.94040 |
| 30 | 0.32450 | 0.01680 | 0.00210 | 0.01470 | 0.93940 |
| 60 | 0.31980 | 0.02150 | 0.00210 | 0.01940 | 0.93470 |
| 120 | 0.31700 | 0.02430 | 0.00210 | 0.02220 | 0.93190 |
| 180 | 0.31600 | 0.02530 | 0.00210 | 0.02320 | 0.93090 |
| 240 | 0.31550 | 0.02580 | 0.00210 | 0.02370 | 0.93040 |
| 1225 | 0.31350 | 0.02780 | 0.00210 | 0.02570 | 0.92840 |



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-007-0-21 Depth: 5.0 - 7.0'

8.0 tsf Load

initial height= 0.92840 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.31350 | | | | |
| 0.25 | 0.31000 | 0.00350 | 0.00210 | 0.00140 | 0.92700 |
| 0.5 | 0.30930 | 0.00420 | 0.00210 | 0.00210 | 0.92630 |
| 1 | 0.30825 | 0.00525 | 0.00210 | 0.00315 | 0.92525 |
| 2 | 0.30690 | 0.00660 | 0.00210 | 0.00450 | 0.92390 |
| 4 | 0.30510 | 0.00840 | 0.00210 | 0.00630 | 0.92210 |
| 9 | 0.30205 | 0.01145 | 0.00210 | 0.00935 | 0.91905 |
| 16 | 0.29910 | 0.01440 | 0.00210 | 0.01230 | 0.91610 |
| 25 | 0.29630 | 0.01720 | 0.00210 | 0.01510 | 0.91330 |
| 30 | 0.29510 | 0.01840 | 0.00210 | 0.01630 | 0.91210 |
| 60 | 0.28950 | 0.02400 | 0.00210 | 0.02190 | 0.90650 |
| 120 | 0.28700 | 0.02650 | 0.00210 | 0.02440 | 0.90400 |
| 180 | 0.28585 | 0.02765 | 0.00210 | 0.02555 | 0.90285 |
| 240 | 0.28520 | 0.02830 | 0.00210 | 0.02620 | 0.90220 |

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: -0.00035

2) 0.5 to 2.0: -0.00030

3) 1.0 to 4.0: 0.00000

Do Avg 1&2: -0.00033

Do Avg 1-3: -0.00022

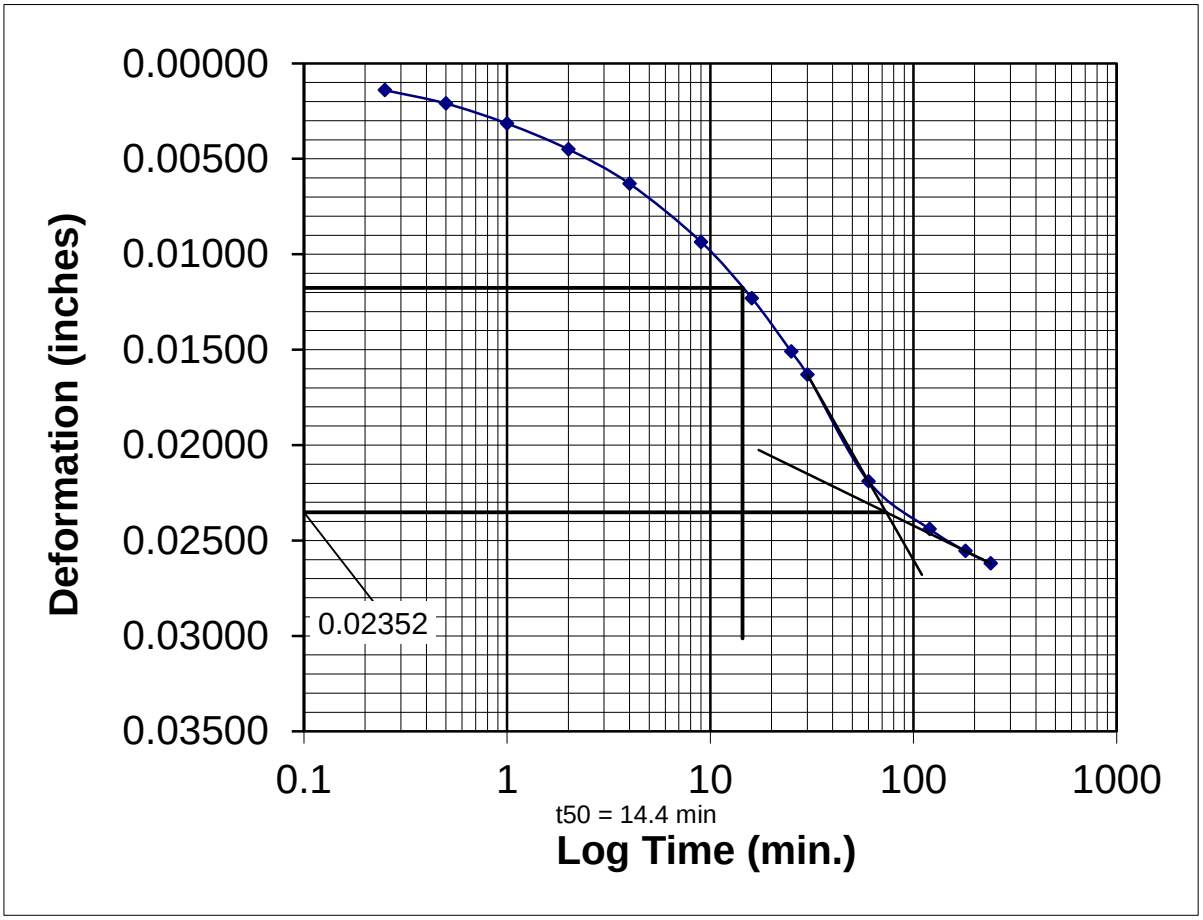
**Use Do=** 0.00000

**D100=** 0.02352

**D50= D100+0.5(Do-D100)**

**D50=** 0.01176

**t50 =** 14.4 min.



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-007-0-21 Depth: 5.0 - 7.0'

16 tsf Load

initial height= 0.9022 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.28520 | | | | |
| 0.25 | 0.28130 | 0.00390 | 0.00210 | 0.00180 | 0.90040 |
| 0.5 | 0.28040 | 0.00480 | 0.00210 | 0.00270 | 0.89950 |
| 1 | 0.27920 | 0.00600 | 0.00210 | 0.00390 | 0.89830 |
| 2 | 0.27740 | 0.00780 | 0.00210 | 0.00570 | 0.89650 |
| 4 | 0.27500 | 0.01020 | 0.00210 | 0.00810 | 0.89410 |
| 9 | 0.27090 | 0.01430 | 0.00210 | 0.01220 | 0.89000 |
| 16 | 0.26710 | 0.01810 | 0.00210 | 0.01600 | 0.88620 |
| 25 | 0.26300 | 0.02220 | 0.00210 | 0.02010 | 0.88210 |
| 30 | 0.26150 | 0.02370 | 0.00210 | 0.02160 | 0.88060 |
| 60 | 0.25600 | 0.02920 | 0.00210 | 0.02710 | 0.87510 |
| 120 | 0.25190 | 0.03330 | 0.00210 | 0.03120 | 0.87100 |
| 180 | 0.25050 | 0.03470 | 0.00210 | 0.03260 | 0.86960 |
| 240 | 0.24980 | 0.03540 | 0.00210 | 0.03330 | 0.86890 |
| 1235 | 0.24740 | 0.03780 | 0.00210 | 0.03570 | 0.86650 |

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: -0.00030

2) 0.5 to 2.0: -0.00030

3) 1.0 to 4.0: -0.00030

Do Avg 1&2: -0.00030

Do Avg 1-3: -0.00030

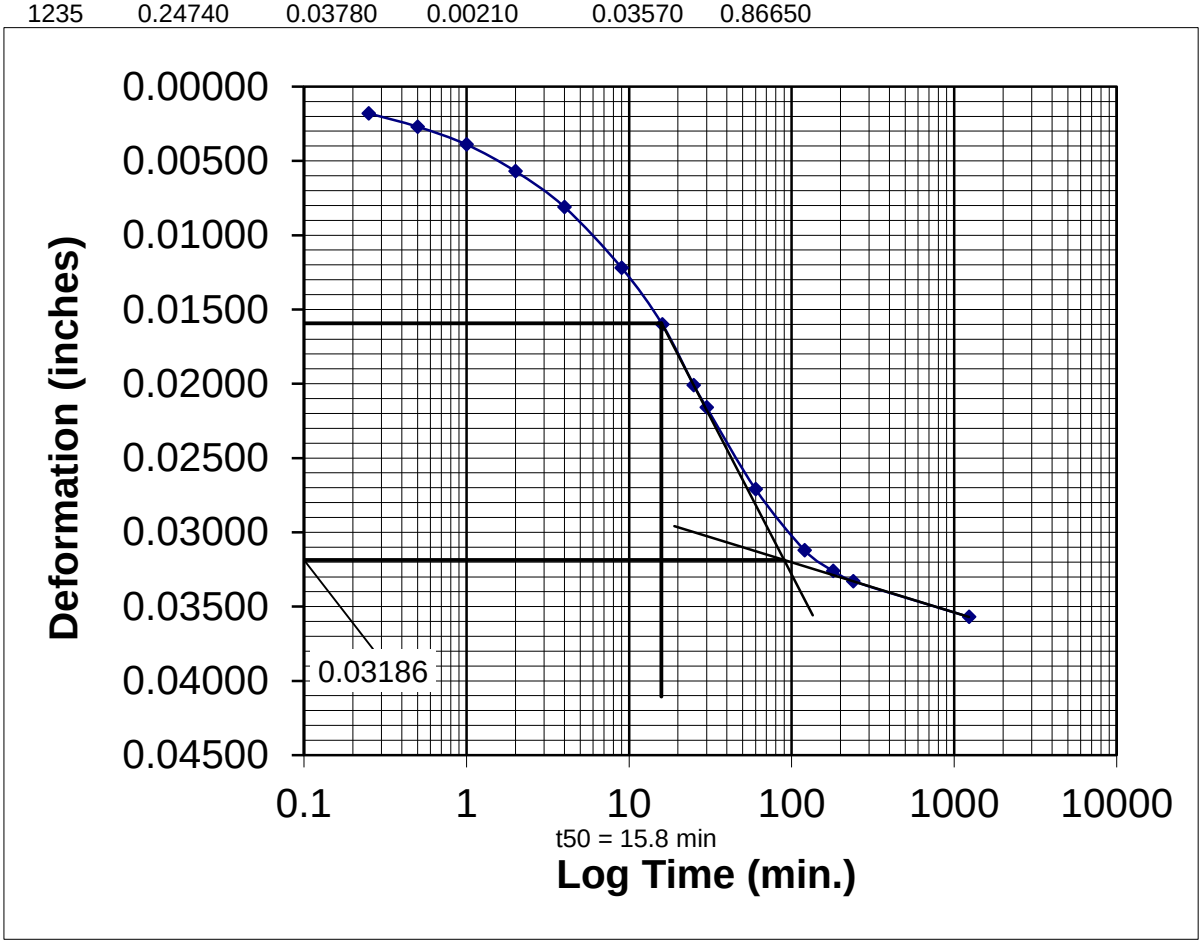
**Use Do=** 0.00000

**D100=** 0.03186

**D50= D100+0.5(Do-D100)**

**D50=** 0.01593

**t50 =** 15.8 min.

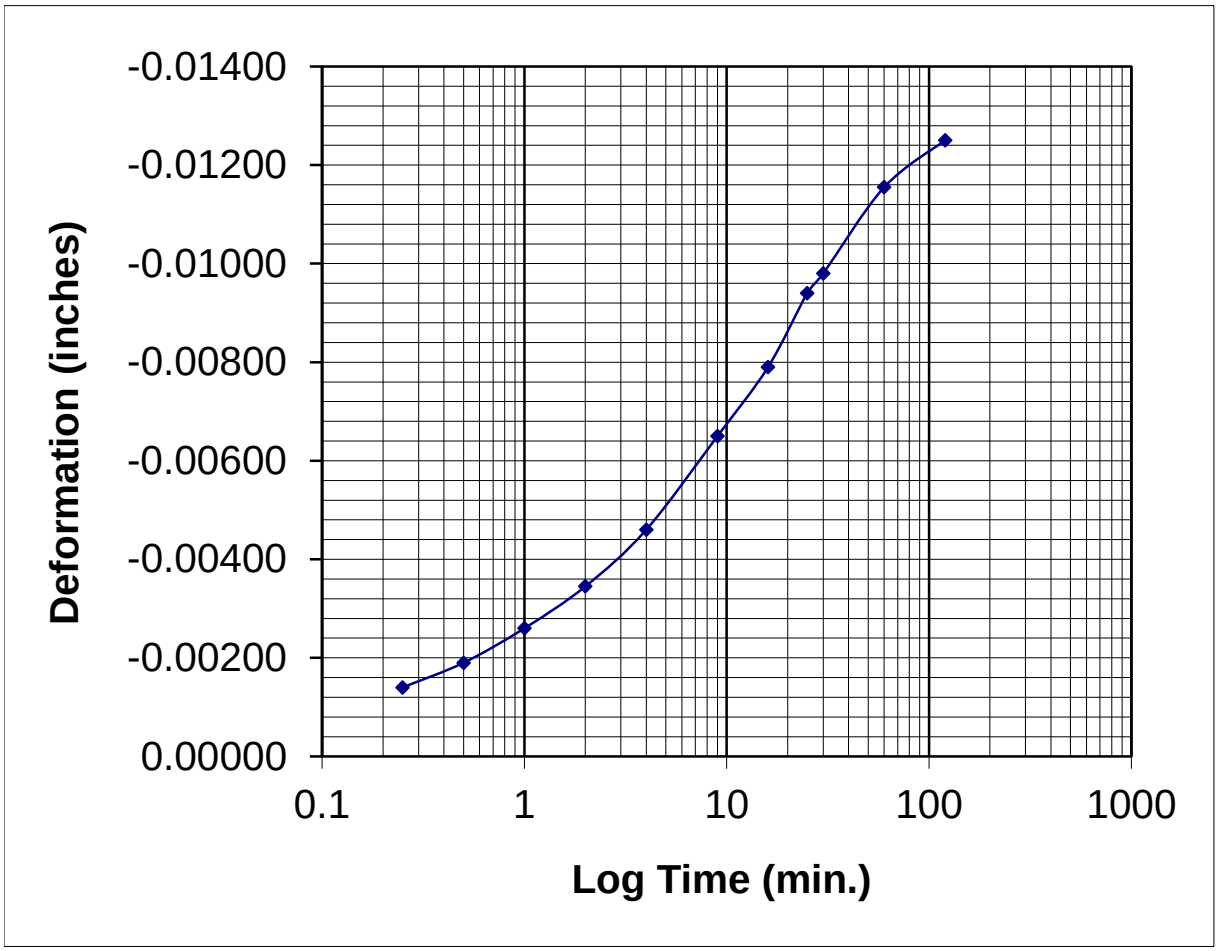


Project No. : 1902501 Sample No.: ST-3
Boring No. : B-007-0-21 Depth: 5.0 - 7.0'

4.0 tsf Unload

initial height= 0.8665 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.24740 | | | | |
| 0.25 | 0.24980 | -0.00240 | -0.00100 | -0.00140 | 0.86790 |
| 0.5 | 0.25030 | -0.00290 | -0.00100 | -0.00190 | 0.86840 |
| 1 | 0.25100 | -0.00360 | -0.00100 | -0.00260 | 0.86910 |
| 2 | 0.25185 | -0.00445 | -0.00100 | -0.00345 | 0.86995 |
| 4 | 0.25300 | -0.00560 | -0.00100 | -0.00460 | 0.87110 |
| 9 | 0.25490 | -0.00750 | -0.00100 | -0.00650 | 0.87300 |
| 16 | 0.25630 | -0.00890 | -0.00100 | -0.00790 | 0.87440 |
| 25 | 0.25780 | -0.01040 | -0.00100 | -0.00940 | 0.87590 |
| 30 | 0.25820 | -0.01080 | -0.00100 | -0.00980 | 0.87630 |
| 60 | 0.25995 | -0.01255 | -0.00100 | -0.01155 | 0.87805 |
| 120 | 0.26090 | -0.01350 | -0.00100 | -0.01250 | 0.87900 |

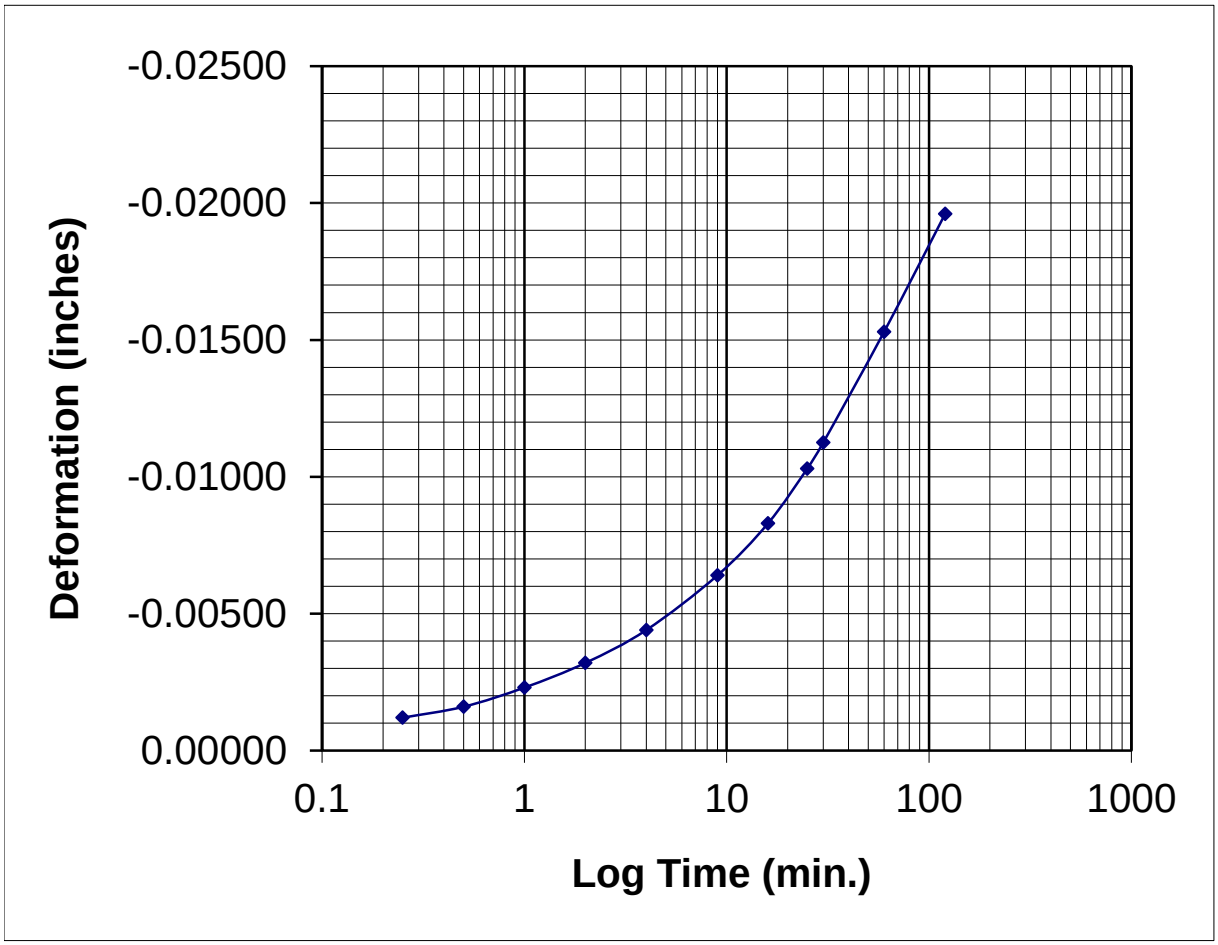


Project No. : 1902501 Sample No.: ST-3
Boring No. : B-007-0-21 Depth: 5.0 - 7.0'

