

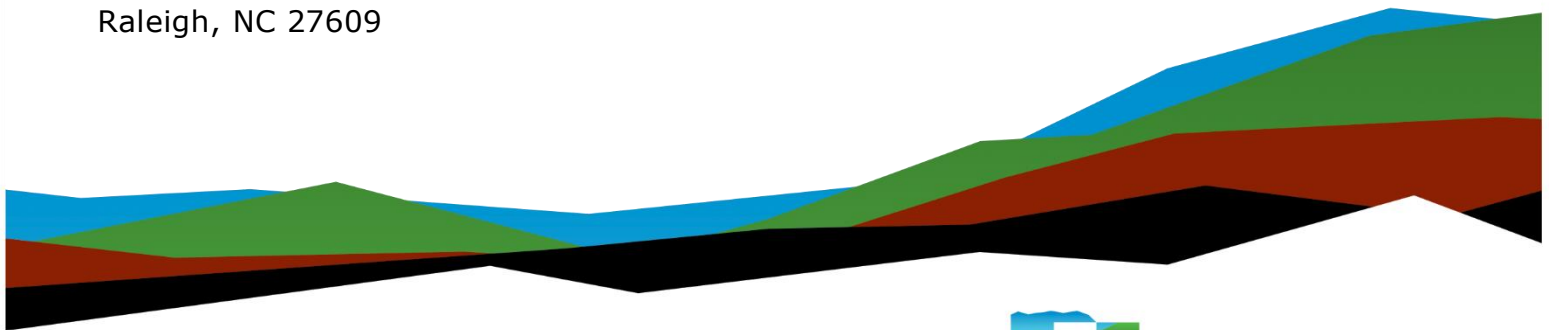
S-23-40 (Pace Bridge Road) Bridge Replacement over South Saluda River Greenville County, SC

Geotechnical Subsurface Data Report

October 30, 2024 | SCDOT Project ID: P041160
Terracon Project No.: 8623P180 Revision 1

Prepared for:

HNTB Corporation
343 E. Six Forks Road, Suite 200
Raleigh, NC 27609





72 Pointe Circle
Greenville, SC 29615
P (864) 292-2901
[Terracon.com](https://www.terracon.com)

October 30, 2024

HNTB Corporation
343 E. Forks Road, Suite 200
Raleigh, NC 27609

Attn: Mr. Spencer Franklin, PE, Senior Vice President
P: 919-546-8997

Re: Geotechnical Subsurface Data Report
S-23-40 Bridge Replacement over South Saluda River
Greenville County, South Carolina
SCDOT Project ID.: P041160
Terracon Project No.: 8623P180 Revision 1

Dear Mr. Franklin:

Terracon Consultants Inc. (Terracon) has completed the exploration, testing and limited engineering analysis services (contained in the geotechnical baseline report) for the above referenced project. The services were conducted in general accordance with our Task Order Number 001, dated May 25, 2023.

Introduction

HNTB Corporation (HNTB) has contracted Terracon to perform subsurface exploration, laboratory testing and limited preliminary engineering recommendations for the replacement of the S-23-40 bridge over South Saluda River in Greenville County, South Carolina. This will be a complete bridge replacement within the project existing alignment. This GSDR was prepared in general accordance with the 2022 SCDOT Geotechnical Design Manual (GDM) and Preconstruction Design Memorandum (PCDM) 11 - Supplemental Design Criteria for Low Volume Bridge Replacement Projects.

Project Description

The project site is located at the S-23-40 (Pace Bridge Road) crossing over South Saluda River in Greenville County, South Carolina. Site location and exploration plans are presented in Appendix A of this report. Based on the conceptual plans by HNTB dated 8/30/2024, the replacement bridge will be constructed in the same general alignment as the current bridge. The current plan indicates the new bridge will be a 150-ft long two-span bridge constructed

with AASHTO Type BIII-36 Box Beams for span A and a prestressed concrete cored slab for span B.

Geotechnical Testing

The geotechnical exploration for this project was performed between August 20 and August 21, 2024. The results of our fieldwork and our associated laboratory testing are included in Appendices A and B.

Field Exploration

Our field exploration consisted of the following:

- Three (3) Standard Penetration Test (SPT) Borings (S-23-40-1, S-23-40-2, and S-23-40-3)
- Two (2) offset borings near S-23-40-1 and S-23-40-3 for bulk sample collection

The tests were performed at the approximate locations as approved by SCDOT. A description of our testing methods and graphical logs outlining the soil conditions at each test location are presented in Appendix A. The test locations were established in the field by Terracon and surveyed by Thomas & Hutton after completion. The station and offset are based on the plans provided at the time the tests were performed.

Laboratory Testing

The following laboratory tests were performed on the soil samples collected at the site.

- Twenty-four (24) Natural Moisture Content Tests
- Six (6) Atterberg Limits Tests
- Eight (8) Fines Content Tests
- Four (4) Grain Size Tests with Hydrometer
- One (1) Remolded, Consolidated-Undrained (CU) Triaxial Compression Test with Pore Pressure Readings
- One (1) Standard Proctor Test
- One (1) Corrosivity Suite (pH, chloride content, sulfate content, and resistivity tests)

The general scope of the laboratory testing frequency was determined by the SCDOT. The laboratory testing assignment was performed by our engineers. The laboratory procedures and results of the laboratory tests are presented in Appendix B.

Geotechnical Subsurface Data Report

S-23-40 BRO South Saluda River | Greenville County, SC

October 30, 2024 | Terracon Project No. 8623P180R1 | SCDOT Project ID: P041160



Closure

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or we may be of further service, please contact us.

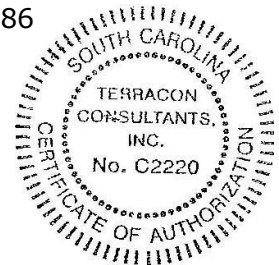
Sincerely,

Terracon Consultants, Inc.

A handwritten signature in black ink that reads 'Maggie McKenney'.

Maggie McKenney, EIT
Senior Staff Engineer

Jonathan Ard, PE
Manager Regional Services
SC Registration No. 30886



Appendix A

Field Exploration

Exhibit A-1 – Site Location Map

Exhibit A-2 – Exploration Plans (2 Pages)

Exhibit A-3 – Summary of Boring Data

Exhibit A-4 – GeoScoping Form (2 Pages)

Exhibit A-5 – Field Exploration Description (2 Pages)

Exhibit A-6 – Soil Description Terms

Exhibit A-7 – Soil/Rock Symbols

Exhibit A-8 – Boring Logs (6 Pages)