1.0 tsf Unload

initial height= 0.879 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.26090 | | | | |
| 0.25 | 0.26340 | -0.00250 | -0.00130 | -0.00120 | 0.88020 |
| 0.5 | 0.26380 | -0.00290 | -0.00130 | -0.00160 | 0.88060 |
| 1 | 0.26450 | -0.00360 | -0.00130 | -0.00230 | 0.88130 |
| 2 | 0.26540 | -0.00450 | -0.00130 | -0.00320 | 0.88220 |
| 4 | 0.26660 | -0.00570 | -0.00130 | -0.00440 | 0.88340 |
| 9 | 0.26860 | -0.00770 | -0.00130 | -0.00640 | 0.88540 |
| 16 | 0.27050 | -0.00960 | -0.00130 | -0.00830 | 0.88730 |
| 25 | 0.27250 | -0.01160 | -0.00130 | -0.01030 | 0.88930 |
| 30 | 0.27345 | -0.01255 | -0.00130 | -0.01125 | 0.89025 |
| 60 | 0.27750 | -0.01660 | -0.00130 | -0.01530 | 0.89430 |
| 120 | 0.28180 | -0.02090 | -0.00130 | -0.01960 | 0.89860 |

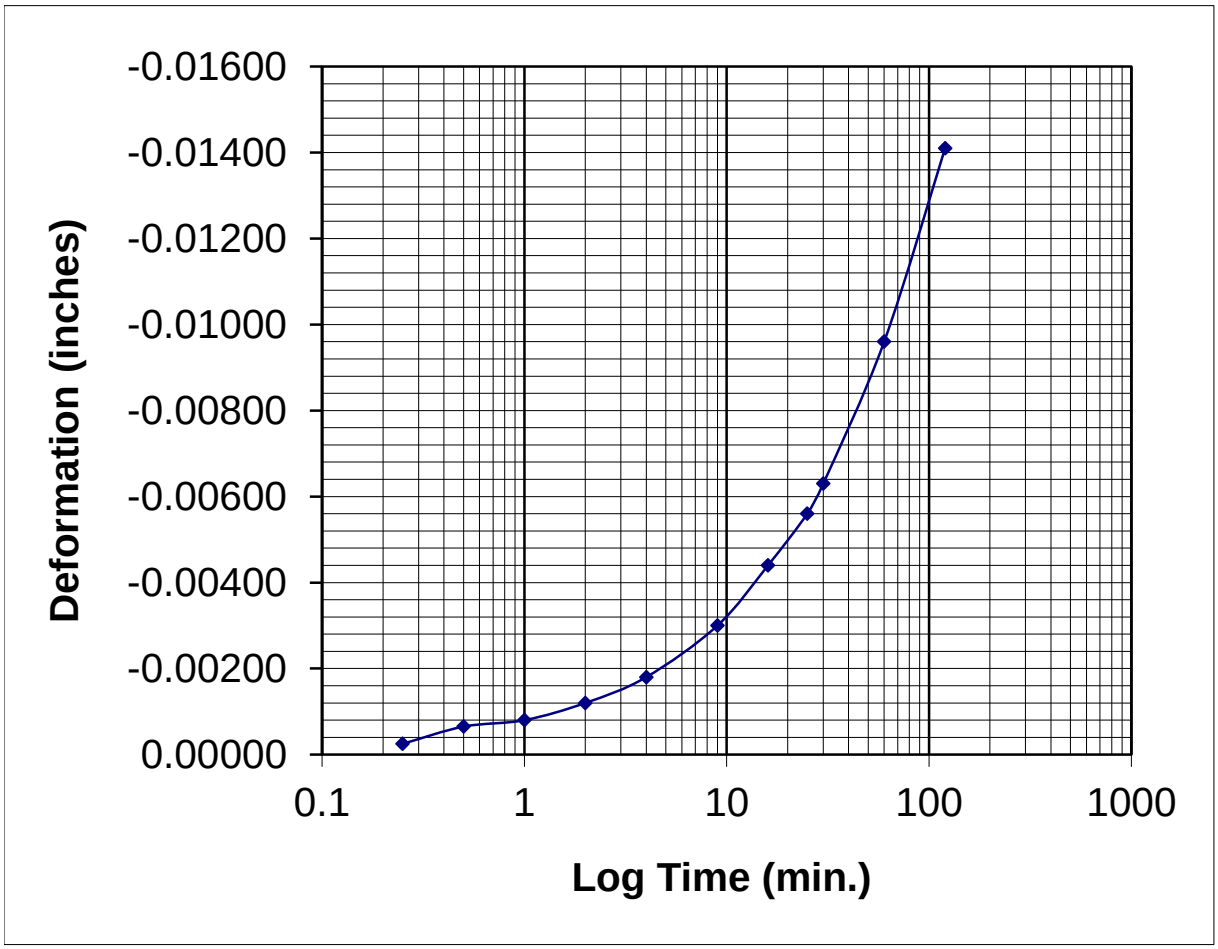


Project No. : 1902501 Sample No.: ST-3
Boring No. : B-007-0-21 Depth: 5.0 - 7.0'

0.25 tsf Unload

initial height= 0.8986 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.28180 | | | | |
| 0.25 | 0.28335 | -0.00155 | -0.00130 | -0.00025 | 0.89885 |
| 0.5 | 0.28375 | -0.00195 | -0.00130 | -0.00065 | 0.89925 |
| 1 | 0.28390 | -0.00210 | -0.00130 | -0.00080 | 0.89940 |
| 2 | 0.28430 | -0.00250 | -0.00130 | -0.00120 | 0.89980 |
| 4 | 0.28490 | -0.00310 | -0.00130 | -0.00180 | 0.90040 |
| 9 | 0.28610 | -0.00430 | -0.00130 | -0.00300 | 0.90160 |
| 16 | 0.28750 | -0.00570 | -0.00130 | -0.00440 | 0.90300 |
| 25 | 0.28870 | -0.00690 | -0.00130 | -0.00560 | 0.90420 |
| 30 | 0.28940 | -0.00760 | -0.00130 | -0.00630 | 0.90490 |
| 60 | 0.29270 | -0.01090 | -0.00130 | -0.00960 | 0.90820 |
| 120 | 0.29720 | -0.01540 | -0.00130 | -0.01410 | 0.91270 |



Project No.: 1902501
Date: 1/13/2022
Client: ODOT
Project: OTT-53-11.67
Ottawa County, OH
Boring No.: B-008-0-21
Sample No.: ST-3
Depth: 6.0 - 8.0'

Initial H= 1 inches

| Pressure tsf | Final Height (in) | Initial Height (in) | DH | Average H (in) | e | t50 (min) | Ave P (tsf) | Cv (in2/s) | Cv (ft2/d) |
|---|---|---|---|---|---|---|---|---|---|
| 0.25 | 1.00465 | 1.00000 | -0.00465 | 1.0023 | 0.761 | | 0.125 | #VALUE! | #VALUE! |
| 0.5 | 0.99780 | 1.00465 | 0.00220 | 1.0012 | 0.749 | 2.0 | 0.375 | 0.000411 | 0.247 |
| 1 | 0.98480 | 0.99780 | 0.01520 | 0.9913 | 0.726 | 6.0 | 0.75 | 0.000133 | 0.080 |
| 2 | 0.96280 | 0.98480 | 0.03720 | 0.9738 | 0.688 | 7.6 | 1.5 | 0.000102 | 0.061 |
| 4 | 0.94040 | 0.96280 | 0.05960 | 0.9516 | 0.649 | 1.5 | 3 | 0.000501 | 0.300 |
| 8 | 0.91500 | 0.94040 | 0.08500 | 0.9277 | 0.604 | 9.4 | 6 | 0.000076 | 0.045 |
| 16 | 0.88000 | 0.91500 | 0.12000 | 0.8975 | 0.543 | 10.4 | 12 | 0.000063 | 0.038 |
| 4 | 0.89015 | 0.88000 | 0.10985 | 0.8851 | 0.560 | | 10 | | |
| 1 | 0.90745 | 0.89015 | 0.09255 | 0.8988 | 0.591 | | 2.5 | | |
| 0.25 | 0.92135 | 0.90745 | 0.07865 | 0.9144 | 0.615 | | 0.625 | | |

Estimated Cc: 0.204
Estimated Cr: 0.040

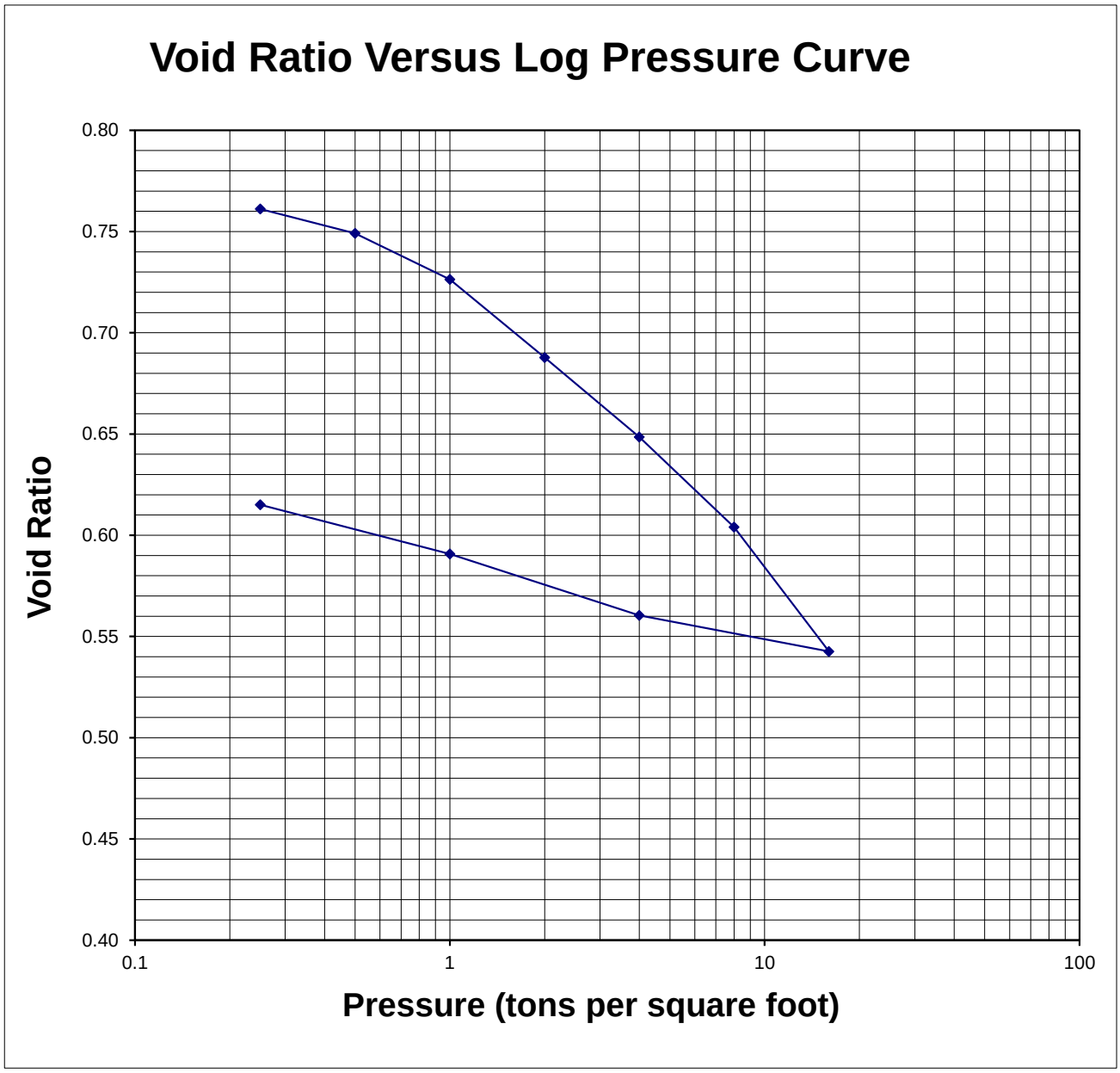
Soil Description: Brown CLAY, Little Silt, Little Sand, Trace Gravel A-7-6 (11)
Specific Gravity: 2.71
Liquid Limit: 41
Plastic Limit: 23
Plasticity Index: 18

| | | | | | |
|---|---|---|---|---|---|
| Initial Water Content: | 24.3 | % | Final Water Content: | 22.2 | % |
| Inital Dry Density: | 96.6 | pcf | Final Dry Density: | 104.9 | pcf |
| Initial Void Ratio: | 0.753 | | Final Void Ratio: | 0.615 | |
| Initial Degree of Saturation: | 87.6 | % | Final Degree of Saturation | 98.0 | % |

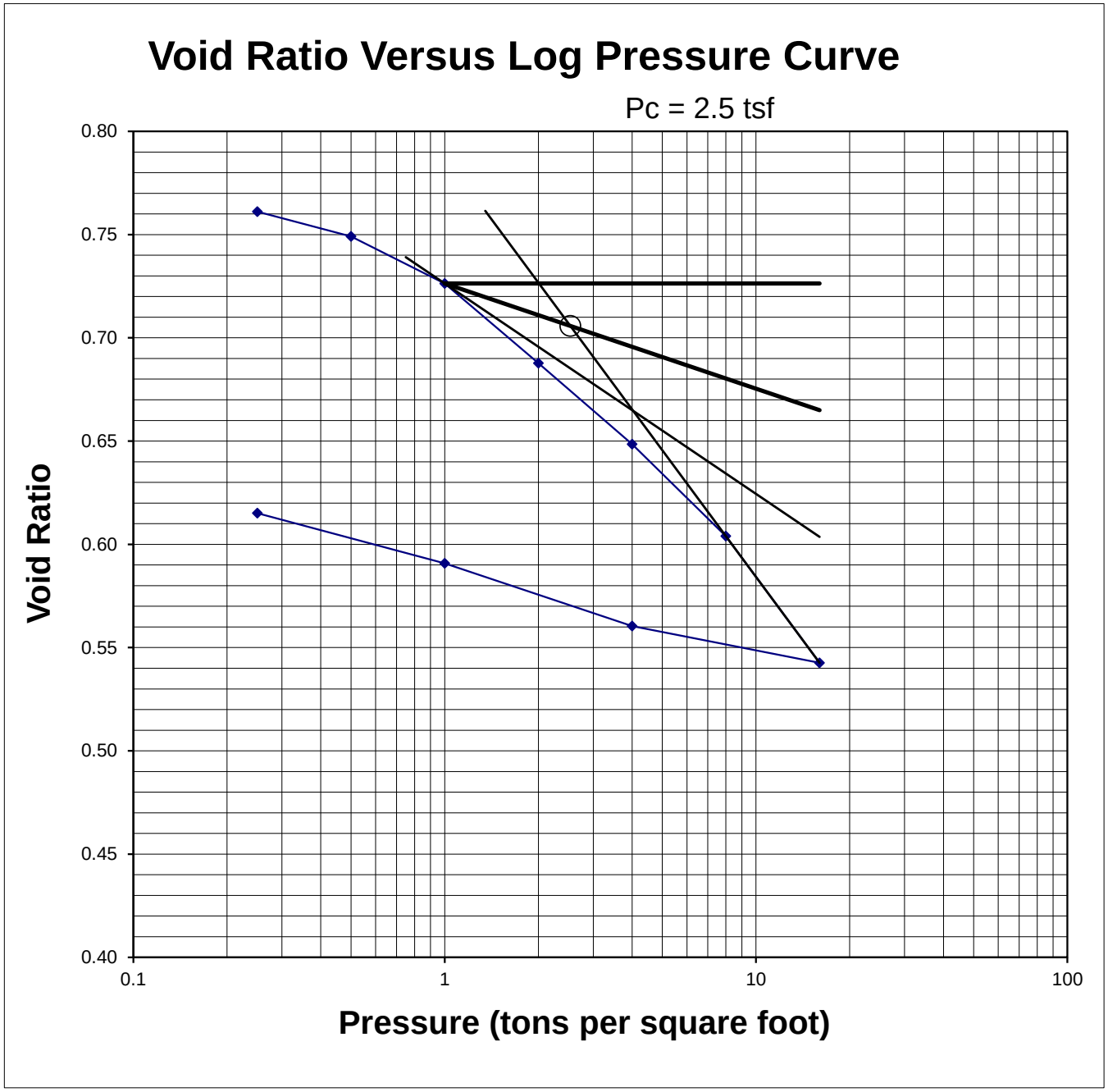
Estimated Preconsolidation Pressure: 2.5 tsf

The sample for the test was trimmed from a Shelby tube sample using a cutting shoe. Test Method B was used with the specimen inundated during testing. Coefficients of consolidation were computed by log of time method.