Note: All exhibits are one page unless noted above

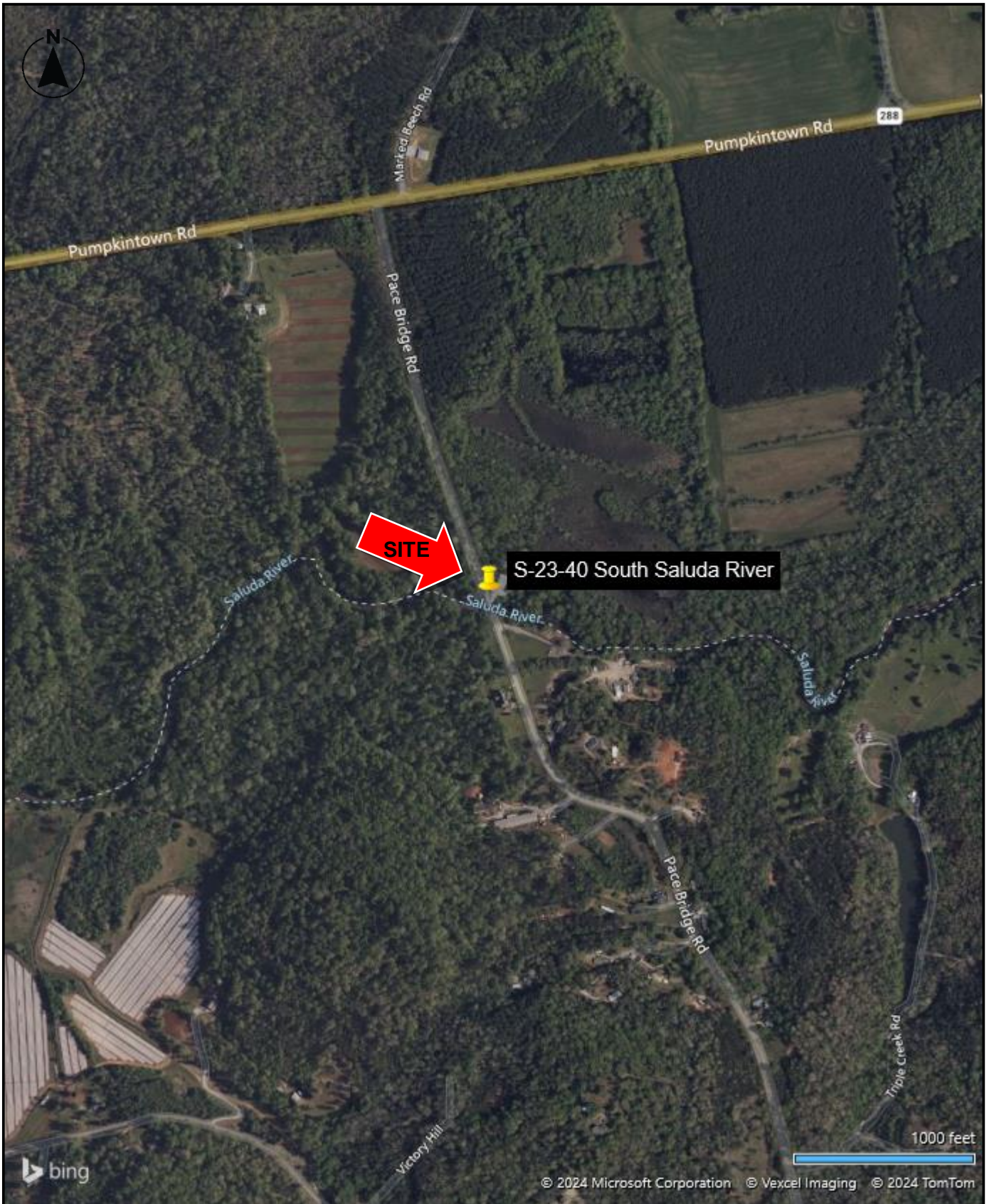


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND
IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED
BY MICROSOFT BING MAPS



| | | | | | |
|----------------|-----------|--|---|--|--------------------|
| Project Number | 8623P180 |  72 Pointe Cir Greenville, South Carolina 29615 | SITE LOCATION | | Exhibit A-1 |
| Scale | AS SHOWN | | S-23-40 BRO South Saluda River Pace Bridge Road Greenville County, SC | | |
| Client | HNTB | | | | |
| Date | 9/20/2024 | | | | |



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND
IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED
BY MICROSOFT BING MAPS

| | |
|----------------|-----------|
| Project Number | 8623P180 |
| Scale | AS SHOWN |
| Client | HNTB |
| Date | 9/20/2024 |



72 Pointe Cir
Greenville, South Carolina 29615

| EXPLORATION PLAN |
|---|
| S-23-40 BRO South Saluda River Pace Bridge Road Greenville County, SC |

| |
|---------|
| Exhibit |
| A-2 |

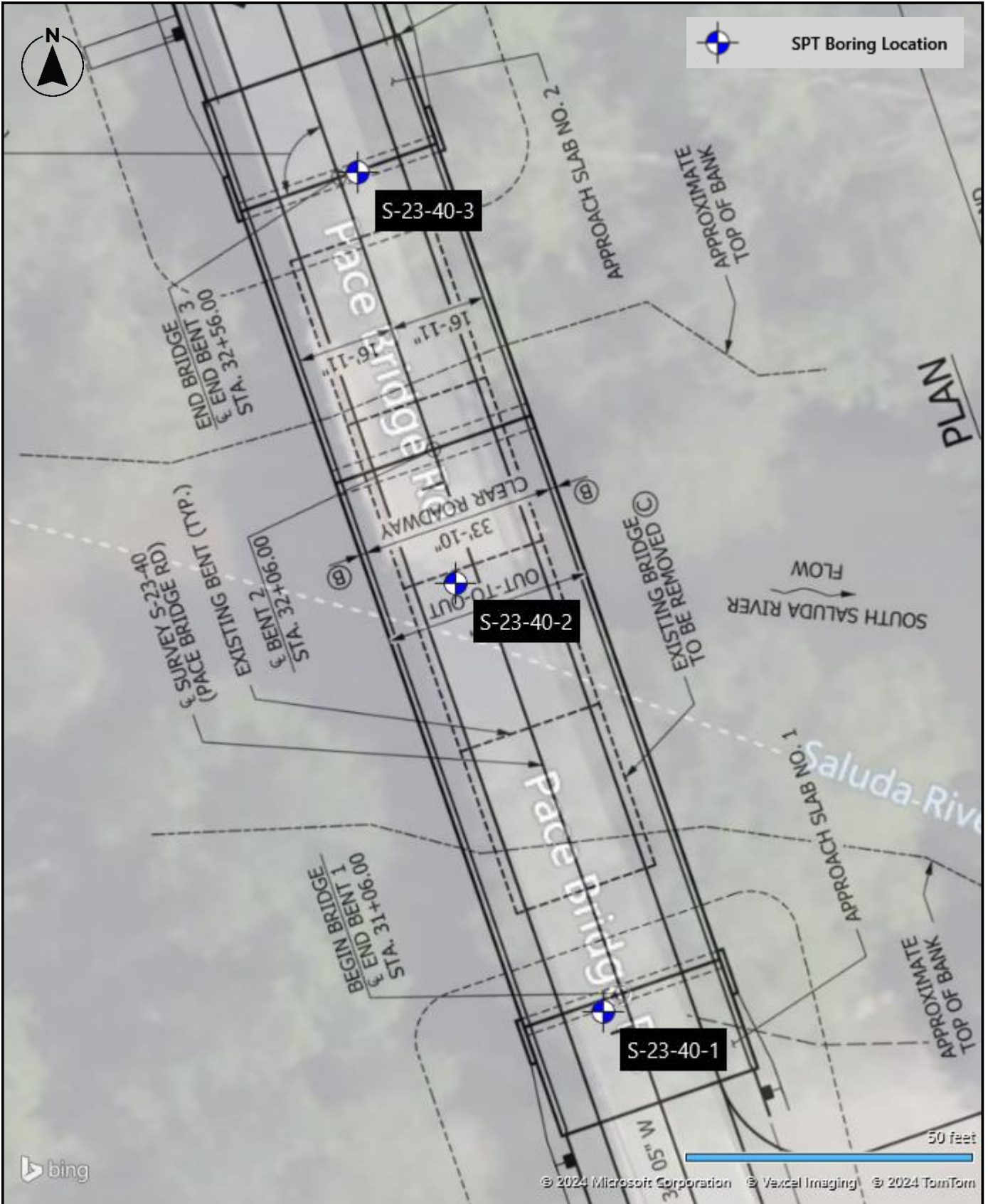


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

PRELIMINARY SITE PLAN PROVIDED BY HNTB

| | |
|----------------|-----------|
| Project Number | 8623P180 |
| Scale | AS SHOWN |
| Client | HNTB |
| Date | 9/20/2024 |