Project No.: 1902501
Date: 1/13/2022
Client: ODOT
Project: OTT-53-11.67
Ottawa County, OH
Boring No.: B-008-0-21
Sample No.: ST-3
Depth: 6.0 - 8.0'



Project No.: 1902501
Date: 1/13/2022
Client: ODOT
Project: OTT-53-11.67
Ottawa County, OH
Boring No.: B-008-0-21
Sample No.: ST-3
Depth: 6.0 - 8.0'



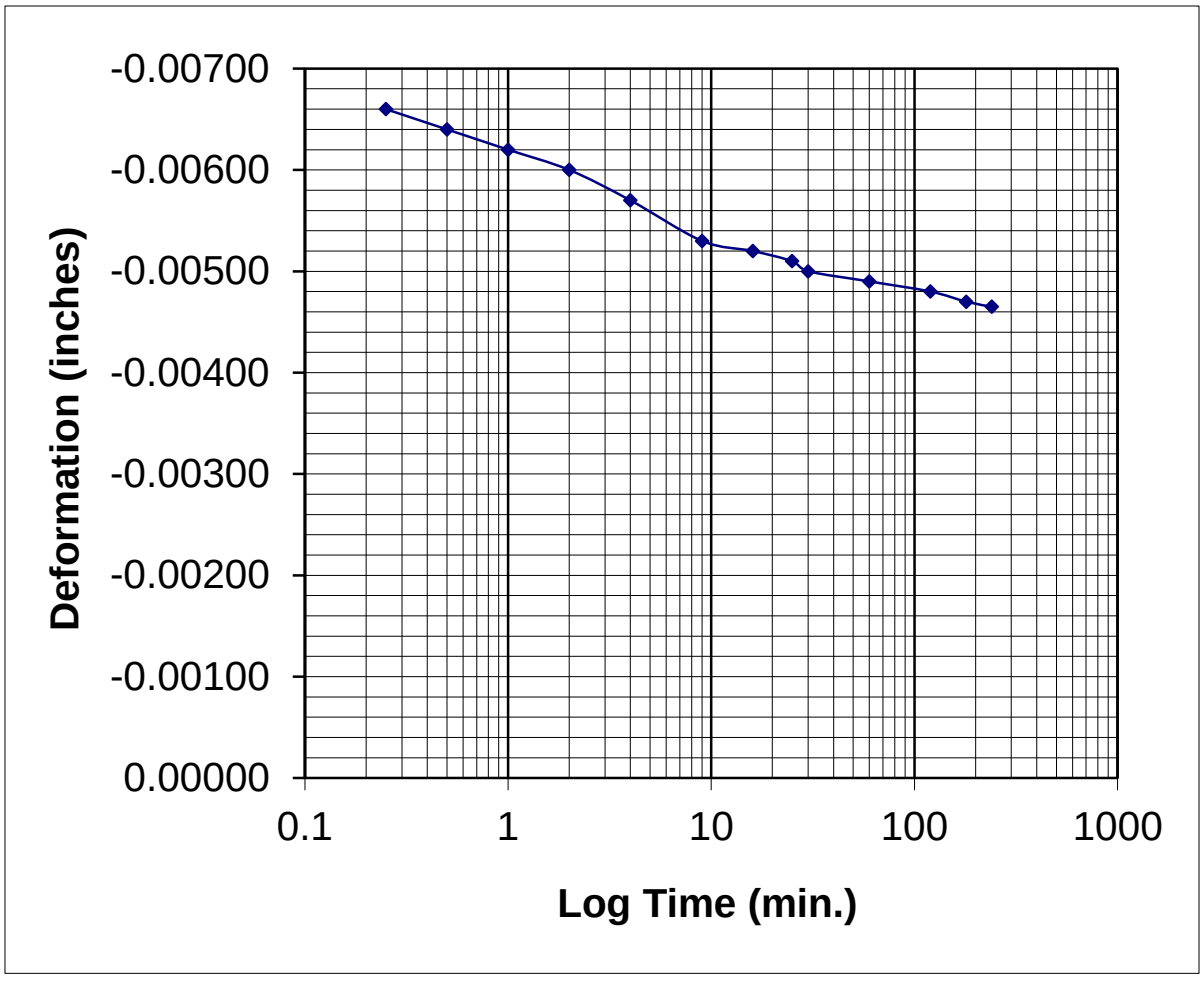
Project No. : 1902501 Sample No.: ST-3

Boring No. : B-008-0-21 Depth: 6.0 - 8.0'

0.25 tsf Load

initial height= 1 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.39990 | | | | |
| 0.25 | 0.39810 | 0.00180 | 0.00840 | -0.00660 | 1.00660 |
| 0.5 | 0.39790 | 0.00200 | 0.00840 | -0.00640 | 1.00640 |
| 1 | 0.39770 | 0.00220 | 0.00840 | -0.00620 | 1.00620 |
| 2 | 0.39750 | 0.00240 | 0.00840 | -0.00600 | 1.00600 |
| 4 | 0.39720 | 0.00270 | 0.00840 | -0.00570 | 1.00570 |
| 9 | 0.39680 | 0.00310 | 0.00840 | -0.00530 | 1.00530 |
| 16 | 0.39670 | 0.00320 | 0.00840 | -0.00520 | 1.00520 |
| 25 | 0.39660 | 0.00330 | 0.00840 | -0.00510 | 1.00510 |
| 30 | 0.39650 | 0.00340 | 0.00840 | -0.00500 | 1.00500 |
| 60 | 0.39640 | 0.00350 | 0.00840 | -0.00490 | 1.00490 |
| 120 | 0.39630 | 0.00360 | 0.00840 | -0.00480 | 1.00480 |
| 180 | 0.39620 | 0.00370 | 0.00840 | -0.00470 | 1.00470 |
| 240 | 0.39615 | 0.00375 | 0.00840 | -0.00465 | 1.00465 |



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-008-0-21 Depth: 6.0 - 8.0'

0.5 tsf Load

initial height= 1.00465 inches

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: 0.00055

2) 0.5 to 2.0: 0.00095

3) 1.0 to 4.0: 0.00155

Do Avg 1&2: 0.00075

Do Avg 1-3: 0.00102

**Use Do=** 0.00075

**D100=** 0.00535

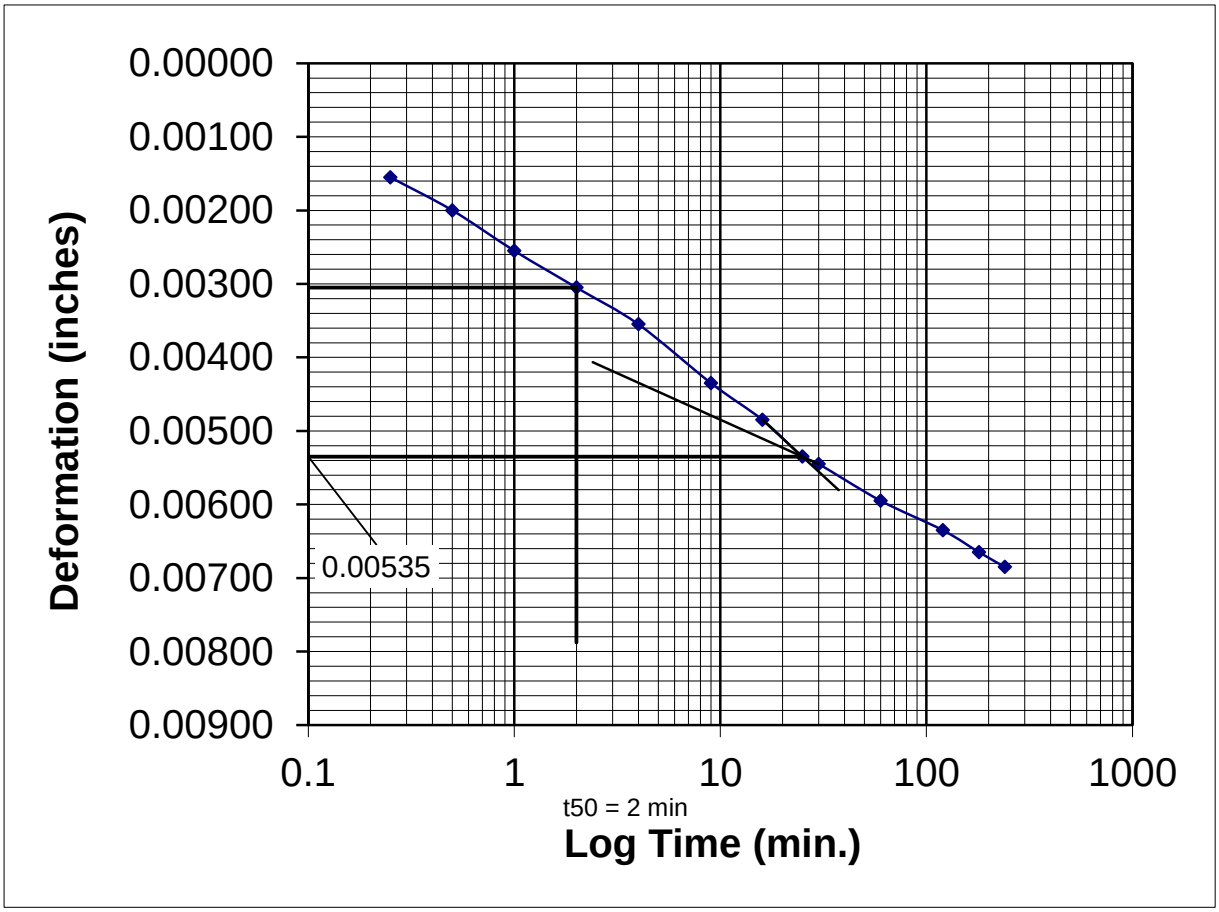
**D50= D100+0.5(Do-D100)**

**D50=** 0.00305

**t50 =** 2.0 min.

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.39615 | | | | |
| 0.25 | 0.39260 | 0.00355 | 0.00200 | 0.00155 | 1.00310 |
| 0.5 | 0.39215 | 0.00400 | 0.00200 | 0.00200 | 1.00265 |
| 1 | 0.39160 | 0.00455 | 0.00200 | 0.00255 | 1.00210 |
| 2 | 0.39110 | 0.00505 | 0.00200 | 0.00305 | 1.00160 |
| 4 | 0.39060 | 0.00555 | 0.00200 | 0.00355 | 1.00110 |
| 9 | 0.38980 | 0.00635 | 0.00200 | 0.00435 | 1.00030 |
| 16 | 0.38930 | 0.00685 | 0.00200 | 0.00485 | 0.99980 |
| 25 | 0.38880 | 0.00735 | 0.00200 | 0.00535 | 0.99930 |
| 30 | 0.38870 | 0.00745 | 0.00200 | 0.00545 | 0.99920 |
| 60 | 0.38820 | 0.00795 | 0.00200 | 0.00595 | 0.99870 |
| 120 | 0.38780 | 0.00835 | 0.00200 | 0.00635 | 0.99830 |
| 180 | 0.38750 | 0.00865 | 0.00200 | 0.00665 | 0.99800 |
| 240 | 0.38730 | 0.00885 | 0.00200 | 0.00685 | 0.99780 |

X



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-008-0-21 Depth: 6.0 - 8.0'

1.0 tsf Load

initial height= 0.9978 inches

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: 0.00355

2) 0.5 to 2.0: 0.00400

3) 1.0 to 4.0: 0.00450

Do Avg 1&2: 0.00378

Do Avg 1-3: 0.00402

**Use Do=** 0.00378

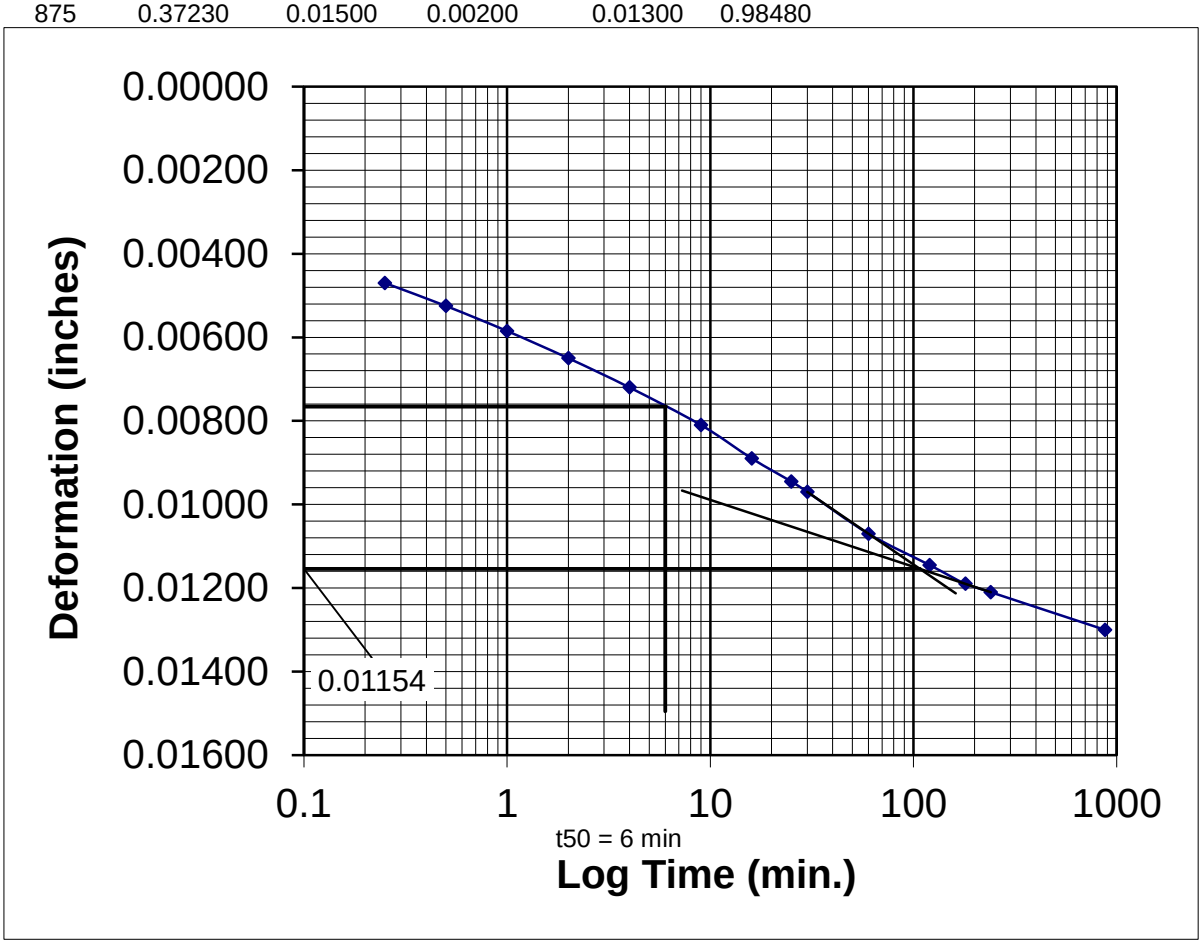
**D100=** 0.01154

**D50= D100+0.5(Do-D100)**

**D50=** 0.00766

**t50 =** 6.0 min.

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.38730 | | | | |
| 0.25 | 0.38060 | 0.00670 | 0.00200 | 0.00470 | 0.99310 |
| 0.5 | 0.38005 | 0.00725 | 0.00200 | 0.00525 | 0.99255 |
| 1 | 0.37945 | 0.00785 | 0.00200 | 0.00585 | 0.99195 |
| 2 | 0.37880 | 0.00850 | 0.00200 | 0.00650 | 0.99130 |
| 4 | 0.37810 | 0.00920 | 0.00200 | 0.00720 | 0.99060 |
| 9 | 0.37720 | 0.01010 | 0.00200 | 0.00810 | 0.98970 |
| 16 | 0.37640 | 0.01090 | 0.00200 | 0.00890 | 0.98890 |
| 25 | 0.37585 | 0.01145 | 0.00200 | 0.00945 | 0.98835 |
| 30 | 0.37560 | 0.01170 | 0.00200 | 0.00970 | 0.98810 |
| 60 | 0.37460 | 0.01270 | 0.00200 | 0.01070 | 0.98710 |
| 120 | 0.37385 | 0.01345 | 0.00200 | 0.01145 | 0.98635 |
| 180 | 0.37340 | 0.01390 | 0.00200 | 0.01190 | 0.98590 |
| 240 | 0.37320 | 0.01410 | 0.00200 | 0.01210 | 0.98570 |
| 875 | 0.37230 | 0.01500 | 0.00200 | 0.01300 | 0.98480 |



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-008-0-21 Depth: 6.0 - 8.0'

2.0 tsf Load

initial height= 0.9848 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.37230 | | | | |
| 0.25 | 0.36380 | 0.00850 | 0.00260 | 0.00590 | 0.97890 |
| 0.5 | 0.36300 | 0.00930 | 0.00260 | 0.00670 | 0.97810 |
| 1 | 0.36200 | 0.01030 | 0.00260 | 0.00770 | 0.97710 |
| 2 | 0.36080 | 0.01150 | 0.00260 | 0.00890 | 0.97590 |
| 4 | 0.35940 | 0.01290 | 0.00260 | 0.01030 | 0.97450 |
| 9 | 0.35725 | 0.01505 | 0.00260 | 0.01245 | 0.97235 |
| 16 | 0.35530 | 0.01700 | 0.00260 | 0.01440 | 0.97040 |
| 25 | 0.35400 | 0.01830 | 0.00260 | 0.01570 | 0.96910 |
| 30 | 0.35280 | 0.01950 | 0.00260 | 0.01690 | 0.96790 |
| 60 | 0.35080 | 0.02150 | 0.00260 | 0.01890 | 0.96590 |
| 120 | 0.34880 | 0.02350 | 0.00260 | 0.02090 | 0.96390 |
| 180 | 0.34810 | 0.02420 | 0.00260 | 0.02160 | 0.96320 |
| 240 | 0.34770 | 0.02460 | 0.00260 | 0.02200 | 0.96280 |

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: 0.00410

2) 0.5 to 2.0: 0.00450

3) 1.0 to 4.0: 0.00510

Do Avg 1&2: 0.00430

Do Avg 1-3: 0.00457

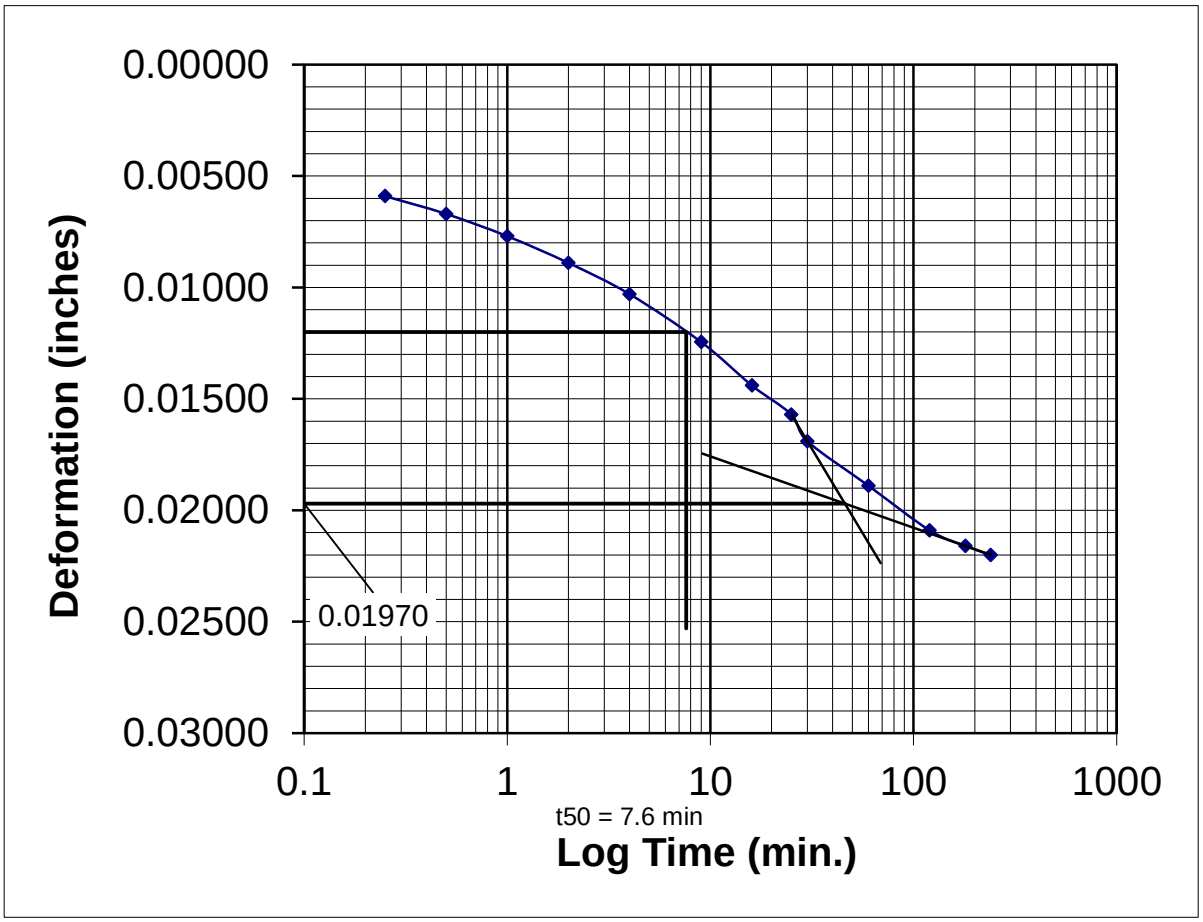
**Use Do=** 0.00430

**D100=** 0.01970

**D50= D100+0.5(Do-D100)**

**D50=** 0.01200

**t50 =** 7.6 min.



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-008-0-21 Depth: 6.0 - 8.0'

4.0 tsf Load

initial height= 0.9628 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.34770 | | | | |
| 0.25 | 0.34350 | 0.00420 | 0.00150 | 0.00270 | 0.96010 |
| 0.5 | 0.34280 | 0.00490 | 0.00150 | 0.00340 | 0.95940 |
| 1 | 0.34200 | 0.00570 | 0.00150 | 0.00420 | 0.95860 |
| 2 | 0.34100 | 0.00670 | 0.00150 | 0.00520 | 0.95760 |
| 4 | 0.33970 | 0.00800 | 0.00150 | 0.00650 | 0.95630 |
| 9 | 0.33830 | 0.00940 | 0.00150 | 0.00790 | 0.95490 |
| 16 | 0.33630 | 0.01140 | 0.00150 | 0.00990 | 0.95290 |
| 25 | 0.33450 | 0.01320 | 0.00150 | 0.01170 | 0.95110 |
| 30 | 0.33400 | 0.01370 | 0.00150 | 0.01220 | 0.95060 |
| 60 | 0.33150 | 0.01620 | 0.00150 | 0.01470 | 0.94810 |
| 120 | 0.32890 | 0.01880 | 0.00150 | 0.01730 | 0.94550 |
| 180 | 0.32740 | 0.02030 | 0.00150 | 0.01880 | 0.94400 |
| 240 | 0.32690 | 0.02080 | 0.00150 | 0.01930 | 0.94350 |
| 1225 | 0.32380 | 0.02390 | 0.00150 | 0.02240 | 0.94040 |

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: 0.00120

2) 0.5 to 2.0: 0.00160

3) 1.0 to 4.0: 0.00190

Do Avg 1&2: 0.00140

Do Avg 1-3: 0.00157

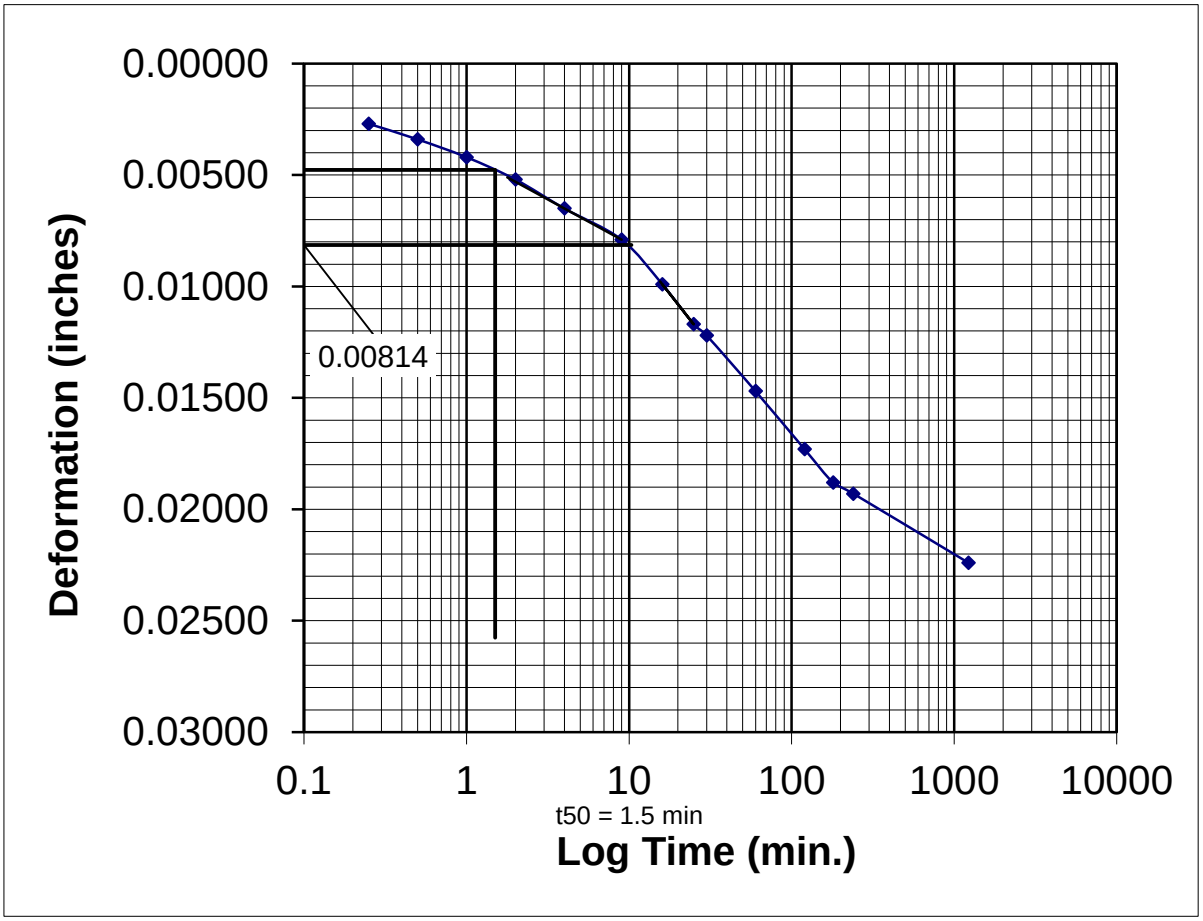
**Use Do=** 0.00140

**D100=** 0.00814

**D50= D100+0.5(Do-D100)**

**D50=** 0.00477

**t50 =** 1.5 min.



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-008-0-21 Depth: 6.0 - 8.0'

8.0 tsf Load

initial height= 0.94040 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.32380 | | | | |
| 0.25 | 0.31930 | 0.00450 | 0.00200 | 0.00250 | 0.93790 |
| 0.5 | 0.31800 | 0.00580 | 0.00200 | 0.00380 | 0.93660 |
| 1 | 0.31650 | 0.00730 | 0.00200 | 0.00530 | 0.93510 |
| 2 | 0.31535 | 0.00845 | 0.00200 | 0.00645 | 0.93395 |
| 4 | 0.31350 | 0.01030 | 0.00200 | 0.00830 | 0.93210 |
| 9 | 0.31040 | 0.01340 | 0.00200 | 0.01140 | 0.92900 |
| 16 | 0.30750 | 0.01630 | 0.00200 | 0.01430 | 0.92610 |
| 25 | 0.30495 | 0.01885 | 0.00200 | 0.01685 | 0.92355 |
| 30 | 0.30350 | 0.02030 | 0.00200 | 0.01830 | 0.92210 |
| 60 | 0.30050 | 0.02330 | 0.00200 | 0.02130 | 0.91910 |
| 120 | 0.29780 | 0.02600 | 0.00200 | 0.02400 | 0.91640 |
| 180 | 0.29690 | 0.02690 | 0.00200 | 0.02490 | 0.91550 |
| 240 | 0.29640 | 0.02740 | 0.00200 | 0.02540 | 0.91500 |

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: -0.00030

2) 0.5 to 2.0: 0.00115

3) 1.0 to 4.0: 0.00230

Do Avg 1&2: 0.00043

Do Avg 1-3: 0.00105

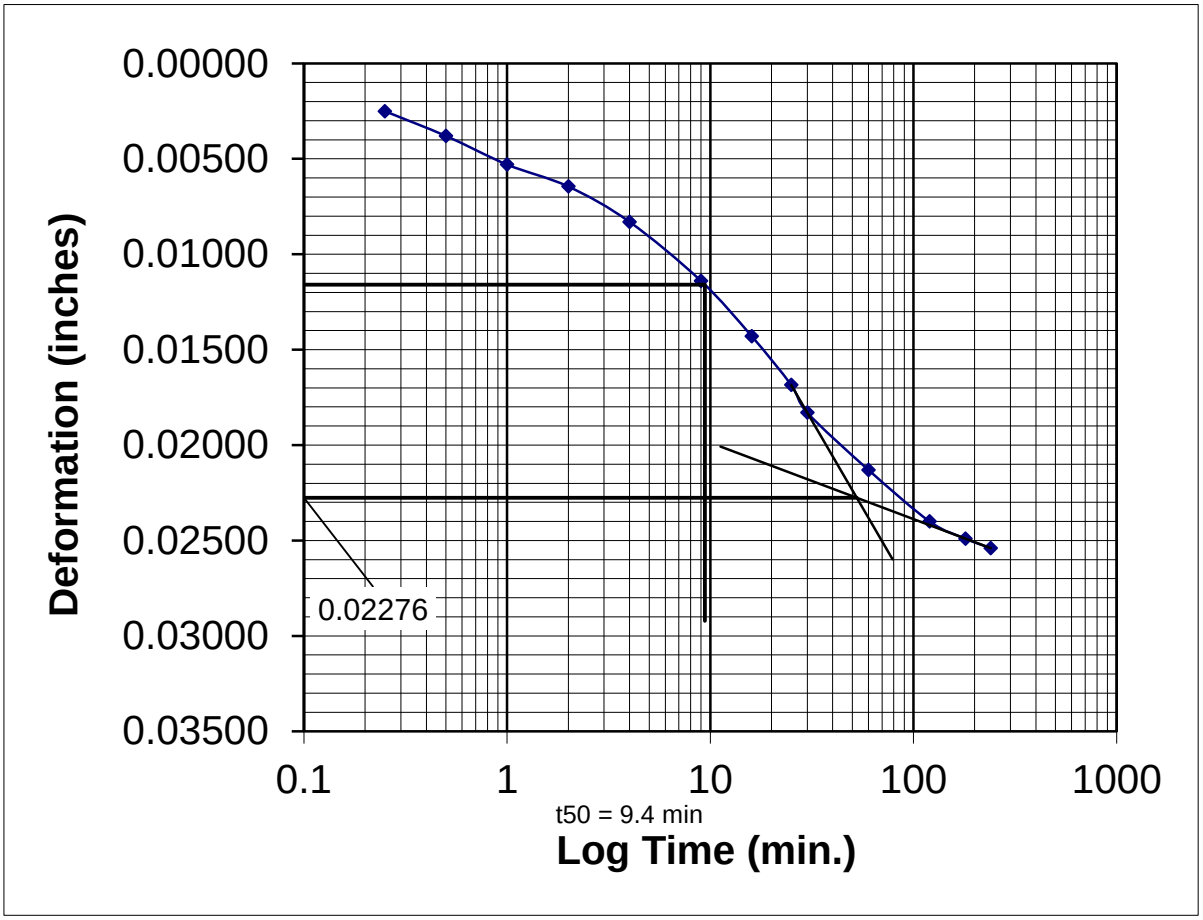
**Use Do=** 0.00043

**D100=** 0.02276

**D50= D100+0.5(Do-D100)**

**D50=** 0.01159

**t50 =** 9.4 min.



Project No. : 1902501 Sample No.: ST-3

Boring No. : B-008-0-21 Depth: 6.0 - 8.0'

16 tsf Load

initial height= 0.915 inches

**Do= D1-(D2-D1)**

1) 0.25 to 1.0: 0.00170

2) 0.5 to 2.0: 0.00180

3) 1.0 to 4.0: 0.00170

Do Avg 1&2: 0.00175

Do Avg 1-3: 0.00173

**Use Do=** 0.00175

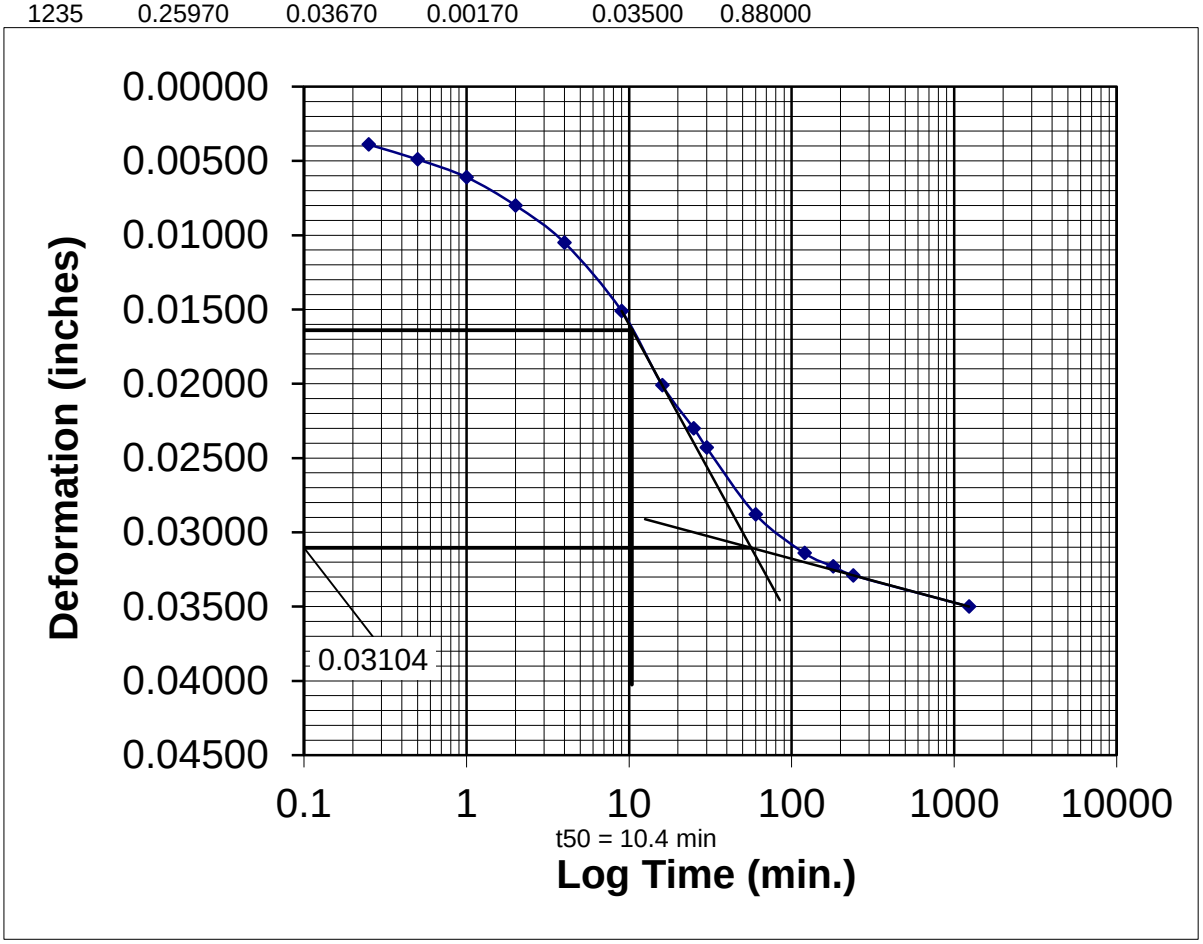
**D100=** 0.03104

**D50= D100+0.5(Do-D100)**

**D50=** 0.01640

**t50 =** 10.4 min.

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.29640 | | | | |
| 0.25 | 0.29080 | 0.00560 | 0.00170 | 0.00390 | 0.91110 |
| 0.5 | 0.28980 | 0.00660 | 0.00170 | 0.00490 | 0.91010 |
| 1 | 0.28860 | 0.00780 | 0.00170 | 0.00610 | 0.90890 |
| 2 | 0.28670 | 0.00970 | 0.00170 | 0.00800 | 0.90700 |
| 4 | 0.28420 | 0.01220 | 0.00170 | 0.01050 | 0.90450 |
| 9 | 0.27960 | 0.01680 | 0.00170 | 0.01510 | 0.89990 |
| 16 | 0.27460 | 0.02180 | 0.00170 | 0.02010 | 0.89490 |
| 25 | 0.27170 | 0.02470 | 0.00170 | 0.02300 | 0.89200 |
| 30 | 0.27040 | 0.02600 | 0.00170 | 0.02430 | 0.89070 |
| 60 | 0.26590 | 0.03050 | 0.00170 | 0.02880 | 0.88620 |
| 120 | 0.26330 | 0.03310 | 0.00170 | 0.03140 | 0.88360 |
| 180 | 0.26240 | 0.03400 | 0.00170 | 0.03230 | 0.88270 |
| 240 | 0.26180 | 0.03460 | 0.00170 | 0.03290 | 0.88210 |
| 1235 | 0.25970 | 0.03670 | 0.00170 | 0.03500 | 0.88000 |

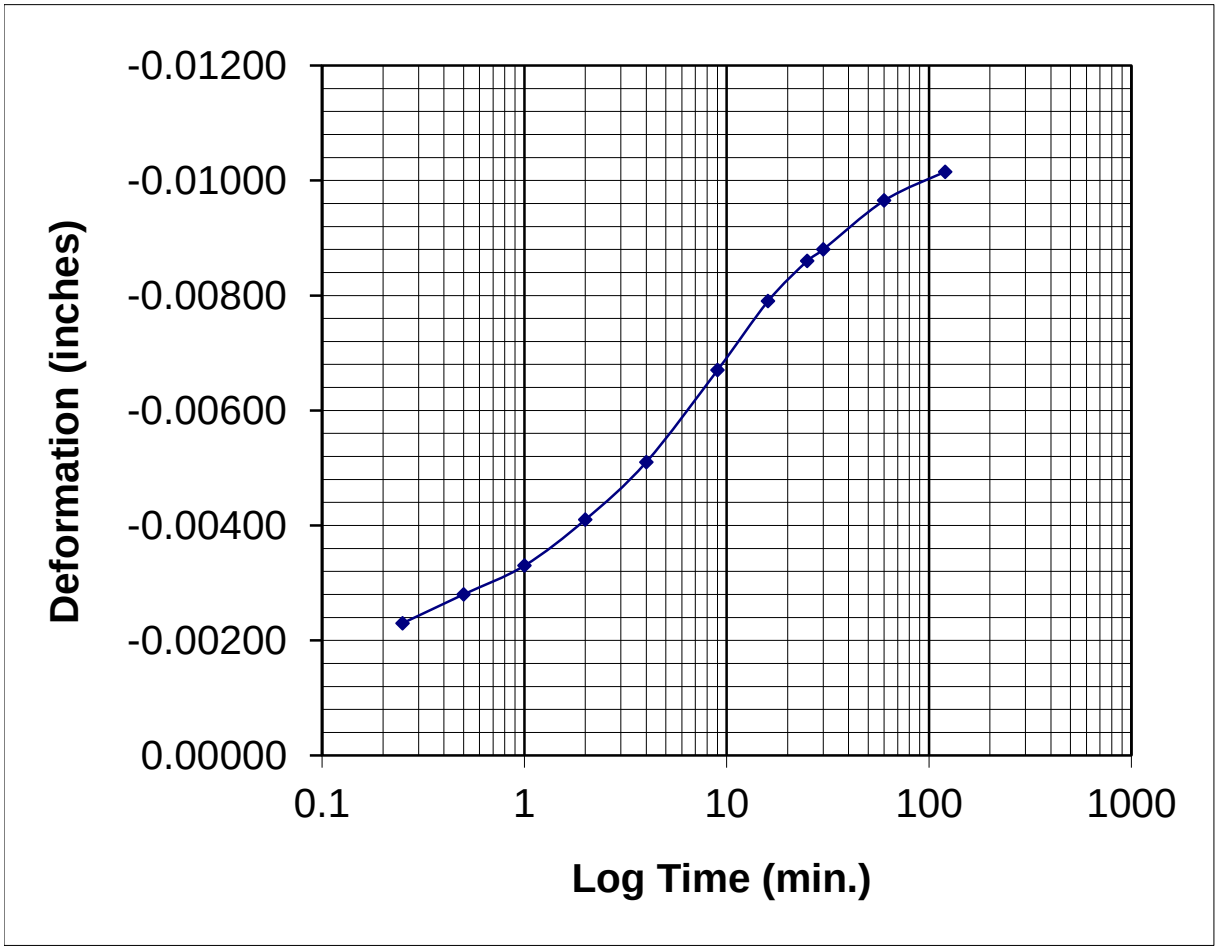


Project No. : 1902501 Sample No.: ST-3
Boring No. : B-008-0-21 Depth: 6.0 - 8.0'