72 Pointe Cir
Greenville, South Carolina 29615

EXPLORATION PLAN

S-23-40 BRO South Saluda River
Pace Bridge Road
Greenville County, SC

Exhibit

A-2

Summary of Boring Data – Exhibit A-3

S-23-40 Bridge Replacement over South Saluda River | Greenville County, SC
Terracon Project No. 8623P180 | SCDOT Project ID: P041160



Summary of Boring Data

| Boring No. | Ground Elevation (ft) | Test Depth (ft) | Northing (ft) | Easting (ft) | Latitude (°) | Longitude (°) | Station (ft) ¹ | Offset (ft) ¹ |
|---------------------------|-----------------------|-----------------|---------------|--------------|--------------|---------------|---------------------------|--------------------------|
| S-23-40-1 ^{2, 3} | 917 | 100 | 1160199.42 | 1529669.78 | 35.012103 | -82.570559 | 31+04 | 4 L |
| S-23-40-2 | 917.5 | 100 | 1160273.90 | 1529645.30 | 35.012307 | -82.570645 | 31+83 | 4 L |
| S-23-40-3 ² | 917.2 | 100 | 1160345.21 | 1529629.35 | 35.012502 | -82.570702 | 32+56 | 4 R |

1. Plans were provided by HNTB after the field exploration and survey. Station and offset values are estimated based on overlay in Google Earth TM.
2. A composite bulk sample was collected about 14 feet south of S-23-40-1 and 8.5 feet west of S-23-40-3.
3. Boring S-23-40-1 was not surveyed due to a dirt mound being placed at the boring location after testing was completed. Testing location values are based on field measurements taken at the time of drilling.
4. Station and offset are based on the plans provided at the time the tests were performed.

GeoScoping Form

| PROJECT INFORMATION | | | |
|---------------------|-------------|---------------|------------------|
| Project ID: | P041160 | Date of Trip: | 8/21/2024 |
| County: | Greenville | Location: | Marietta |
| Rd/ Route: | S-23-40 | Local Name: | Pace Bridge Road |
| Attendees: | M. McKenney | | |

| EXISTING BRIDGE INFORMATION | | | |
|--|------------------------------|--|--------------------------|
| Bridge Length: | 120 ft | Bridge Width: | 26 ft |
| Superstructure Type: | Concrete framing and decking | Substructure Type: | Timber and Steel H-Piles |
| Begin Bridge Sta ¹ : | 31+06 | End Bridge Sta ¹ : | 32+56 |
| Begin Bridge Embankment Sta ¹ : | 30+06 | End Bridge Embankment Sta ¹ : | 33+56 |
| Structure Number: | 02540 | Posted Weight Limit: | 11 tons |
| Crossing: | South Saluda River | Skew: | N/A |
| Latitude: | 35.01233° | Longitude: | -82.57065° |
| Existing Fill Height: | approx. 8 ft | Approx Existing Slope Angle: | 2H:1V |

1. Begin & End Bridge Embankment 100 ft down Sta. or up Sta., respectively. Sta. estimated from overlay of bridge plan provided by HNTB.

| EXISTING ROADWAY EMBANKMENT INFORMATION | | | |
|---|---|------------------------------|----------|
| Begin Project Sta: | 29+60 | Begin Bridge Embankment Sta: | 30+06 |
| Accessibility Issues: | Dirt mounds | | |
| Ground Cover: | Asphalt pavement and vegetation along shoulders | | |
| Existing Fill Height: | 8 feet, sloping | Approx Existing Slope Angle: | 2H:1V |
| Local Development: | developed - residential | | |
| Topography: | slope to river | | |
| Traffic Control Necessary: | No | | |
| Surface Soils: | silty sand / clayey sand | Muck: | No |
| Exposed Rock in Stream Bed: | No | Exposed Rock in banks: | No |
| Wetlands on Site: | Yes | Wetland Adjacent: | Yes |
| Depth FG to Water: | 14 ft | Water Depth: | 2 ft |
| Depth to Existing Ground: | approx. 16 ft at center of bridge | | |
| Scour Condition at EB: | Critical | Scour Condition at IB: | Critical |

| | | | |
|-----------------------------|---|------------------------------|----------|
| End Bridge Embankment Sta: | 33+56 | End Project Sta: | 33+56 |
| Accessibility Issues: | Dirt mounds | | |
| Ground Cover: | Asphalt pavement and vegetation along shoulders | | |
| Existing Fill Height: | 8 feet, sloping | Approx Existing Slope Angle: | 2H:1V |
| Local Development: | developed - residential | | |
| Topography: | slope to river | | |
| Traffic Control Necessary: | No | | |
| Surface Soils: | silty sand / clayey sand | Muck: | No |
| Exposed Rock in Stream Bed: | No | Exposed Rock in banks: | No |
| Wetlands on Site: | Yes | Wetland Adjacent: | Yes |
| Depth FG to Water: | 14 ft | Water Depth: | 2 ft |
| Depth to Existing Ground: | approx. 16 ft at center of bridge | | |
| Scour Condition at EB: | Critical | Scour Condition at IB: | Critical |

GeoScoping Form

| UTILITIES INFORMATION | |
|-----------------------|---|
| Attached: | N/A |
| Above Ground: | Overhead power was observed along the west side of the road |
| Underground: | N/A |

| Comments: |
|-----------|
| |

Field Exploration Description

Overview

The testing locations were proposed to and approved by SCDOT and located in the field by Terracon using measurements from existing structures shown on the provided drawings. The borings were surveyed by Thomas and Hutton, LLC after testing and drilling was complete. Boring S-23-40-1 was not surveyed due to a dirt mound being placed at the boring location prior to the survey being completed. The locations as shown in the Exploration Plan are shown to the scale indicated.

A field log of each test location was prepared by our engineer. The final boring logs included with this report represent the engineer's description of the encountered conditions modified as necessary based on laboratory test results of the individual samples.

Soil Test Borings (STB)

All boring and sampling operations were conducted in general accordance with the following procedures:

- SCDOT Geotechnical Design Manual 2022
- Preconstruction Design Memorandum (PCDM) 11 - Supplemental Design Criteria for Low Volume Bridge Replacement Projects
- ASTM D5783, "Standard Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geo-environmental Exploration"
- ASTM D6151, "Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling"
- ASTM D1586 "Test Method for Penetration Test and Split-Barrel Sampling of Soils"
- ASTM D4220 "Standard Practices for Preserving and Transporting Soil"

Each soil test boring was advanced using rotary wash drilling techniques. The initial sampling program is summarized in the following table:

| Test ID | Total Depth | Interval of Continuous Sampling |
|-----------------------|-------------|---------------------------------|
| S-23-40-1 | 100 feet | 2 to 10 feet |
| S-23-40-2 | 100 feet | 16 to 26 feet |
| S-23-40-3 | 100 feet | 2 to 10 feet |
| S-23-40-1/3 Offset | 5 feet | Bulk Sample ¹ |

1. Bulk sample was obtained with 2 ¼-inch Hollow Stem Auger (HSA).

Soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel sampler, also known as a standard split-spoon. The sampler is advanced into the soil a total of 18 to 24 inches by striking the drill rod using a 140-pound automatic hammer falling 30 inches.