4.0 tsf Unload

initial height= 0.88 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.25970 | | | | |
| 0.25 | 0.26280 | -0.00310 | -0.00080 | -0.00230 | 0.88230 |
| 0.5 | 0.26330 | -0.00360 | -0.00080 | -0.00280 | 0.88280 |
| 1 | 0.26380 | -0.00410 | -0.00080 | -0.00330 | 0.88330 |
| 2 | 0.26460 | -0.00490 | -0.00080 | -0.00410 | 0.88410 |
| 4 | 0.26560 | -0.00590 | -0.00080 | -0.00510 | 0.88510 |
| 9 | 0.26720 | -0.00750 | -0.00080 | -0.00670 | 0.88670 |
| 16 | 0.26840 | -0.00870 | -0.00080 | -0.00790 | 0.88790 |
| 25 | 0.26910 | -0.00940 | -0.00080 | -0.00860 | 0.88860 |
| 30 | 0.26930 | -0.00960 | -0.00080 | -0.00880 | 0.88880 |
| 60 | 0.27015 | -0.01045 | -0.00080 | -0.00965 | 0.88965 |
| 120 | 0.27065 | -0.01095 | -0.00080 | -0.01015 | 0.89015 |

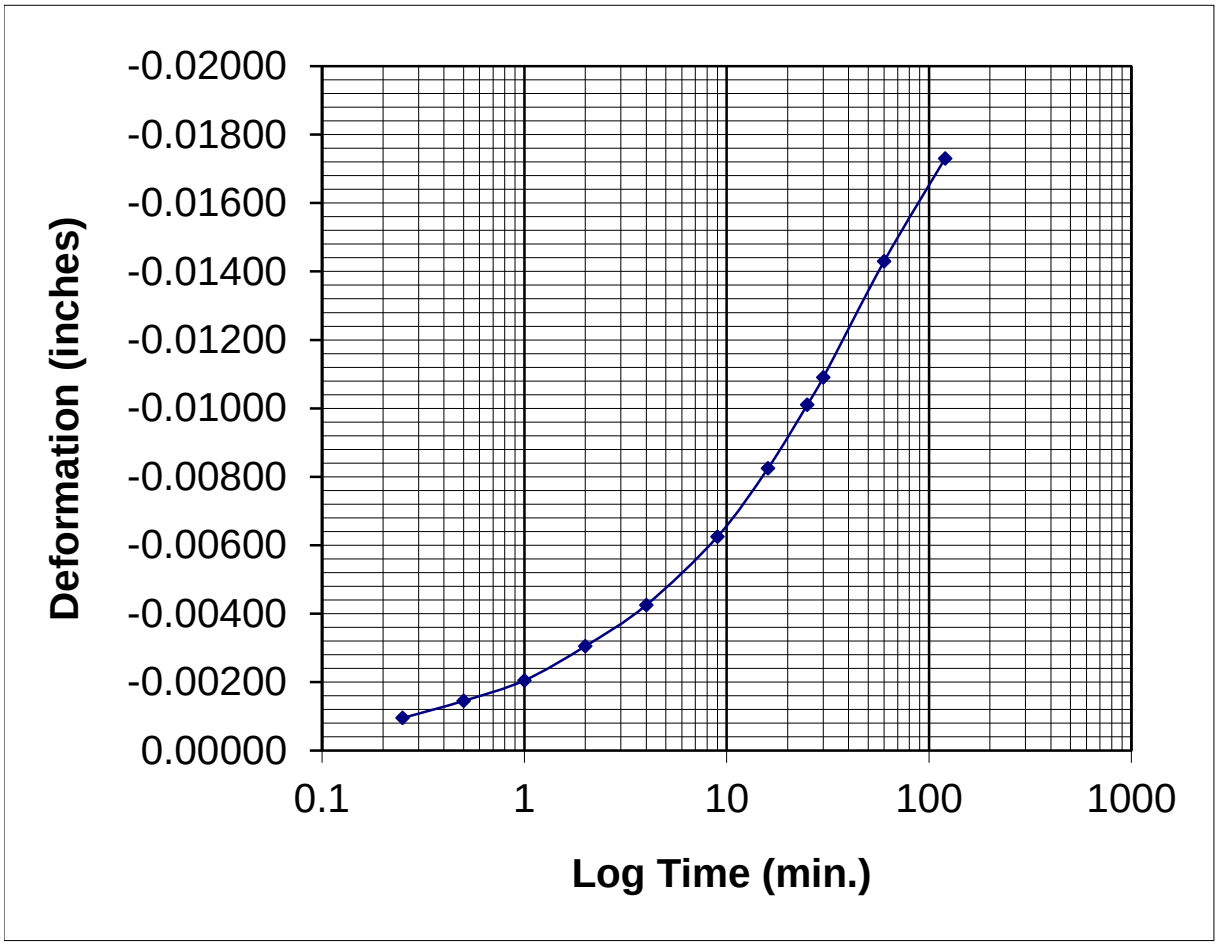


Project No. : 1902501 Sample No.: ST-3
Boring No. : B-008-0-21 Depth: 6.0 - 8.0'

1.0 tsf Unload

initial height= 0.89015 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.27065 | | | | |
| 0.25 | 0.27290 | -0.00225 | -0.00130 | -0.00095 | 0.89110 |
| 0.5 | 0.27340 | -0.00275 | -0.00130 | -0.00145 | 0.89160 |
| 1 | 0.27400 | -0.00335 | -0.00130 | -0.00205 | 0.89220 |
| 2 | 0.27500 | -0.00435 | -0.00130 | -0.00305 | 0.89320 |
| 4 | 0.27620 | -0.00555 | -0.00130 | -0.00425 | 0.89440 |
| 9 | 0.27820 | -0.00755 | -0.00130 | -0.00625 | 0.89640 |
| 16 | 0.28020 | -0.00955 | -0.00130 | -0.00825 | 0.89840 |
| 25 | 0.28205 | -0.01140 | -0.00130 | -0.01010 | 0.90025 |
| 30 | 0.28285 | -0.01220 | -0.00130 | -0.01090 | 0.90105 |
| 60 | 0.28625 | -0.01560 | -0.00130 | -0.01430 | 0.90445 |
| 120 | 0.28925 | -0.01860 | -0.00130 | -0.01730 | 0.90745 |

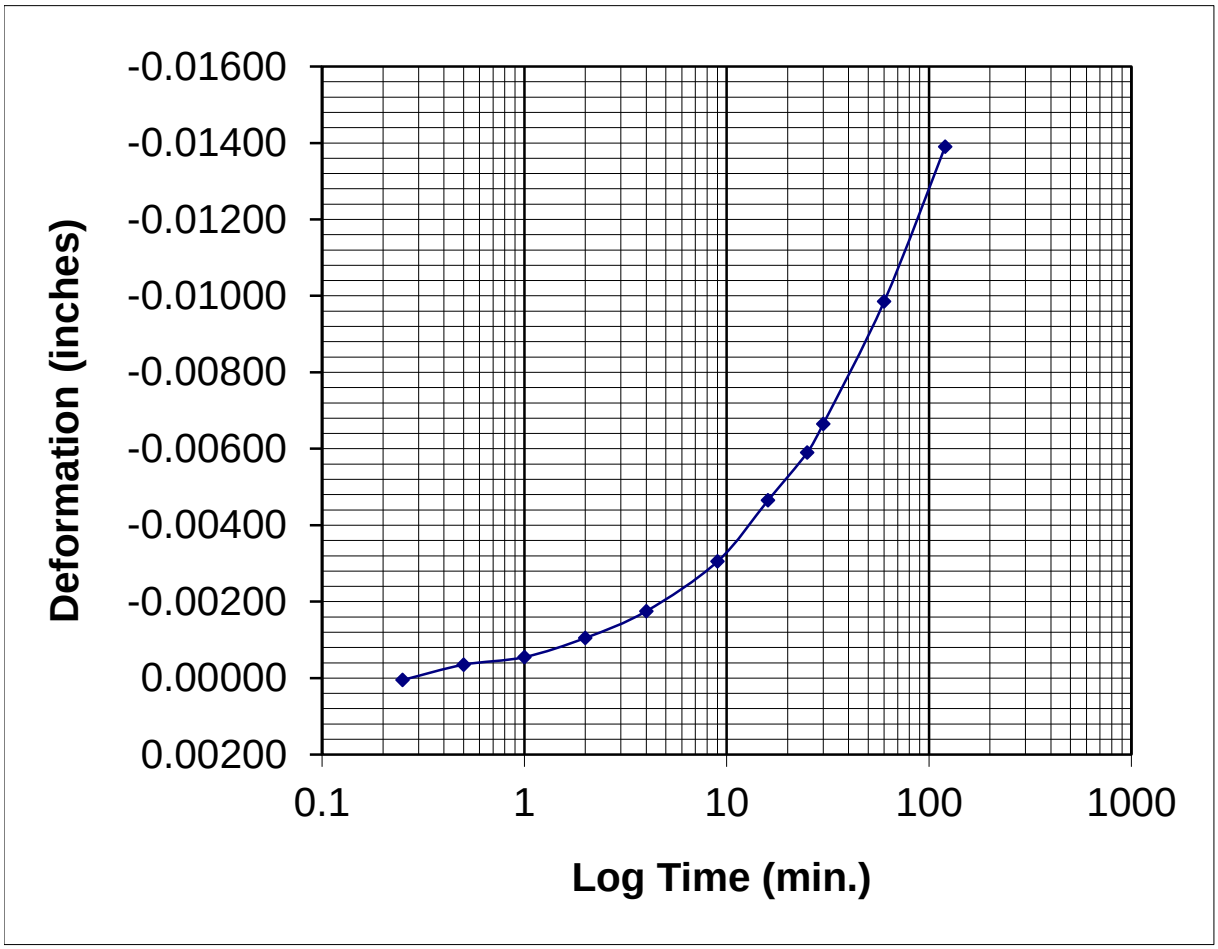


Project No. : 1902501 Sample No.: ST-3
Boring No. : B-008-0-21 Depth: 6.0 - 8.0'

0.25 tsf Unload

initial height= 0.90745 inches

| Interval Minutes | Dial Reading | ΔH | Deformation Constant | TRUE ΔH | Height of Sample |
|---|---|---|---|---|---|
| 0 | 0.28925 | | | | |
| 0.25 | 0.29040 | -0.00115 | -0.00120 | 0.00005 | 0.90740 |
| 0.5 | 0.29080 | -0.00155 | -0.00120 | -0.00035 | 0.90780 |
| 1 | 0.29100 | -0.00175 | -0.00120 | -0.00055 | 0.90800 |
| 2 | 0.29150 | -0.00225 | -0.00120 | -0.00105 | 0.90850 |
| 4 | 0.29220 | -0.00295 | -0.00120 | -0.00175 | 0.90920 |
| 9 | 0.29350 | -0.00425 | -0.00120 | -0.00305 | 0.91050 |
| 16 | 0.29510 | -0.00585 | -0.00120 | -0.00465 | 0.91210 |
| 25 | 0.29635 | -0.00710 | -0.00120 | -0.00590 | 0.91335 |
| 30 | 0.29710 | -0.00785 | -0.00120 | -0.00665 | 0.91410 |
| 60 | 0.30030 | -0.01105 | -0.00120 | -0.00985 | 0.91730 |
| 120 | 0.30435 | -0.01510 | -0.00120 | -0.01390 | 0.92135 |



# APPENDIX A

## Engineering Calculations

# OHIO DEPARTMENT OF TRANSPORTATION

## OFFICE OF GEOTECHNICAL ENGINEERING

## PLAN SUBGRADES
## Geotechnical Bulletin GB1

**OTT-53-11.67**
**110859**
**State Route 53 from State Route 2 to E. Knol Crest Dr.**
**Portage Township, Ottawa County, Ohio**

**TTL Associates, Inc**

**Prepared By:** Imad El Hajjar, EI
**Date prepared:** Tuesday, May 31, 2022

Imad El Hajjar, EI
TTL Associates, Inc.
1915 North 12 Street
Toledo, Ohio 43604
216-217-5449
ihajjar@ttlassoc.com

**NO. OF BORINGS:** 22

| # | Boring ID | Alignment | Station | Offset | Dir | Drill Rig | ER | Boring EL. | Proposed Subgrade EL | Cut Fill |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B-001-0-21 | SR-2 Ramp | 51+14 | 474 | LT | CME 75 Truck Mounted | 66 | 584.4 | 582.9 | 1.5 C |
| 2 | B-004-0-21 | SR-2 Ramp | 52+74 | 193 | RT | CME 75 Truck Mounted | 66 | 589.7 | 588.2 | 1.5 C |
| 3 | B-005-0-21 | SR-2 Ramp | 58+84 | 452 | RT | CME 75 Truck Mounted | 66 | 584.5 | 583.0 | 1.5 C |
| 4 | B-006-0-21 | East State Road | 58+84 | 298 | LT | CME 75 Truck Mounted | 66 | 582.6 | 581.1 | 1.5 C |
| 5 | B-007-0-21 | SR-53 | 59+47 | 29 | LT | CME 75 Truck Mounted | 66 | 583.4 | 583.4 | 0.0 |
| 6 | B-008-0-21 | SR-53 | 59+73 | 31 | RT | CME 75 Truck Mounted | 66 | 584.2 | 584.2 | 0.0 |
| 7 | B-009-0-21 | East State Road | 58+68 | 352 | RT | CME 75 Truck Mounted | 66 | 590.4 | 588.4 | 2.0 C |
| 8 | B-011-0-21 | SR-53 | 53+86 | 23 | LT | CME 75 Truck Mounted | 66 | 596.1 | 594.6 | 1.5 C |
| 9 | B-012-0-21 | SR-53 | 57+17 | 30 | RT | CME 75 Truck Mounted | 66 | 586.2 | 584.7 | 1.5 C |
| 10 | B-013-0-21 | SR-53 | 61+50 | 24 | LT | CME 75 Truck Mounted | 66 | 581.0 | 581.0 | 0.0 |
| 11 | B-014-0-21 | SR-53 | 66+01 | 25 | LT | CME 75 Truck Mounted | 66 | 580.0 | 580.0 | 0.0 |
| 12 | B-015-0-21 | SR-53 | 69+84 | 18 | RT | CME 75 Truck Mounted | 66 | 581.2 | 581.2 | 0.0 |
| 13 | B-016-0-21 | SR-53 | 74+16 | 19 | LT | CME 75 Truck Mounted | 66 | 580.0 | 580.0 | 0.0 |
| 14 | B-017-0-21 | SR-53 | 77+55 | 22 | RT | CME 75 Truck Mounted | 66 | 584.4 | 584.4 | 0.0 |
| 15 | B-018-0-21 | SR-53 | 82+31 | 27 | LT | CME 75 Truck Mounted | 66 | 584.0 | 584.0 | 0.0 |
| 16 | B-019-0-21 | SR-53 | 86+10 | 25 | RT | CME 75 Truck Mounted | 66 | 586.4 | 586.4 | 0.0 |
| 17 | B-020-0-21 | SR-53 | 91+11 | 24 | LT | CME 75 Truck Mounted | 66 | 588.0 | 588.0 | 0.0 |
| 18 | B-021-0-21 | SR-53 | 94+82 | 51 | RT | CME 75 Truck Mounted | 66 | 589.6 | 589.6 | 0.0 |
| 19 | B-022-0-21 | SR-53 | 99+26 | 22 | LT | CME 75 Truck Mounted | 66 | 588.2 | 588.2 | 0.0 |
| 20 | B-023-0-21 | SR-53 | 102+89 | 14 | RT | CME 75 Truck Mounted | 66 | 589.4 | 589.4 | 0.0 |
| 21 | B-024-0-21 | SR-53 | 107+52 | 27 | LT | CME 75 Truck Mounted | 66 | 589.2 | 589.2 | 0.0 |
| 22 | B-025-0-21 | SR-53 | 111+52 | 45 | RT | CME 75 Truck Mounted | 66 | 586.0 | 586.0 | 0.0 |