Exhibit A-5 – Field Exploration Description

S-23-40 BRO South Saluda River | Greenville County, SC
Terracon Project No. 8623P180 | SCDOT Project ID: P041160



The number of blows required to advance the sampler for each of three to four, 6-inch increments is recorded. The sum of the number of blows for the second and third increments is called the "Standard Penetration Value", or N-value (N_{meas} , blows per foot). The N-value, when properly evaluated, is an index to the soil strength.

Soil classification provides a general guide to the engineering properties of various soil types and enables the engineer to apply his experience to current situations. In our exploration, samples obtained during drilling operations are examined and visually classified by a geotechnical engineer using the procedures outlined in ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System). Laboratory testing was also performed on select split-spoon samples to evaluate index properties for further classification. The soils are described according to color, texture, and relative density or consistency (based on standard penetration resistance). The designations shown on the logs are described in the 2022 SCDOT Geotechnical Design Manual, Chapter 6.

The borings were advanced to the planned drilling depth at which they were terminated. As practical, groundwater readings were collected from each of the soil test borings after 24 hours. These water levels are indicated on the boring logs. The borings were advanced using mud rotary drilling techniques. As the drilling method introduces water into the borehole, time-of-drilling water levels may not be reliable.

At the conclusion of the work, the boreholes were backfilled with the drill cuttings and clean sand. The upper 20 feet of those in the embankments were grouted with a cement bentonite grout and capped with cold-patch asphalt.

SOIL DESCRIPTION TERMS

Relative Density/Consistency Terms

| <u>Relative Density</u> ¹ | | | <u>Consistency</u> ² | | |
|--------------------------------------|------------------|----------------|---------------------------------|---|----------------|
| Descriptive Term | Relative Density | SPT Blow Count | Descriptive Term | Unconfined Compression Strength (q _u) (tsf) | SPT Blow Count |
| Very Loose | 0 to 15% | 4 and less | Very Soft | 0.25 and less | 2 and less |
| Loose | 16 to 35% | 5 to 10 | Soft | 0.26 to 0.50 | 3 to 4 |
| Medium Dense | 36 to 65% | 11 to 30 | Firm | 0.51 to 1.00 | 5 to 8 |
| Dense | 66 to 85% | 31 to 50 | Stiff | 1.01 to 2.00 | 9 to 15 |
| Very Dense | 86 to 100% | 51 and more | Very Stiff | 2.01 to 4.00 | 16 to 30 |
| | | | Hard | 4.01 and more | 31 and more |

Moisture Condition

| <u>Descriptive Term</u> | <u>Criteria</u> |
|-------------------------|---|
| Dry | Absence of moisture, dusty, dry to the touch |
| Moist | Damp but no visible water |
| Wet | Visible free water, usually in coarse-grained soils below the water table |

Color

Describe the sample color while sample is still moist.

Angularity¹

| <u>Descriptive Term</u> | <u>Criteria</u> |
|-------------------------|---|
| Angular | Particles have sharp edges and relatively plane sides with unpolished surfaces. |
| Subangular | Particles are similar to angular description but have rounded edges. |
| Subrounded | Particles have nearly plane sides but have well-rounded corners and edges. |
| Rounded | Particles have smoothly curved sides and no edges. |

HCl Reaction³

| <u>Descriptive Term</u> | <u>Criteria</u> |
|-------------------------|--|
| None Reactive | No visible reaction |
| Weakly Reactive | Some reaction, with bubbles forming slowly |
| Strongly Reactive | Violent reaction, with bubbles forming immediately |

Cementation³

| <u>Descriptive Term</u> | <u>Criteria</u> |
|-------------------------|--|
| Weakly Cemented | Crumbles or breaks with handling or little finger pressure |
| Cemented | Crumbles or breaks with considerable finger pressure |
| Strongly Cemented | Will not crumble or break with finger pressure |

Particle-Size Range¹

| <u>Gravel</u> | Diameter, mm | Sieve Size | <u>Sand</u> | Diameter, mm | Sieve Size |
|---------------|--------------|------------------|-------------|---------------|-------------|
| Fine | 4.76 to 19.1 | #4 to ¾ inch | Fine | 0.074 to 0.42 | #200 to #40 |
| Coarse | 19.1 to 76.2 | ¾ inch to 3 inch | Medium | 0.42 to 2.00 | #40 to #10 |
| | | | Coarse | 4.00 to 4.76 | #10 to #4 |

Primary Soil Type^{1, 2}

The primary soil type will be shown in all capital letters.

USCS Soil Designation

Indicate USCS soil designation as defined in ASTM D-2487 and D-2488

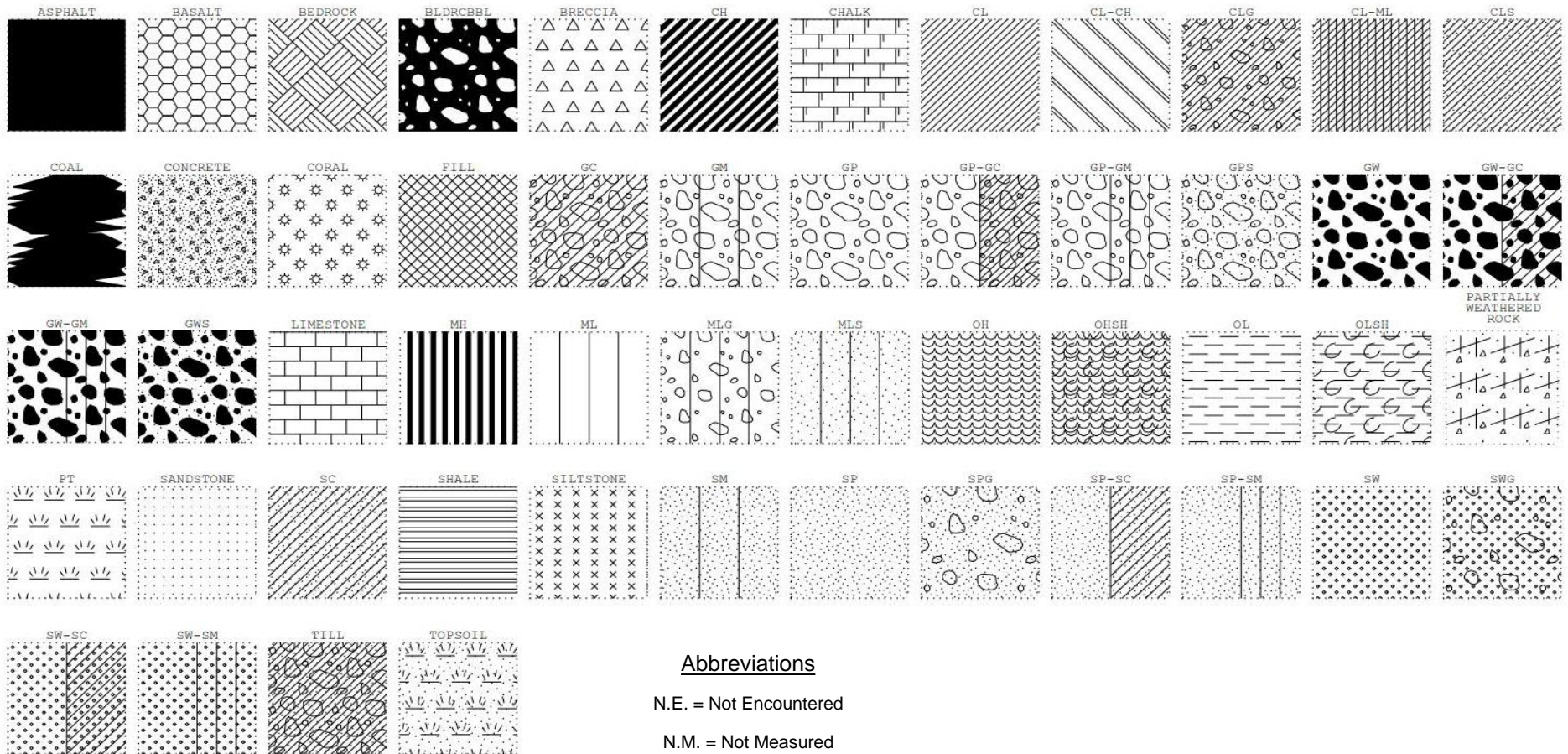
AASHTO Soil Designation

Indicate AASHTO soil designation as defined in AASHTO M-145 and ASTM D-3282

¹Applies to coarse-grained soils (major portion retained on No. 200 sieve)

²Applies to fine-grained soils (major portion passing No. 200 sieve)

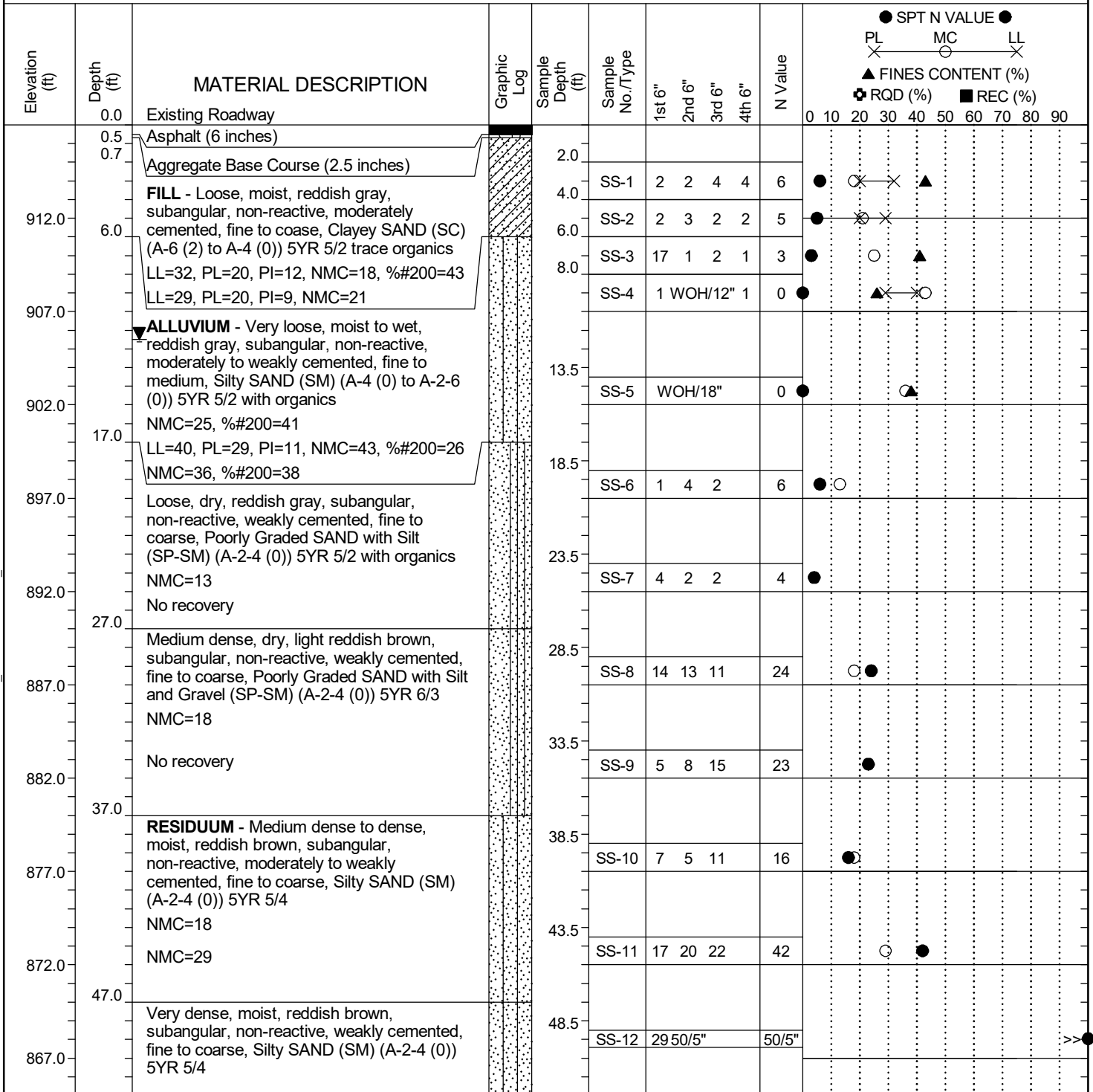
³Use as required



| | | | | | |
|------------------|-----|-------------|-------------------|--|---|
| Project Manager: | MEM | Project No. | 8623P180 | <div> </div> <div> 72 Pointe Circle Greenville, SC 29615 PH. (864) 292-2901 FAX. (864) 292-6361 </div> | <div> SOIL AND ROCK SYMBOLS </div> <div> Exhibit A-7 </div> |
| Drawn by: | KJZ | Scale: | N.T.S. | | |
| Checked by: | SG | File Name: | Soil – Rock – Log | | |
| Approved by: | DJC | Date: | Jul 2023 | | |

SCDOT Soil Test Log

| | | | | | |
|---------------------------------|--------------------------------|------------------------------|------------------------------|---------------------|--------------------------|
| Project ID: | P041160 | County: | Greenville | Boring No.: | S-23-40-1 |
| Site Description: | S-23-40 BRO South Saluda River | | | Route: | S-23-40 |
| Eng./Geo.: | S. Greaber | Boring Location: | 31+04 | Offset: | 4 L |
| Elev.: | 917.0 ft | Latitude: | 35.0121 | Longitude: | -82.57056 |
| Date Started: | 8/20/2024 | | | | |
| Total Depth: | 100 ft | Soil Depth: | 100 ft | Core Depth: | 0 ft |
| Date Completed: | 8/20/2024 | | | | |
| Bore Hole Diameter (in): | 4 | Sampler Configuration | Liner Required: Y (N) | | Liner Used: Y (N) |
| Drill Machine: | DR#554 | Drill Method: | RW | Hammer Type: | Automatic |
| Energy Ratio: | 88.5% | | | | |
| Core Size: | N/A | Driller: | G. Robinson | Groundwater: | TOB N.M. |
| 24HR | 11.5 ft | | | | |