OHIO DEPARTMENT OF TRANSPORTATION

# Subgrade Analysis

V. 14.5 1/18/2019

| # | Boring | Sample | Sample Depth | | Subgrade Depth | | Standard Penetration | | HP (tsf) | Physical Characteristics | | | | | | Moisture | | Ohio DOT | | Sulfate Content (ppm) | Problem | | Excavate and Replace (Item 204) | | Recommendation (Enter depth in inches) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | From | To | From | To | $N_{60}$ | $N_{60L}$ | | LL | PL | PI | % Silt | % Clay | P200 | $M_C$ | $M_{OPT}$ | Class | GI | | Unsuitable | Unstable | Unsuitable | Unstable | |
| 1 | B | SS-1 | 1.0 | 2.5 | -0.5 | 1.0 | 11 | | 2 | 24 | 13 | 11 | 19 | 36 | 55 | 11 | 14 | A-6a | 4 | 430 | | $N_{60}$ | | 12" | 12" |
| | 001-0 | SS-2 | 2.5 | 4.0 | 1.0 | 2.5 | 39 | | 4.5+ | | | | | | | 12 | 14 | A-6a | 10 | | | | | | 204 Geotextile |
| | 21 | SS-3 | 4.0 | 5.5 | 2.5 | 4.0 | 60 | | 4.5+ | 27 | 16 | 11 | 18 | 50 | 68 | 12 | 14 | A-6a | 7 | | | | | | |
| | | SS-4 | 5.5 | 7.0 | 4.0 | 5.5 | 71 | 11 | 4.5+ | | | | | | | 12 | 14 | A-6a | 10 | | | | | | |
| 2 | B | SS-1 | 1.0 | 2.5 | -0.5 | 1.0 | 9 | | 4.5+ | 28 | 16 | 12 | 24 | 43 | 67 | 16 | 14 | A-6a | 7 | 470 | | $N_{60}$ | | 12" | 12" |
| | 004-0 | SS-2 | 3.5 | 5.0 | 2.0 | 3.5 | 10 | | 1.25 | | | | | | | 16 | 14 | A-6a | 10 | | | HP | | | 204 Geotextile |
| | 21 | SS-3 | 6.0 | 7.5 | 4.5 | 6.0 | 29 | | 4.25 | 28 | 17 | 11 | 28 | 27 | 55 | 14 | 14 | A-6a | 4 | | | | | | |
| | | | | | | | | 9 | | | | | | | | | | | | | | | | | |
| 3 | B | SS-1 | 1.0 | 2.5 | -0.5 | 1.0 | 7 | | 1.5 | | | | | | | 19 | 14 | A-6a | 10 | 360 | | HP & Mc | | 15" | 15" |
| | 005-0 | SS-2 | 2.5 | 4.0 | 1.0 | 2.5 | 13 | | 2.5 | 32 | 19 | 13 | 27 | 43 | 70 | 21 | 14 | A-6a | 8 | | | $N_{60}$ & Mc | | 12" | 204 Geotextile |
| | 21 | SS-3 | 4.0 | 5.5 | 2.5 | 4.0 | 26 | | 4.5 | | | | | | | 20 | 14 | A-6a | 10 | | | | | | |
| | | SS-4 | 5.5 | 7.0 | 4.0 | 5.5 | 40 | 7 | 3.5 | 43 | 23 | 20 | 24 | 59 | 83 | 23 | 20 | A-7-6 | 13 | | | | | | |
| 4 | B | SS-1 | 1.0 | 3.0 | -0.5 | 1.5 | 17 | | 4.5+ | | | | | | | 17 | 14 | A-6a | 10 | | | Mc | | | |
| | 006-0 | SS-2 | 3.0 | 4.5 | 1.5 | 3.0 | 6 | | 1.75 | 37 | 21 | 16 | 22 | 66 | 88 | 24 | 16 | A-6b | 10 | 310 | | HP & Mc | | | |
| | 21 | SS-3 | 4.5 | 6.0 | 3.0 | 4.5 | 9 | | 2 | | | | | | | 23 | 14 | A-6a | 10 | 450 | | | | | |
| | | SS-4 | 6.0 | 7.5 | 4.5 | 6.0 | 9 | 6 | 4.5+ | | | | | | | 17 | 14 | A-6a | 10 | | | | | | |
| 5 | B | SS-1 | 1.0 | 2.5 | 1.0 | 2.5 | 6 | | 1.5 | | | | | | | 13 | 14 | A-6a | 10 | 420 | | HP | | 18" | 18" |
| | 007-0 | SS-2 | 3.5 | 5.0 | 3.5 | 5.0 | 9 | | - | 45 | 23 | 22 | 23 | 51 | 74 | 26 | 20 | A-7-6 | 14 | | | | | | 204 Geotextile |
| | 21 | ST-3 | 5.0 | 7.0 | 5.0 | 7.0 | | | 2.5 | 49 | 24 | 25 | 15 | 69 | 84 | 26 | 21 | A-7-6 | 16 | | | | | | |
| | | SS-4 | | | | | | 6 | | | | | | | | | | | | | | | | | |
| 6 | B | SS-1 | 1.0 | 2.5 | 1.0 | 2.5 | 15 | | 4.25 | 39 | 19 | 20 | 18 | 50 | 68 | 20 | 16 | A-6b | 11 | 420 | | Mc | | | |
| | 008-0 | SS-2 | 3.5 | 5.0 | 3.5 | 5.0 | 13 | | 2.75 | | | | | | | 25 | 16 | A-6b | 16 | | | | | | |
| | 21 | ST-3 | 6.0 | 8.0 | 6.0 | 8.0 | | | 3.25 | 41 | 23 | 18 | 19 | 69 | 88 | 23 | 20 | A-7-6 | | | | | | | |
| | | SS-4 | | | | | | 13 | | | | | | | | | | | | | | | | | |
| 7 | B | SS-1 | 2.0 | 3.5 | 0.0 | 1.5 | 18 | | 4.5+ | 39 | 17 | 22 | 20 | 52 | 72 | 21 | 16 | A-6b | 12 | 470 | | Mc | | | |
| | 009-0 | SS-2 | 3.5 | 5.0 | 1.5 | 3.0 | 33 | | 4.5+ | | | | | | | 14 | 16 | A-6b | 16 | | | | | | |
| | 21 | SS-3 | 5.0 | 6.5 | 3.0 | 4.5 | 36 | | 4.5+ | 33 | 19 | 14 | 30 | 46 | 76 | 15 | 14 | A-6a | 10 | | | | | | |
| | | SS-4 | 6.5 | 8.0 | 4.5 | 6.0 | 26 | 18 | 2 | | | | | | | 16 | 14 | A-6a | 10 | | | | | | |
| 8 | B | SS-1 | 1.0 | 2.5 | -0.5 | 1.0 | 11 | | 0.5 | 28 | 17 | 11 | 23 | 46 | 69 | 17 | 14 | A-6a | 7 | 530 | | HP & Mc | | 24" | 12" |
| | 011-0 | SS-2 | 2.5 | 4.0 | 1.0 | 2.5 | 17 | | - | | | | | | | 4 | 6 | A-1-b | 0 | | | | | | 204 Geotextile |
| | 21 | SS-3 | 4.0 | 5.5 | 2.5 | 4.0 | 26 | | 4.5+ | 34 | 14 | 20 | 27 | 49 | 76 | 19 | 14 | A-6a | 10 | | | | | | |
| | | SS-4 | 5.5 | 7.0 | 4.0 | 5.5 | 39 | 11 | 4.5+ | | | | | | | 18 | 14 | A-6a | 10 | | | | | | |
| 9 | B | SS-1 | 1.0 | 2.5 | -0.5 | 1.0 | 6 | | 4.5+ | | | | | | | 18 | 14 | A-6a | 10 | 520 | | $N_{60}$ & Mc | | 18" | 12" |
| | 012-0 | SS-2 | 2.5 | 4.0 | 1.0 | 2.5 | 24 | | 4.5+ | 29 | 17 | 12 | 25 | 52 | 77 | 15 | 14 | A-6a | 9 | | | | | | 204 Geotextile |
| | 21 | SS-3 | 4.0 | 5.5 | 2.5 | 4.0 | 56 | | 4.5+ | | | | | | | 14 | 14 | A-6a | 10 | | | | | | |
| | | SS-4 | 5.5 | 7.0 | 4.0 | 5.5 | 46 | 6 | 4.5+ | 33 | 19 | 14 | 27 | 42 | 69 | 14 | 14 | A-6a | 8 | | | | | | |

OHIO DEPARTMENT OF TRANSPORTATION

# Subgrade Analysis

V. 14.5 1/18/2019

| # | Boring | Sample | Sample Depth | | Subgrade Depth | | Standard Penetration | | HP (tsf) | Physical Characteristics | | | | | | Moisture | | Ohio DOT | | Sulfate Content (ppm) | Problem | | Excavate and Replace (Item 204) | | Recommendation (Enter depth in inches) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | From | To | From | To | $N_{60}$ | $N_{60L}$ | | LL | PL | PI | % Silt | % Clay | P200 | $M_C$ | $M_{OPT}$ | Class | GI | | Unsuitable | Unstable | Unsuitable | Unstable | |
| 10 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 12 | | 2 | | | | | | | 23 | 16 | A-6b | 16 | 480 | | $N_{60}$ & Mc | | 12" | 12" |
| | 013-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 11 | | 1.75 | 40 | 17 | 23 | 24 | 68 | 92 | 26 | 16 | A-6b | 13 | | | HP & Mc | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 11 | | 2 | 46 | 21 | 25 | 21 | 73 | 94 | 25 | 18 | A-7-6 | 15 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 21 | 11 | 4 | | | | | | | 21 | 14 | A-6a | 10 | | | | | | |
| 11 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 8 | | 3.5 | 46 | 23 | 23 | 18 | 66 | 84 | 25 | 20 | A-7-6 | 14 | 410 | | $N_{60}$ & Mc | | 12" | 12" |
| | 014-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 10 | | 2 | | | | | | | 29 | 14 | A-6a | 10 | | | $N_{60}$ & Mc | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 2 | | 0.25 | 53 | 26 | 27 | 21 | 75 | 96 | 30 | 23 | A-7-6 | 17 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 4 | 2 | 0.25 | | | | | | | 30 | 18 | A-7-6 | 16 | | | | | | |
| 12 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 19 | | 1.5 | | | | | | | 13 | 14 | A-6a | 10 | | | HP | | 12" | 12" |
| | 015-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 14 | | 2.5 | 50 | 25 | 25 | 20 | 75 | 95 | 27 | 22 | A-7-6 | 16 | 380 | | $N_{60}$ & Mc | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 8 | | 1.5 | | | | | | | 26 | 14 | A-6a | 10 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 9 | 8 | 1.5 | | | | | | | 27 | 14 | A-6a | 10 | | | | | | |
| 13 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 9 | | 4 | 41 | 22 | 19 | 22 | 40 | 62 | 22 | 19 | A-7-6 | 9 | 450 | | $N_{60}$ & Mc | | 12" | 12" |
| | 016-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 8 | | 3.75 | | | | | | | 22 | 18 | A-7-6 | 16 | | | $N_{60}$ & Mc | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 6 | | 1.5 | | | | | | | 27 | 18 | A-7-6 | 16 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 9 | 6 | 1.5 | 46 | 24 | 22 | 16 | 69 | 85 | 28 | 21 | A-7-6 | 14 | | | | | | |
| 14 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 10 | | 3.75 | 32 | 21 | 11 | 30 | 24 | 54 | 16 | 16 | A-6a | 4 | 460 | | $N_{60}$ | | 12" | 12" |
| | 017-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 24 | | 4.5+ | | | | | | | 20 | 18 | A-7-6 | 16 | | | | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 12 | | 4 | 43 | 23 | 20 | 20 | 73 | 93 | 21 | 20 | A-7-6 | 13 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 12 | 10 | 4.25 | | | | | | | 21 | 18 | A-7-6 | 16 | | | | | | |
| 15 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 8 | | 0.25 | | | | | | | 36 | 10 | A-2-6 | 4 | | | HP & Mc | | 42" | 18" |
| | 018-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 9 | | - | 39 | 22 | 17 | 23 | 9 | 32 | 14 | 10 | A-2-6 | 1 | 390 | | $N_{60}$ & Mc | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 4 | | 3.25 | 45 | 24 | 21 | 17 | 74 | 91 | 24 | 21 | A-7-6 | 13 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 17 | 4 | 3 | | | | | | | 11 | 14 | A-6a | 10 | | | | | | |
| 16 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 9 | | 1.25 | 41 | 22 | 19 | 20 | 37 | 57 | 25 | 19 | A-7-6 | 8 | 500 | | HP & Mc | | 12" | 12" |
| | 019-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 11 | | 3 | 39 | 22 | 17 | 20 | 65 | 85 | 23 | 17 | A-6b | 11 | | | $N_{60}$ & Mc | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 8 | | 2.5 | | | | | | | 22 | 14 | A-6a | 10 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 11 | 8 | 3 | | | | | | | 22 | 14 | A-6a | 10 | | | | | | |
| 17 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 6 | | 0.75 | 38 | 23 | 15 | 19 | 64 | 83 | 28 | 18 | A-6a | 10 | 490 | | HP & Mc | | 18" | 18" |
| | 020-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 12 | | 3.25 | 48 | 25 | 23 | 18 | 70 | 88 | 25 | 22 | A-7-6 | 15 | | | $N_{60}$ & Mc | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 7 | | 3 | | | | | | | 21 | 14 | A-6a | 10 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 15 | 6 | 4.5+ | | | | | | | 15 | 14 | A-6a | 10 | | | | | | |
| 18 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 2 | | 0.5 | 38 | 20 | 18 | 30 | 37 | 67 | 23 | 16 | A-6b | 10 | 480 | | HP & Mc | | 42" | 18" |
| | 021-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 11 | | 4.5+ | | | | | | | 18 | 14 | A-6a | 10 | | | $N_{60}$ & Mc | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 13 | | 4.5+ | 34 | 20 | 14 | 24 | 51 | 75 | 16 | 15 | A-6a | 10 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 19 | 2 | 4.5+ | | | | | | | 16 | 14 | A-6a | 10 | | | | | | |

OHIO DEPARTMENT OF TRANSPORTATION

# Subgrade Analysis

V. 14.5 1/18/2019

| # | Boring | Sample | Sample Depth | | Subgrade Depth | | Standard Penetration | | HP (tsf) | Physical Characteristics | | | | | | Moisture | | Ohio DOT | | Sulfate Content (ppm) | Problem | | Excavate and Replace (Item 204) | | Recommendation (Enter depth in inches) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | From | To | From | To | $N_{60}$ | $N_{60L}$ | | LL | PL | PI | % Silt | % Clay | P200 | $M_C$ | $M_{OPT}$ | Class | GI | | Unsuitable | Unstable | Unsuitable | Unstable | |
| 19 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 9 | | 2 | | | | | | | 20 | 16 | A-6b | 16 | 470 | | $N_{60}$ & Mc | | 12" | 12" |
| | 022-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 9 | | 4 | 38 | 22 | 16 | 27 | 51 | 78 | 22 | 17 | A-6b | 10 | | | $N_{60}$ & Mc | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 6 | | 2.5 | | | | | | | 21 | 16 | A-6b | 16 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 9 | 6 | 1.25 | 35 | 20 | 15 | 26 | 44 | 70 | 23 | 15 | A-6a | 9 | | | | | | |
| 20 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 6 | | 2.5 | 32 | 21 | 11 | 28 | 32 | 60 | 17 | 16 | A-6a | 5 | | | $N_{60}$ | | 18" | 18" |
| | 023-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 8 | | 2.5 | 43 | 23 | 20 | 25 | 56 | 81 | 24 | 20 | A-7-6 | 13 | 380 | | $N_{60}$ & Mc | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 8 | | 3 | | | | | | | 17 | 18 | A-7-6 | 16 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 13 | 6 | 0.75 | | | | | | | 24 | 14 | A-6a | 10 | | | | | | |
| 21 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 3 | | 2.5 | 29 | 18 | 11 | 26 | 51 | 77 | 17 | 16 | A-6b | 8 | 410 | | $N_{60}$ | | 33" | 18" |
| | 024-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 8 | | 1.5 | 29 | 18 | 11 | 23 | 42 | 65 | 20 | 16 | A-6b | 6 | | | HP & Mc | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 17 | | 4.5+ | | | | | | | 14 | 10 | A-4a | 8 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 35 | 3 | 4.25 | | | | | | | 17 | 14 | A-6a | 10 | | | | | | |
| 22 | B | SS-1 | 0.0 | 1.5 | 0.0 | 1.5 | 7 | | 4.25 | | | | | | | 16 | 16 | A-6b | 16 | 450 | | $N_{60}$ | | 15" | 42" |
| | 025-0 | SS-2 | 1.5 | 3.0 | 1.5 | 3.0 | 10 | | 4 | | | | | | | 18 | 16 | A-6b | 16 | | | $N_{60}$ | | | 204 Geotextile |
| | 21 | SS-3 | 3.0 | 4.5 | 3.0 | 4.5 | 2 | | 1 | 32 | 19 | 13 | 22 | 47 | 69 | 21 | 16 | A-6b | 8 | | | | | | |
| | | SS-4 | 4.5 | 6.0 | 4.5 | 6.0 | 3 | 2 | 1 | 32 | 19 | 13 | 24 | 45 | 69 | 22 | 16 | A-6b | 8 | | | | | | |

OHIO DEPARTMENT OF TRANSPORTATION

# Subgrade Analysis

V. 14.5 1/18/2019

**PID:** 110859

**County-Route-Section:** OTT-53-11.67
**No. of Borings:** 22

**Geotechnical Consultant:** TTL Associates, Inc
**Prepared By:** Imad El Hajjar, EI
**Date prepared:** 5/31/2022

| 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): | 15" |
| Average(HP): | 0" |
| Global Geogrid Average(N60L): | 0" |
| Average(HP): | 0" |

| Design CBR | 6 |
|---|---|

| % Samples within 6 feet of subgrade | | | |
|---|---|---|---|
| $N_{60} \leq 5$ | 8% | HP ≤ 0.5 | 6% |
| $N_{60} < 12$ | 57% | 0.5 < HP ≤ 1 | 5% |
| $12 \leq N_{60} < 15$ | 11% | 1 < HP ≤ 2 | 24% |
| $N_{60} \geq 20$ | 20% | HP > 2 | 38% |
| M+ | 32% | | |
| Rock | 0% | | |
| Unsuitable | 0% | | |

| Excavate and Replace at Surface | |
|---|---|
| Average | 14" |
| Maximum | 42" |
| Minimum | 0" |

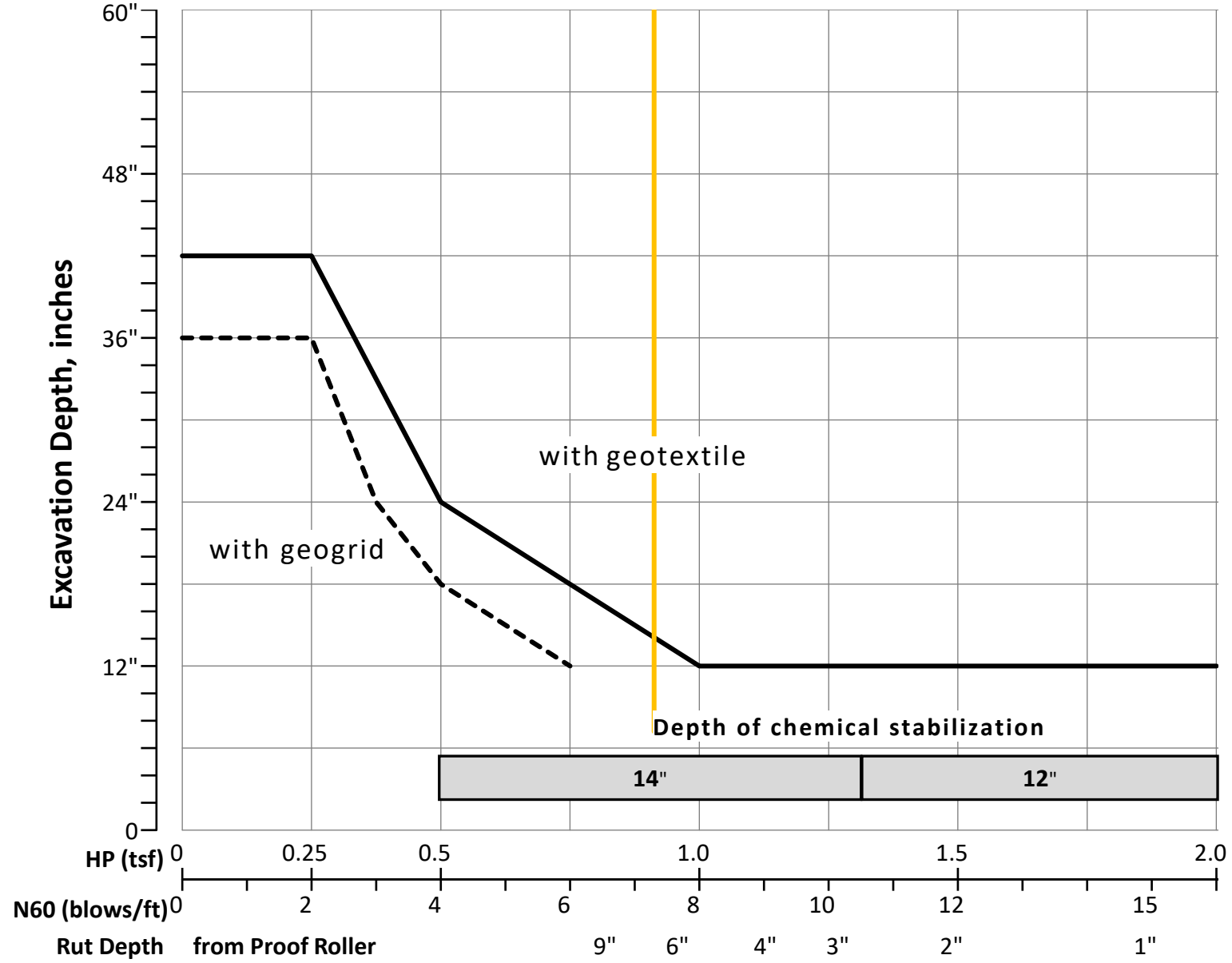
| % Proposed Subgrade Surface | |
|---|---|
| Unstable & Unsuitable | 80% |
| Unstable | 80% |
| Unsuitable | 0% |

| | $N_{60}$ | $N_{60L}$ | HP | LL | PL | PI | Silt | Clay | P 200 | $M_C$ | $M_{OPT}$ | GI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 15 | 7 | 2.40 | 38 | 20 | 17 | 23 | 52 | 75 | 20 | 16 | 11 |
| Maximum | 71 | 18 | 4.50 | 53 | 26 | 27 | 30 | 75 | 96 | 36 | 23 | 17 |
| Minimum | 2 | 2 | 0.25 | 24 | 13 | 11 | 15 | 9 | 32 | 4 | 6 | 0 |