LEGEND

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| SAMPLER TYPE | | DRILLING METHOD | |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings | CFA - Continuous Flight Augers | RC - Rock Core |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube | DC - Driving Casing | |

SCDOT Soil Test Log

| | | | | | |
|---------------------------------|--------------------------------|------------------------------|------------------------------|---------------------|--------------------------|
| Project ID: | P041160 | County: | Greenville | Boring No.: | S-23-40-1 |
| Site Description: | S-23-40 BRO South Saluda River | | | Route: | S-23-40 |
| Eng./Geo.: | S. Greaber | Boring Location: | 31+04 | Offset: | 4 L |
| Elev.: | 917.0 ft | Latitude: | 35.0121 | Longitude: | -82.57056 |
| Date Started: | 8/20/2024 | | | | |
| Total Depth: | 100 ft | Soil Depth: | 100 ft | Core Depth: | 0 ft |
| Date Completed: | 8/20/2024 | | | | |
| Bore Hole Diameter (in): | 4 | Sampler Configuration | Liner Required: Y (N) | | Liner Used: Y (N) |
| Drill Machine: | DR#554 | Drill Method: | RW | Hammer Type: | Automatic |
| Energy Ratio: | 88.5% | | | | |
| Core Size: | N/A | Driller: | G. Robinson | Groundwater: | TOB N.M. |
| 24HR | 11.5 ft | | | | |

| Elevation (ft) | Depth (ft) | MATERIAL DESCRIPTION | Graphic Log | Sample Depth (ft) | Sample No./Type | 1st 6" | 2nd 6" | 3rd 6" | 4th 6" | N Value | <div> <div> ● SPT N VALUE ● </div> <div> PL X MC X LL X </div> <div> ▲ FINES CONTENT (%) </div> <div> ⊕ RQD (%) ■ REC (%) </div> </div> |
|----------------|------------|-------------------------------|-------------|-------------------|-----------------|--------|--------|--------|--------|---------|---|
| 862.0 | | | | 53.5 | SS-13 | 20 | 50/5" | | 50/5" | | >>● |
| 857.0 | | | | 58.5 | SS-14 | 50/5" | | | 50/5" | | >>● |
| 852.0 | | | | 63.5 | SS-15 | 50/5" | | | 50/5" | | >>● |
| 847.0 | | | | 68.5 | SS-16 | 50/3" | | | 50/3" | | >>● |
| 842.0 | | | | 73.5 | SS-17 | 50/3" | | | 50/3" | | >>● |
| 837.0 | | No recovery | | 78.5 | SS-18 | 50/2" | | | 50/2" | | >>● |
| 832.0 | | | | 83.5 | SS-19 | 50/2" | | | 50/2" | | >>● |
| 827.0 | | | | 88.5 | SS-20 | 50/2" | | | 50/2" | | >>● |
| 822.0 | | | | 93.5 | SS-21 | 50/2" | | | 50/2" | | >>● |
| 817.0 | 100.0 | BORING TERMINATED AT 100 FEET | | 98.5 | SS-22 | 50/2" | | | 50/2" | | >>● |

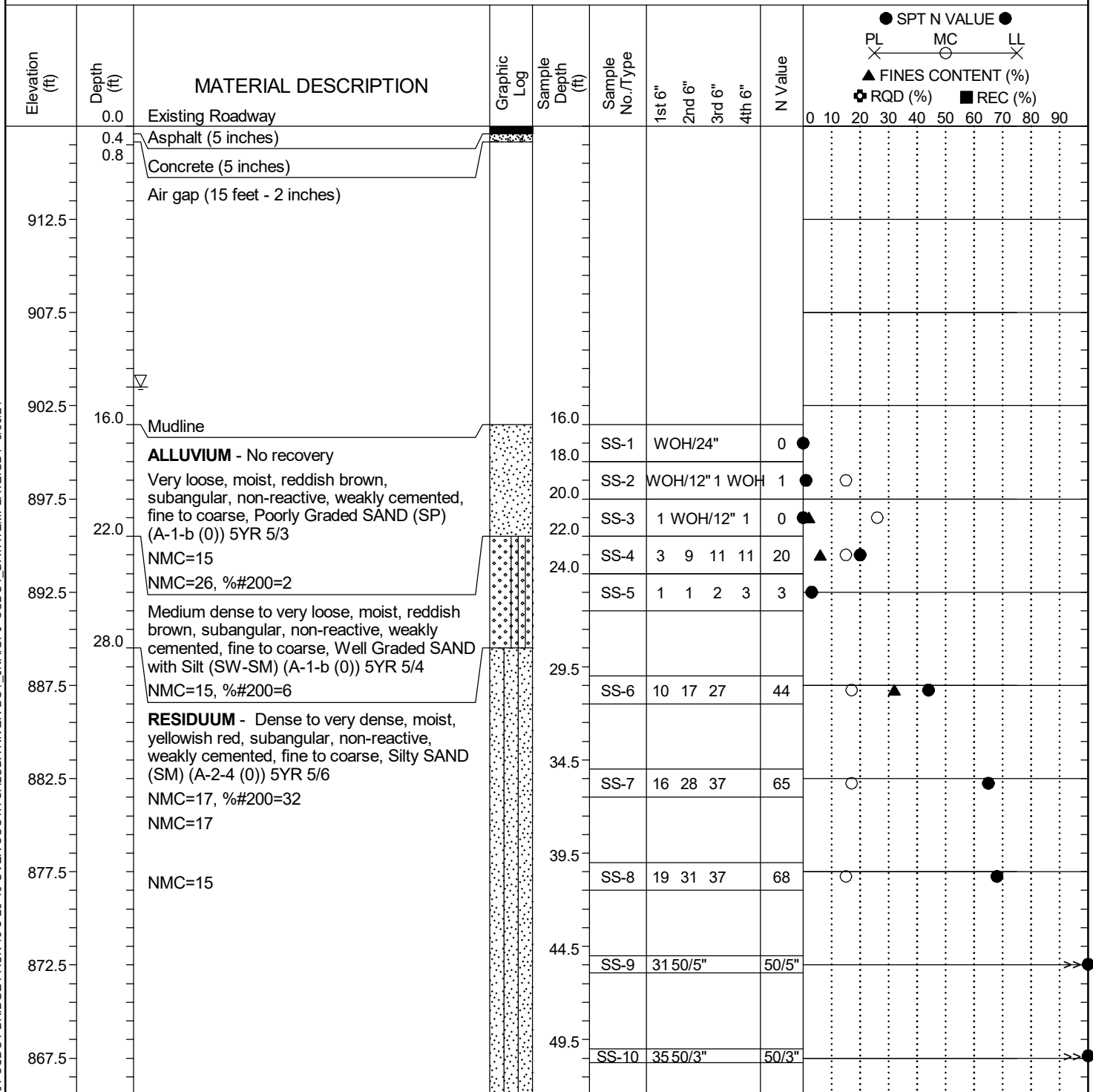
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| SAMPLER TYPE | | DRILLING METHOD | |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings | CFA - Continuous Flight Augers | RC - Rock Core |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube | DC - Driving Casing | |

SC.DOT 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT_JNA.GPJ SCDOT_DATATEMPLATE.GDT 9/30/24

SCDOT Soil Test Log

| | | | | | | | | | | | |
|---------------------------------|--------------------------------|--|------------------------------|-------------|----------------|------------------------|------------|--------------------|------------------------|-------------|------|
| Project ID: | P041160 | | | | County: | Greenville | | Boring No.: | S-23-40-2 | | |
| Site Description: | S-23-40 BRO South Saluda River | | | | | | | Route: | S-23-40 | | |
| Eng./Geo.: | S. Greaber | | Boring Location: | 31+83 | | Offset: | 4 L | | Alignment: | Existing | |
| Elev.: | 917.5 ft | | Latitude: | 35.01231 | | Longitude: | -82.57065 | | Date Started: | 8/20/2024 | |
| Total Depth: | 100 ft | | Soil Depth: | 100 ft | | Core Depth: | 0 ft | | Date Completed: | 8/21/2024 | |
| Bore Hole Diameter (in): | 4 | | Sampler Configuration | | | Liner Required: | Y (N) | | Liner Used: | Y (N) | |
| Drill Machine: | DR#1327 | | Drill Method: | RW | | Hammer Type: | Automatic | | Energy Ratio: | 92.6% | |
| Core Size: | N/A | | Driller: | B. Burnette | | Groundwater: | TOB | 14 ft | | 24HR | N.M. |



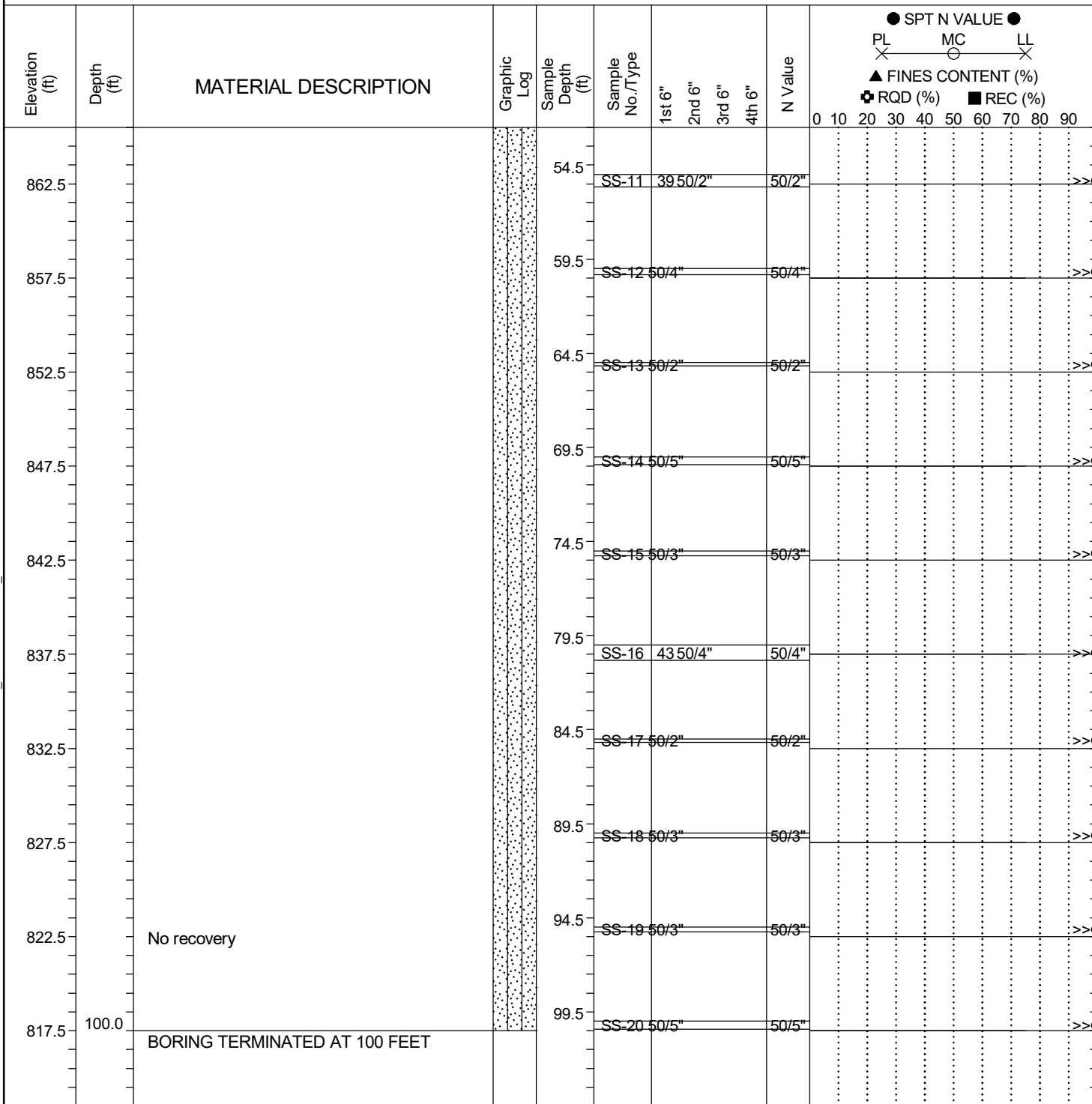
LEGEND

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| SAMPLER TYPE | | DRILLING METHOD | |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings | CFA - Continuous Flight Augers | RC - Rock Core |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube | DC - Driving Casing | |

SCDOT Soil Test Log

| | | | | | | | |
|---|--|-------------------------------|--|-------------------------------|--|----------------------------------|--|
| Project ID: P041160 | | | | County: Greenville | | Boring No.: S-23-40-2 | |
| Site Description: S-23-40 BRO South Saluda River | | | | Route: S-23-40 | | | |
| Eng./Geo.: S. Greaber | | Boring Location: 31+83 | | Offset: 4 L | | Alignment: Existing | |
| Elev.: 917.5 ft | | Latitude: 35.01231 | | Longitude: -82.57065 | | Date Started: 8/20/2024 | |
| Total Depth: 100 ft | | Soil Depth: 100 ft | | Core Depth: 0 ft | | Date Completed: 8/21/2024 | |
| Bore Hole Diameter (in): 4 | | Sampler Configuration | | Liner Required: Y (N) | | Liner Used: Y (N) | |
| Drill Machine: DR#1327 | | Drill Method: RW | | Hammer Type: Automatic | | Energy Ratio: 92.6% | |
| Core Size: N/A | | Driller: B. Burnette | | Groundwater: TOB 14 ft | | 24HR N.M. | |