**Classification Counts by Sample**

| ODOT Class | Rock | A-1-a | A-1-b | A-2-4 | A-2-5 | A-2-6 | A-2-7 | A-3 | A-3a | A-4a | A-4b | A-5 | A-6a | A-6b | A-7-5 | A-7-6 | A-8a | A-8b | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Count | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 42 | 18 | 0 | 21 | 0 | 0 | 85 |
| Percent | 0% | 0% | 1% | 0% | 0% | 2% | 0% | 0% | 0% | 1% | 0% | 0% | 49% | 21% | 0% | 25% | 0% | 0% | 100% |
| % Rock\|Granular\|Cohesive | 0% | 5% | | | | | | | | | 95% | | | | | | | | 100% |
| Surface Class Count | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 14 | 0 | 8 | 0 | 0 | 46 |
| Surface Class Percent | 0% | 0% | 2% | 0% | 0% | 4% | 0% | 0% | 0% | 0% | 0% | 0% | 46% | 30% | 0% | 17% | 0% | 0% | 100% |

## GB1 Figure B – Subgrade Stabilization




OVERRIDE TABLE

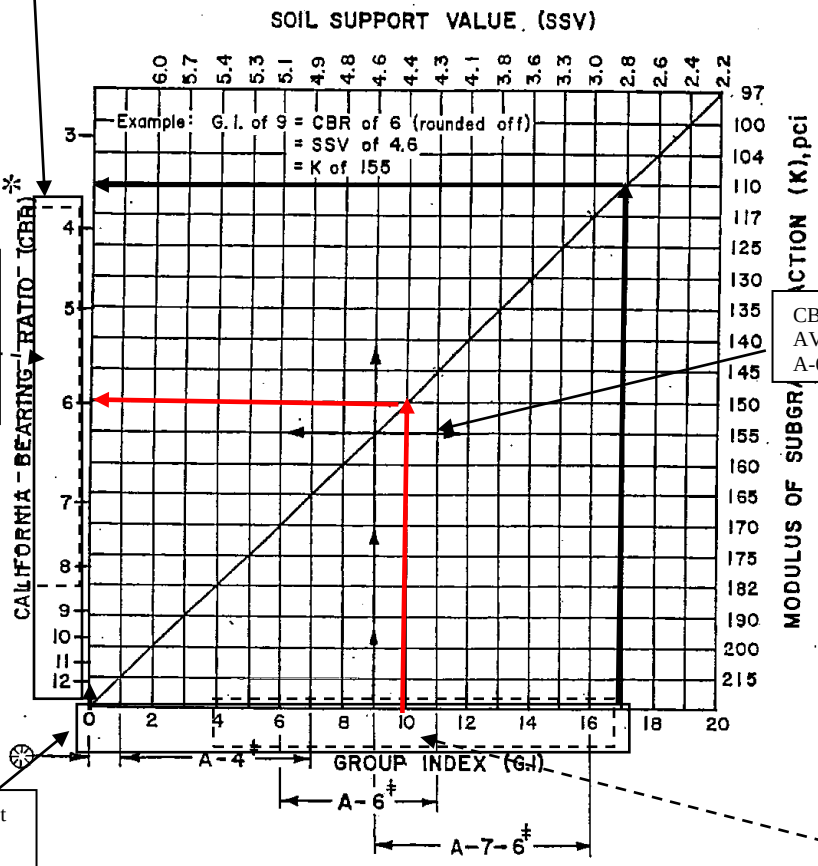
| Calculated Average | New Values | Check to Override |
|---|---|---|
| 2.40 | | ☐ HP |
| 7.32 | | ☐ N60L |

Average HP
Average $N_{60L}$

# OTT 53-11.67 PID 110859

Range of GI from 0 to 17 for all pavement subgrade samples corresponds to CBR values ranging from 3 to 12 percent.

Fig.1301-3
Feb.1978




Range of GI from 4 to 16 for tested **A-4a**, **A-6a, A-6b** and **A-7-6** pavement subgrade samples corresponds to CBR values of 4 to 8 percent.

CBR = 6 for the project based on AVG GI of 10 for all tested A-4a, A-6a, A-6b and A-7-6 soils.

Range of GI for all pavement subgrade samples: 0 to 17

Range of GI for tested **A-4a**, **A-6a, A-6b** and **A-7-6** pavement subgrade samples: 4 to 17, with average of 10

⊛ AASHTO Classes A-1, A-2 & A-3 lie below 0. SSV=6-10; K=200+.

‡ Usual range of AASHTO Classes.

✲ 5-1/2 Lb. hammer, 12" drop, 4 layers, 45 blows per layer, compacted at optimum moisture as determined by AASHTO T-99.

CORRELATION CHART FOR SUBGRADE STRENGTHS

**Settlement Calculations Outputs From Embank**

ONE DIMENSIONAL SETTLEMENT ANALYSIS/Federal Highway Administration
STRIP SYMMETRICAL VERTICAL EMBANKMENT LOADING

| | | | |
|---|---|---|---|
| Project Name | : OTT 53 11.67 | Client | : TETRA TECH INC |
| File Name | : OTT531167 | Project Manager | : ijh |
| Date | : 05/31/22 | Computed by | : ijh |

Settlement for X = 45.00 (ft)

| | | | |
|---|---|---|---|
| Embankment slope a | = 33.00 (ft) | Height of fill H | = 11.00 (ft) |
| Embankment top width | = 25.00 (ft) | Unit weight of fill | = 130.00 (pcf) |
| Embankment bottom width | = 91.00 (ft) | p load/unit area | = 1430.00 (psf) |
| Ground Surface Elev. | = 585.00 (ft) | Foundation Elev. | = 585.00 (ft) |
| Water table Elev. | = 580.00 (ft) | Unit weight of Wat. | = 62.40 (pcf) |

| Nº. | LAYER TYPE | THICK. (ft) | COMP. | RECOMP. RATIO | SWELL. | UNIT WEIGHT (pcf) | | Settlement (in.) |
|---|---|---|---|---|---|---|---|---|
| 1 | COMP. | 5.0 | 0.204 | 0.040 | 0.040 | 130.00 | | 1.76 |
| 2 | COMP. | 10.0 | 0.135 | 0.015 | 0.015 | 130.00 | | 0.69 |
| 3 | INCOMP. | 10.0 | ----- | ----- | ----- | 135.00 | 0.00 | |

Total Settlement = 2.44

| Nº. | SUBLAYER THICK. (ft) | ELEV. (ft) | SOIL STRESSES INITIAL (psf) | INCREMENT (psf) | MAX.PAST PRESS. (psf) | SETTLEMENT (in.) |
|---|---|---|---|---|---|---|
| 1 | 5.00 | 582.50 | 325.00 | 1429.17 | 5900.00 | 1.76 |
| 2 | 10.00 | 575.00 | 988.00 | 1391.02 | 6800.00 | 0.69 |
| 3 | INCOMP. | | | | | |

Total Settlement = 2.44 (in.)

2.44 in +/- 15% = 2.1 to 2.8 inches. Say approximately 2 to 3 inches.
CPI 6-6-22

Project Name: OTT 53 11.67
Project Number: 1902501
Calculated by: IJH

**Embankment Parameters**

| Height | Pressure @130 pcf | |
|---|---|---|
| 11 feet | 1430 psf | 0.715 tsf |

**Coefficient of Consolidation from NAVFAC Figure 4 (7.1-144)**

| Stratum | LL | Virgin Compression | | Recompression | | Virgin Average |
|---|---|---|---|---|---|---|
| | | $C_v$ ($cm^2$/sec) | $C_v$ ($ft^2$/day) | $C_v$ ($cm^2$/sec) | $C_v$ ($ft^2$/day) | $C_v$ ($ft^2$/day) |
| I Upper Stiff Clay | 24 | >.005 | >0.5 | >.03 | >2 | |
| | 37 | 0.003 | 0.28 | 0.020 | 1.9 | |
| | 35 | 0.004 | 0.37 | 0.025 | 2.3 | 0.30 |
| | 45 | 0.002 | 0.19 | 0.010 | 0.9 | |
| | 49 | 0.002 | 0.19 | 0.007 | 0.7 | |
| II V. Stiff to Hard Clay | 27 | >.005 | >0.5 | >.03 | >2 | |
| | 25 | >.005 | >0.5 | >.03 | >2 | |
| | 26 | >.005 | >0.5 | >.03 | >2 | |
| | 24 | >.005 | >0.5 | >.03 | >2 | |
| | 28 | >.005 | >0.5 | >.03 | >2 | 0.5 |
| | 28 | >.005 | >0.5 | >.03 | >2 | |
| | 32 | 0.005 | 0.42 | >.03 | >2 | |
| | 43 | 0.002 | 0.22 | 0.013 | 1.2 | |
| | | | | | | |

**Coefficient of Consolidation from Tested Values**

| Stratum | Pressure (tsf) | Virgin Compression | | Recompression | | Cv for 0.715 tsf |
|---|---|---|---|---|---|---|
| | | $C_v$ ($cm^2$/sec) | $C_v$ ($ft^2$/day) | $C_v$ ($cm^2$/sec) | $C_v$ ($ft^2$/day) | |
| B-8 (ST-3) I | 0.5 | - | | - | 0.25 | 0.18 |
| | 1.0 | - | | - | 0.08 | |

| Stratum | Pressure (tsf) | Virgin Compression | | Recompression | | Cv for 0.715 tsf |
|---|---|---|---|---|---|---|
| | | $C_v$ ($cm^2$/sec) | $C_v$ ($ft^2$/day) | $C_v$ ($cm^2$/sec) | $C_v$ ($ft^2$/day) | |
| B-7 (ST-3) I | 0.5 | - | | - | 0.33 | 0.22 |
| | 1.0 | - | | - | 0.07 | |

Project Name: OTT 53 11.67
Project Number: 1902501
Calculated by: IJH

**Encountered Conditions**

| | Low H (feet) | High H (feet) |
|---|---|---|
| Stratum I layer thicknesses, between partings/changes | 3 | 5 |
| Stratum II layer thicknesses, between partings/changes | 5 | 10 |

**Assume double drainage between strata layers**

| | Low $H_{dr}$ (feet) | High $H_{dr}$ (feet) |
|---|---|---|
| Stratum I drainage thicknesses | 1.5 | 2.5 |
| Stratum II drainage thicknesses | 2.5 | 5 |
| | | |

**Time for 90% Consolidation**

$$t = \frac{T\,(H_{dr})^2}{C_v}$$

where T = 0.848 for 90% consolidation

Results Based on Low End $H_{dr}$

Lab Cv from B-008, so evaluation range for Stratum I is low Cv from B-008 to Cv from LL Correlation Stratum I

| Stratum | From NAVFAC Cv Values | | | From Lab Cv Values | | |
|---|---|---|---|---|---|---|
| | t (days) | t (weeks) | t (months) | t (days) | t (weeks) | t (months) |
| | | | | | | |
| I | 6.3 | 0.9 | 0.2 | 11 | 1.5 | 0.4 |
| II | 10.6 | 1.5 | 0.4 | | | |

Results Based on High End $H_{dr}$

| Stratum | From NAVFAC Cv Values | | | From Lab Cv Values | | |
|---|---|---|---|---|---|---|
| | t (days) | t (weeks) | t (months) | t (days) | t (weeks) | t (months) |
| I | 17.4 | 2.5 | 0.580 | 30 | 4 | 1.0 |
| II | 42 | 6 | 1 | | | |

**Final Conclusions**

Say approximately 2 to 6 weeks based on Stratum I data.
Based on experience, may be approximately 4 weeks.

Project: OTT-53-11.67
By: CPI
Subject: Pole sign foundation shaft eval.

| depth | HP (tsf) | UCS (psf) | |
|---|---|---|---|
| 0'-2' | 0.5 | – | |
| 2'-6' | 1.5 | – | |
| 6'-21' | 5 @ 4.5 | 8985 | Avg ≥ 4 tsf |
| | 10 @ 4.25 | 13,015 | |
| | | 7,210 | |
| 21-23.5 | 3.25 | – | |
| 23.5-25' | 1 | 2,375 | |

## $Q_u$ Avg Calcs

0-6': $Q_u$ Avg = $\left(\frac{(12\times0.5)+(4\times1.5)}{6}\right)$ tsf $\geq$ 4 tsf $\Rightarrow$ 1,160 psf < 2,000

0-10' $Q_u$ Avg = $\left(\frac{(2\times0.5)+(4\times1.5)+(4\times4)}{10}\right) \Rightarrow S_u = 2,300 > 2,000$

0-18' $Q_u$ Avg = $\left(\frac{(2\times0.5)+(4\times1.5)+(12\times4)}{18}\right) \Rightarrow S_u = 3,000 > 2,000$

proposed shaft depth Meets Requirements

# APPENDIX B

## Historic Borings

IR 54 B
1500 10 66

# SR 357 INTERCHANGE

Revised 8/27/62

# SOIL PROFILE
## OTTAWA COUNTY
## OTT-2-23.43
OHIO STATE HIGHWAY
TESTING LABORATORY
COLUMBUS, OHIO

13
14

SR 357

Proposed grade SR 2

℄ - 28' Rt.

TS=0.6'

28' Lt.

℄ TS=0.6'

Refusal (Hand auger)

℄ TS=0.6'

Refusal (Hand auger)

10' Lt.

Refusal (Hand auger)

Top of Rock-In-Place

Limestone, light gray, aranaceous, dense, hard, well jointed, fractured, badly broken, contains mart and clay seams, slightly weathered on joints. Core loss: 10%.

A. Gravel, limestone fragments and cobbles.

B. Broken limestone cobbles and fragments.

C. Limestone, brown, aranaceous, dense, hard, firm, jointed, badly broken. Core loss: 33%.

Top of Rock-In-Place

49 +2' Penetration

## RAMP "C"

(Sta. 514+00-℄ Proposed SR 2) 75' Rt. TS=0.5'

Refusal

(Sta. 518+00-℄ Proposed SR 2) 97' Rt. TS=0.4'

Refusal

Approximate groundline

6' Rt. TS=0.6'

Refusal (Hand auger)

(Sta. 53+00-℄ Proposed SR 357) 53' Rt. TS=0.6'

Refusal (Hand auger)

## RAMP "D"

(Sta. 55+00-℄ Proposed SR 357) 50' Rt. TS=0.6'

Refusal (Hand auger)

5' Rt. TS=0.5'

Refusal (Boulders)

Approximate groundline

(Sta. 530+00-℄ Proposed SR 2) 96' Rt. TS=0.4'

Refusal (Boulders)

## RAMP "A"

(Sta. 48+50-℄ Proposed SR 357) 12' Lt. TS=0.6'

Refusal (Hand auger)

℄ TS=0.8'

Approximate groundline

3' Rt. TS=0.8'

(Sta. 7+82-9' Lt. Proposed Ramp "B") 233' Lt. TS=0.8'

(Sta. 533+00-℄ Proposed SR 2) 141' Lt. TS=0.4'

Refusal (Boulders)

(Sta. 531+00-℄ Proposed SR 2) 85' Lt. TS=0.4'

## RAMP "B"

(Sta. 48+50-℄ Proposed SR 357) 19' Rt. TS=0.6'

Refusal (Hand auger)

(Sta. 3+33-℄ Proposed Ramp "A") 46' Rt. TS=0.8'

Approximate groundline

3' Rt. TS=0.8'

(Sta. 525+50-℄ Proposed SR 2) 83' Rt. TS=0.4'

Refusal

## CORE SAMPLE SOIL TEST DATA

NP shown in L.L. & P.I. columns indicates that the material is non-plastic.

| STATION & OFFSET | DEPTH FEET TO | % AGG. | % C.S. | % F.S. | % SILT | % CLAY | L.L. | P.I. | % W.C. | SHTD CLASS. |
|---|---|---|---|---|---|---|---|---|---|---|
| 48+09 28' Rt. | 2.5-3.5 | 9 | 7 | 14 | 27 | 45 | 38 | 18 | 18 | A-6b |
| | 5.0-6.0 | 10 | 8 | 13 | 26 | 43 | 31 | 11 | 18 | A-6a |
| | 7.5-8.5 | 14 | 9 | 22 | 33 | 22 | 23 | 5 | 16 | A-4b |
| | 10.0-10.5 | 9 | 23 | 34 | 26 | 17 | NP | NP | 16 | A-2-4a |
| | 12.5-13.5 | 23 | 23 | 13 | 21 | 21 | 32 | 10 | 14 | A-4b |
| | 15.0-15.5 | 29 | 28 | 14 | 21 | 8 | NP | NP | 11 | A-1-b |
| | 17.5-18.5 | 15 | 13 | 13 | 10 | 8 | NP | NP | 9 | A-1-b |
| | 20.0-21.0 | 58 | 16 | 13 | 12 | 8 | NP | NP | 8 | A-1-b |
| | 22.5-23.5 | 13 | 15 | 31 | 26 | 13 | NP | NP | 10 | A-2-4a |
| | 33.0-33.2 | 78 | 11 | 4 | - 7 - | | NP | NP | 7 | A-1-a |
| 50+00 28' Lt. | 0.5-1.0 | 9 | 9 | 23 | 35 | 25 | 23 | 5 | 11 | A-1b |
| | 7.5-8.5 | 10 | 28 | 28 | 27 | 15 | 28 | 4 | 11 | A-1b |
| | 10.0-11.0 | 28 | 34 | 13 | 13 | 12 | 27 | 8 | 13 | A-2-4b |
| | 12.5-13.5 | 21 | 29 | 7 | 11 | 31 | 29 | 7 | 11 | A-4b |

TE - 127
1600-18 GR

# SOIL PROFILE

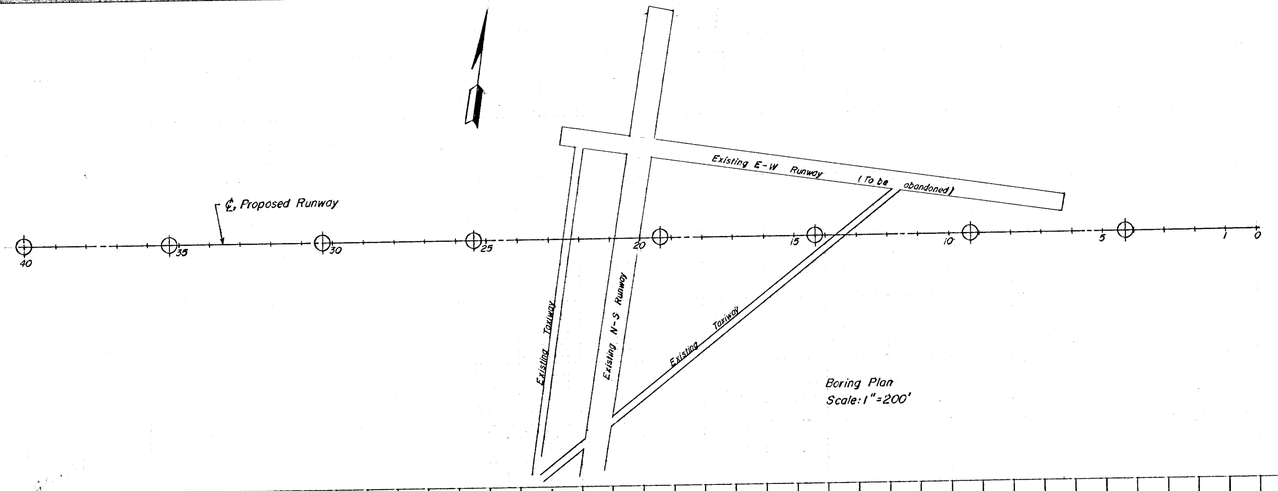
**OTTAWA COUNTY**
**OTT-PORT CLINTON MUNICIPAL AIRPORT**

OHIO STATE HIGHWAY TESTING LABORATORY
1620 W. BROAD ST. COLUMBUS, OHIO 43223

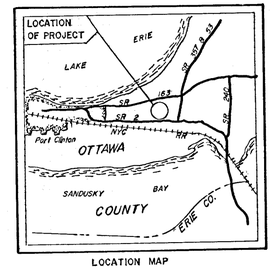
## LEGEND FOR PROJECT

| DESCRIPTION | OHIO CLASS |
|---|---|
| Silt and clay | A-6a |
| Silty clay | A-6b |
| Clay | A-7-6 |
| Sod and or Topsoil = Approximate depth | |
| Auger boring – plan view | Free water |
| Auger boring plotted to vertical scale only | |

NOTE: Figures beside borings indicate water content in percent e.g. 15




Boring Plan
Scale: 1" = 200'




LOCATION MAP

Drilling - Auger - L.M.O. - 10/18/67 to 10/19/67
Drafting - E.J.S - 12/8/67

## GENERAL INFORMATION

### INTRODUCTION

THE PROJECT CONSISTS OF THE CONSTRUCTION OF A 4000-FOOT RUNWAY AT THE PORT CLINTON AIRPORT, WHICH IS LOCATED NORTHWEST OF THE SR 2-SR 163 INTERCHANGE. THE PROPOSED RUNWAY EXTENDS FROM EAST TO WEST AND IS IMMEDIATELY SOUTH OF THE EXISTING 1600-FOOT EAST-WEST RUNWAY, WHICH IS TO BE ABANDONED.

### GEOLOGY OF THE PROJECT

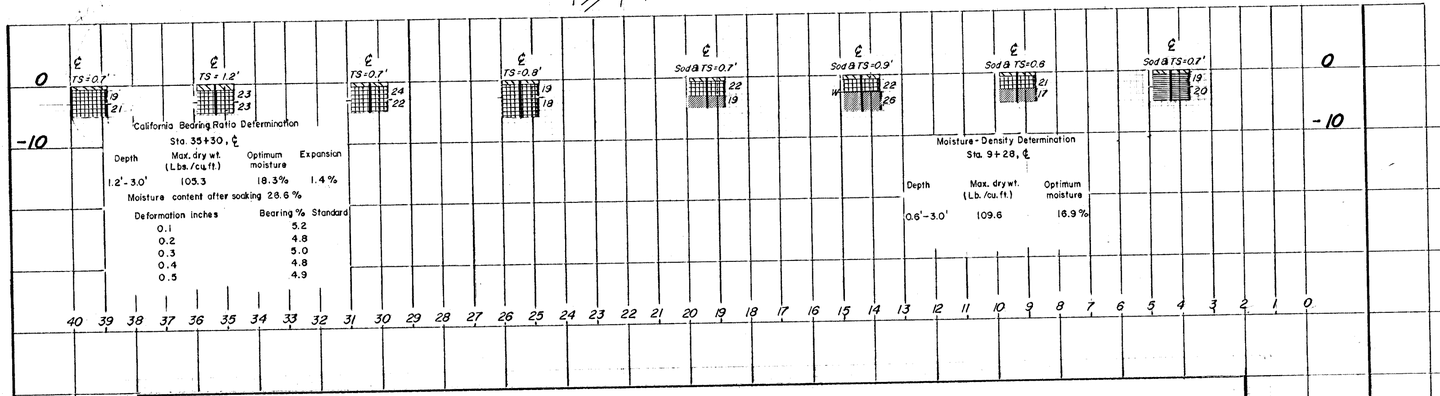
THE PROJECT IS LOCATED ON THE FLAT, GLACIATED LAKE PLAIN, IN AN AREA WHERE MODERATELY DEEP GLACIAL DRIFT OVERLIES DOLOMITE BEDROCK OF THE TYMOCHTEE MEMBER OF THE MONROE GROUP.

### EXPLORATION

EXPLORATORY BORINGS WERE MADE BY MEANS OF TRUCK-MOUNTED MECHANICAL SOIL AUGER ON OCTOBER 18 AND 19, 1967.

### INVESTIGATIONAL FINDINGS

MATERIALS ENCOUNTERED ON THE PROJECT WERE PREDOMINANTLY COMPRISED OF CLAYS: (A-7-6), WITH OCCASIONAL SANDY SILTS, (A-4a) AND SILT CLAYS (A-6a AND A-6b), GENERALLY HAVING LOW MOISTURE CONTENTS AND MOISTURE CONTENTS IN THE LOWER PORTIONS OF THE PLASTIC RANGE.




## SUMMARY OF SOIL TEST DATA

NOTE: NP SHOWN IN LIQUID LIMIT AND PLASTICITY INDEX COLUMNS INDICATES THAT THE MATERIAL IS NON-PLASTIC.

| STATION & OFFSET | DEPTH FROM | DEPTH TO | % AGG. | % C.S. | % F.S. | % SILT | % CLAY | L.L. | P.I. | % W.C. | SHTD CLASS. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4+30 CL | 0.0 | 0.7 | ( 6 TOPSOIL | 5 | 16 | 34 | 39 | 33 | 13 | 23) | VISUAL A-6b |
| | 0.7 | 3.0 | 13 | 4 | 14 | 26 | 43 | 38 | 18 | 19 | A-6b |
| | 3.0 | 5.0 | 13 | 4 | 11 | 22 | 45 | 37 | 17 | 20 | A-6b |
| 9+28 CL | 0.0 | 0.6 | ( 2 TOPSOIL | 3 | 12 | 36 | 47 | 44 | 12 | 24) | VISUAL A-7-6 |
| | 0.6 | 3.0 | 13 | 4 | 12 | 23 | 48 | 42 | 18 | 21 | A-7-6 |
| | 3.0 | 5.0 | 9 | 7 | 13 | 23 | 48 | 33 | 11 | 17 | A-6a |
| 14+35 CL | 0.0 | 0.3 | ( 8 TOPSOIL | 7 | 5 | 24 | 56 | 50 | 22 | 29) | VISUAL A-7-6 |
| | 0.3 | 3.0 | 14 | 1 | 6 | 42 | 37 | 51 | 28 | 22 | A-7-6 |
| | 3.0 | 6.0 | 11 | 1 | 2 | 42 | 54 | 38 | 15 | 25 | A-6a |
| 19+35 CL | 0.0 | 0.7 | ( 2 TOPSOIL | 1 | 5 | 40 | 52 | 52 | 18 | 30) | VISUAL A-7-6 |
| | 0.7 | 3.0 | 1 | 5 | 33 | 60 | 47 | 21 | 22 | | A-6a |
| | 3.0 | 5.0 | 13 | 4 | 11 | 28 | 44 | 34 | 14 | 19 | A-6a |
| 25+40 CL | 0.0 | 0.8 | ( 1 TOPSOIL | 2 | 8 | 40 | 49 | 37 | 11 | 23) | VISUAL A-7-6 |
| | 0.8 | 3.0 | 0 | 1 | 4 | 30 | 65 | 45 | 21 | 19 | A-7-6 |
| | 3.0 | 6.0 | 0 | 2 | 4 | 30 | 64 | 48 | 22 | 18 | A-7-6 |
| 30+30 CL | 0.0 | 0.7 | ( 0 TOPSOIL | 1 | 5 | 36 | 58 | 59 | 21 | 31) | VISUAL A-7-6 |
| | 0.7 | 3.0 | 0 | 1 | 5 | 30 | 64 | 44 | 17 | 24 | A-7-6 |
| | 3.0 | 5.0 | 0 | 1 | 4 | 33 | 62 | 50 | 25 | 22 | |
| 35+30 CL | 0.0 | 1.2 | ( 0 TOPSOIL | 1 | 5 | 33 | 61 | 50 | 27 | 28) | VISUAL A-7-6 |
| | 1.2 | 3.0 | 1 | 1 | 5 | 28 | 65 | 53 | 27 | 23 | A-7-6 |
| | 3.0 | 5.0 | 6 | 1 | 4 | 30 | 59 | 50 | 24 | 23 | |
| 40+00 CL | 0.0 | 0.7 | ( 4 TOPSOIL | 10 | 22 | 32 | 32 | NP | NP | 18) | VISUAL A-7-6 |
| | 0.7 | 3.0 | 9 | 0 | 2 | 30 | 59 | 47 | 21 | 19 | A-7-6 |
| | 3.0 | 5.0 | 8 | 3 | 4 | 18 | 70 | 49 | 23 | 21 | A-7-6 |

# APPENDIX C

## Geotechnical Engineering Design Checklists

| I. Geotechnical Design Checklists | |
|---|---|
| **Project: OTT 53 11.67** | **PDP Path:** |
| **PID: 110859** | **Review Stage: Final** |

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

## II. Reconnaissance and Planning Checklist

| C-R-S: | OTT 53 11.67 | PID: | 110859 | Reviewer: | IJH | Date: | 5/31/2022 |
|---|---|---|---|---|---|---|---|

| 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: | X | Plans to be prepared 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 | |
| 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 | Included with 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 | Station and offset were not available during planning. |
| 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? | X | |

## II. Reconnaissance and Planning Checklist

| **Planning – Boring Types** | | (Y/N/X) | Notes: |
|---|---|---|---|
| 14 | Based on Sections 303.3 to 303.7.6 of the SGE, have the location, depth, and sampling requirements for the following boring types been determined for the project? | Y | |
| | 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: | OTT 53 11.67 | PID: | 110859 | Reviewer: | IJH | Date: | 5/31/2022 |
|---|---|---|---|---|---|---|---|

***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 | |
| b. Has mechanical classification (Plastic Limit (PL), Liquid Limit (LL), and gradation testing) been done on at least two samples from each boring within six feet of the proposed subgrade? | Y | |
| c. Has the sulfate content of at least one sample from each boring within 3 feet of the proposed subgrade been determined, per Supplement 1122, Determining Sulfate Content in Soils? | Y | |
| d. Has the sulfate content of all samples that exhibit gypsum crystals been determined? | X | No gypsum observed in samples. |
| 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 | None present. |
| 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 | None present. |
| 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 | Rock deeper than 24 inches below anticipated subgrade elevation so removal not required. |
| a. If removal of any rock, shale, or coal is required, have the station limits, depth, and lateral limits for the planned removal of the material at proposed subgrade been provided? | | |

## III.C. Subgrade Checklist

| Subgrade | (Y/N/X) | Notes: |
|---|---|---|
| 4 In accordance with GB1, do the SPT ($N_{60}$)/HP values and existing moisture contents for the proposed subgrade soils indicate the need for subgrade stabilization? | N | |
| a. If removal and replacement is applicable, has the detail of subgrade removal been shown on the plans, including depth of removal, station limits, lateral extent, replacement material, and plan notes (Item 204 - Subgrade Compaction and Proof Rolling)? | Y | Removal and replacement is anticipated. Extent of Removal and replacement is shown in the report.<br><br>Plans to be prepared by others. |
| 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? | Y | Chemical stabilization is anticipated. Depth of Chemical stabilization is shown in the report.<br><br>Plans to be prepared by others. |
| Indicate type of chemical stabilization specified: | | |
| cement stabilization | ✓ | |
| lime stabilization | ✓ | |
| 5 If removal and replacement has been specified, do the plans include Plan Note G121 from L&D3? | X | 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 | Plans to be prepared by others. |
| 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 to be prepared by others. |
| 8 Has a design CBR value been provided? | Y | |

## IV.A Foundations of Structures Checklist

| C-R-S: | OTT 53 11.67 | PID: | 110859 | Reviewer: | LGH | Date: | 6/28/2021 |
|---|---|---|---|---|---|---|---|

***If you do not have such a foundation or structure on the project, you do not have to fill out this checklist.***

| | **Soil and Bedrock Strength Data** | (Y/N/X) | Notes: |
|---|---|---|---|
| 1 | Has the shear strength of the foundation soils been determined? | Y | |
| | Check method used: | | |
| | laboratory shear tests | ✓ | |
| | estimation from SPT or field tests | ✓ | |
| 2 | Have sufficient soil shear strength, consolidation, and other parameters been determined so that the required allowable loads for the foundation/structure can be designed? | Y | |
| 3 | Has the shear strength of the foundation bedrock been determined? | X | |
| | Check method used: | | |
| | laboratory shear tests | | |
| | other (describe other methods) | | |
| | **Spread Footings** | (Y/N/X) | Notes: |
| 4 | Are there spread footings on the project? If no, go to Question 11 | N | |
| 5 | Have the recommended bottom of footing elevation and reason for this recommendation been provided? | | |
| a. | Has the recommended bottom of footing elevation taken scour from streams or other water flow into account? | | |
| 6 | Were representative sections analyzed for the entire length of the structure for the following: | | |
| a. | factored bearing resistance? | | |
| b. | factored sliding resistance? | | |
| c. | eccentric load limitations (overturning)? | | |
| d. | predicted settlement? | | |
| e. | overall (global) stability? | | |
| 7 | Has the need for a shear key been evaluated? | | |
| a. | If needed, have the details been included in the plans? | | |
| 8 | If special conditions exist (e.g. geometry, sloping rock, varying soil conditions), was the bottom of footing “stepped” to accommodate them? | | |
| 9 | Have the Service I and Maximum Strength Limit States for bearing pressure on soil or rock been provided? | | |

## IV.A Foundations of Structures Checklist

| **Spread Footings** | (Y/N/X) | Notes: |
|---|---|---|
| 10 If weak soil is present at the proposed foundation level, has the removal / treatment of this soil been developed and included in the plans? | | |
| a. Have the procedure and quantities related to this removal / treatment been included in the plans? | | |
| **Pile Structures** | (Y/N/X) | Notes: |
| 11 Are there piles on the project? If no, go to Question 17 | N | |
| 12 Has an appropriate pile type been selected? | | |
| Check the type selected: | | |
| H-pile (driven) | | |
| H-pile (prebored) | | |
| Cast In-place Reinforced Concrete Pipe | | |
| Micropile | | |
| Continuous Flight Auger (CFA) | | |
| other (describe other types) | | |
| 13 Have the estimated pile length or tip elevation and section (diameter) based on either the Ultimate Bearing Value (UBV) or the depth to top of bedrock been specified? Indicate method used. | | |
| 14 If scour is predicted, has pile resistance in the scour zone been neglected? | | |
| 15 Has a wave equation drivability analysis been performed as per BDM 305.4.1.2 to determine whether the pile can be driven to either the UBV, the pile tip elevation, or refusal on bedrock without overstressing the pile? | | |
| 16 If required for design, have sufficient soil parameters been provided and calculations performed to evaluate the: | | |
| a. Nominal unit tip resistance and maximum settlement of the piles? | | |
| b. Nominal unit side resistance for each contributing soil layer and maximum deflection of the piles? | | |
| c. Downdrag load on piles driven through new embankment or compressible soil layers, as per BDM 305.4.2.2? | | |
| d. Potential for and impact of lateral squeeze from soft foundation soils? | | |

## IV.A Foundations of Structures Checklist

| **Pile Structures** | | (Y/N/X) | Notes: |
|---|---|---|---|
| 17 | If piles are to be driven to strong bedrock ($Q_u$ >7.5 ksi) or through very dense granular soils or overburden containing boulders, have "pile points" been recommended in order to protect the tips of the steel piling, as per BDM 305.4.5.6? | | |
| 18 | If subsurface obstacles exist, has preboring been recommended to avoid these obstructions? | | |
| 19 | If piles will be driven through 15 feet or more of new embankment, has preboring been specified as per BDM 305.4.5.7? | | |

## IV.A Foundations of Structures Checklist

| **Drilled Shafts** | (Y/N/X) | Notes: |
|---|---|---|
| 20 Are there drilled shafts on the project? If no, go to the next checklist. | Y | |
| 21 Have the drilled shaft diameter and embedment length been specified? | X | Assined by Tetra Tech at 18 feet below exising grades |
| 22 Have the recommended drilled shaft diameter and embedment been developed based on the nominal unit side resistance and nominal unit tip resistance for vertical loading situations? | X | Assigned by Tetra Tech based on Standard Drawings |
| 23 For shafts undergoing lateral loading, have the following been determined: | X | Assigned by Tetra Tech based on Standard Drawings |
| a. total factored lateral shear? | | |
| b. total factored bending moment? | | |
| c. maximum deflection? | | |
| d. reinforcement design? | | |
| 24 If a bedrock socket is required, has a minimum rock socket length equal to 1.5 times the rock socket diameter been used, as per BDM 305.5.2? | X | |
| 25 Generally, bedrock sockets are 6" smaller in diameter than the soil embedment section of the drilled shaft. Has this factor been accounted for in the drilled shaft design? | X | |
| 26 If scour is predicted, has shaft resistance in the scour zone been neglected? | ✓ | |
| 27 Has the site been assessed for groundwater influence? | X | |
| a. If yes, and if artesian flow is a potential concern, does the design address control of groundwater flow during construction? | X | |
| 28 Have all the proper items been included in the plans for integrity testing? | X | Plans to be prepared by others. |
| 29 If special construction features (e.g., slurry, casing, load tests) are required, have all the proper items been included in the plans? | X | |
| 30 If necessary, have wet construction methods been specified? | X | |
| **General** | (Y/N/X) | Notes: |
| 31 Has the need for load testing of the foundations been evaluated? | X | |
| a. If needed, have details and plan notes for load testing been included in the plans? | X | |

## VI.B. Geotechnical Reports

| C-R-S: | OTT 53 11.67 | PID: | 110859 | Reviewer: | IJH | Date: | 5/31/2022 |
|---|---|---|---|---|---|---|---|

| General | | (Y/N/X) | Notes: |
|---|---|---|---|
| 1 | Has an electronic copy of all geotechnical submissions been provided to the District Geotechnical Engineer (DGE)? | Y | |
| 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'? | Y | This is a draft Submittal |
| 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. | Y | gINT Project File is being be submitted with this final report. |
| 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 | |
| 11 | Do the Appendices include reports of undisturbed test data as described in Section 705.8.3 of the SGE? | Y | |
| 12 | Do the Appendices include calculations in a logical format to support recommendations as described in Section 705.8.4 of the SGE? | Y | |