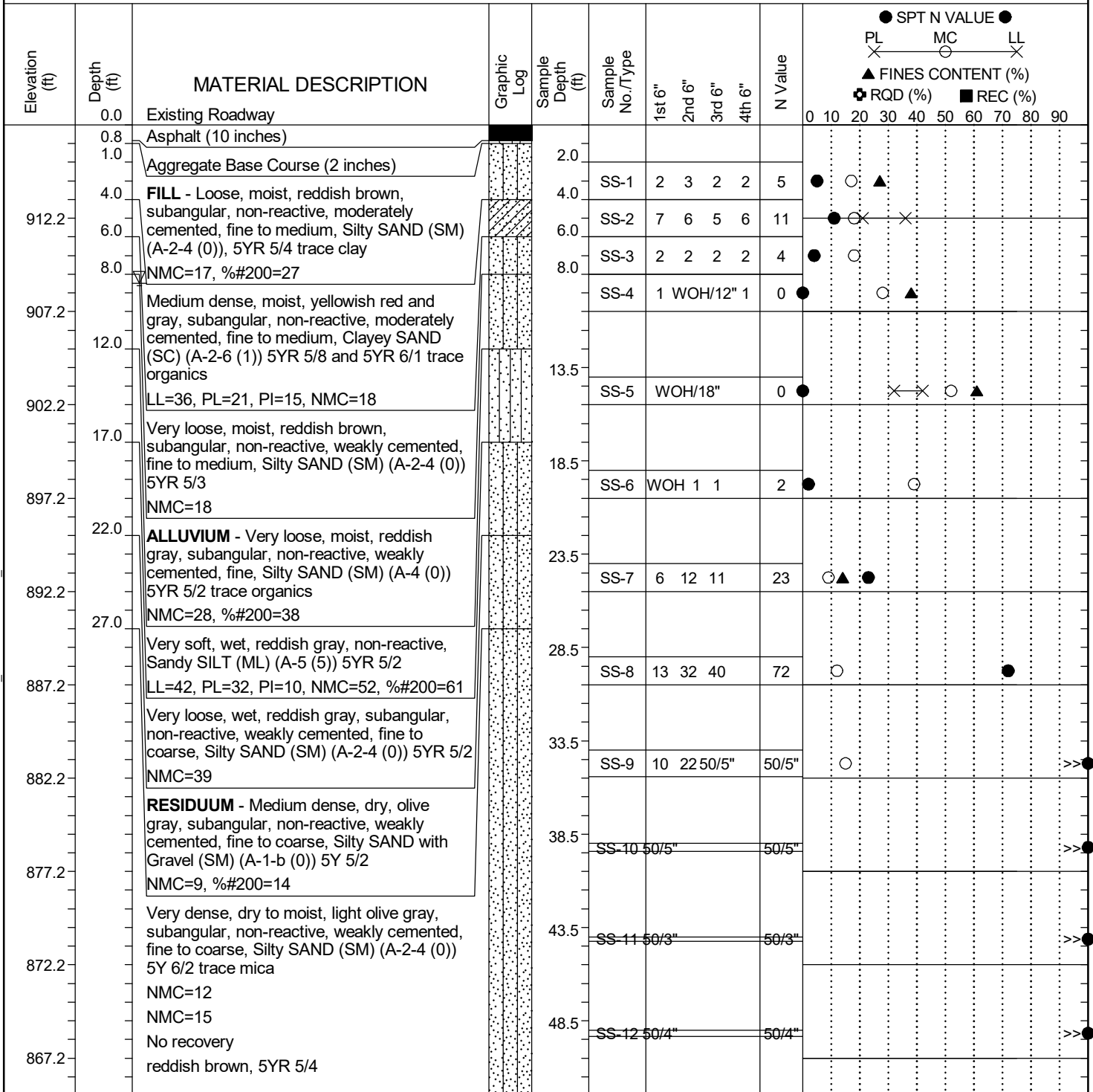
LEGEND

| SAMPLER TYPE | | DRILLING METHOD | |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings | CFA - Continuous Flight Augers | RC - Rock Core |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube | DC - Driving Casing | |

SC.DOT 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT_JNA.GPJ SCDOT_DATATEMPLATE.GDT 9/30/24

SCDOT Soil Test Log

| | | | | | |
|---------------------------------|--------------------------------|------------------------------|------------------------------|---------------------|-------------------------------|
| Project ID: | P041160 | County: | Greenville | Boring No.: | S-23-40-3 |
| Site Description: | S-23-40 BRO South Saluda River | | | Route: | S-23-40 |
| Eng./Geo.: | S. Greaber | Boring Location: | 32+56 | Offset: | 4 R |
| Elev.: | 917.2 ft | Latitude: | 35.0125 | Longitude: | -82.5707 |
| Date Started: | 8/21/2024 | | | | |
| Total Depth: | 100 ft | Soil Depth: | 100 ft | Core Depth: | 0 ft |
| Date Completed: | 8/21/2024 | | | | |
| Bore Hole Diameter (in): | 4 | Sampler Configuration | Liner Required: Y (N) | | Liner Used: Y (N) |
| Drill Machine: | DR#554 | Drill Method: | RW | Hammer Type: | Automatic |
| Energy Ratio: | 88.5% | | | | |
| Core Size: | N/A | Driller: | G. Robinson | Groundwater: | TOB 8.5 (After 1hr) 24HR N.M. |



LEGEND

Continued Next Page

| | |
|-------------------------|--------------------------------|
| SAMPLER TYPE | DRILLING METHOD |
| SS - Split Spoon | HSA - Hollow Stem Auger |
| UD - Undisturbed Sample | RW - Rotary Wash |
| AWG - Rock Core, 1-1/8" | CFA - Continuous Flight Augers |
| NQ - Rock Core, 1-7/8" | RC - Rock Core |
| CU - Cuttings | DC - Driving Casing |
| CT - Continuous Tube | |

SCDOT Soil Test Log

| | | | | | |
|---------------------------------|--------------------------------|------------------------------|------------------------------|---------------------|-------------------------------|
| Project ID: | P041160 | County: | Greenville | Boring No.: | S-23-40-3 |
| Site Description: | S-23-40 BRO South Saluda River | | | Route: | S-23-40 |
| Eng./Geo.: | S. Greaber | Boring Location: | 32+56 | Offset: | 4 R |
| Elev.: | 917.2 ft | Latitude: | 35.0125 | Longitude: | -82.5707 |
| Total Depth: | 100 ft | Soil Depth: | 100 ft | Core Depth: | 0 ft |
| Date Started: | 8/21/2024 | | | | |
| Date Completed: | 8/21/2024 | | | | |
| Bore Hole Diameter (in): | 4 | Sampler Configuration | Liner Required: Y (N) | | Liner Used: Y (N) |
| Drill Machine: | DR#554 | Drill Method: | RW | Hammer Type: | Automatic |
| Energy Ratio: | 88.5% | | | | |
| Core Size: | N/A | Driller: | G. Robinson | Groundwater: | TOB 8.5 (After 1hr) 24HR N.M. |

| Elevation (ft) | Depth (ft) | MATERIAL DESCRIPTION | Graphic Log | Sample Depth (ft) | Sample No./Type | 1st 6" | 2nd 6" | 3rd 6" | 4th 6" | N Value | <div> ● SPT N VALUE ● PL X MC X LL X ▲ FINES CONTENT (%) ⊕ RQD (%) ■ REC (%) </div> |
|----------------|------------|-------------------------------|-------------|-------------------|-----------------|---------|--------|--------|--------|---------|--|
| 862.2 | | No recovery | | 53.5 | SS-13 | 50/3" | | | | 50/3" | >>● |
| 857.2 | | | | 58.5 | SS-14 | 35 | 50/4" | | | 50/4" | >>● |
| 852.2 | | | | 63.5 | SS-15 | 50/2" | | | | 50/2" | >>● |
| 847.2 | | | | 68.5 | SS-16 | 50/2" | | | | 50/2" | >>● |
| 842.2 | | | | 73.5 | SS-17 | 50/2" | | | | 50/2" | >>● |
| 837.2 | | | | 78.5 | SS-18 | 50/3" | | | | 50/3" | >>● |
| 832.2 | | | | 83.5 | SS-19 | 50/1.5" | | | | 50/1.5" | >>● |
| 827.2 | | | | 88.5 | SS-20 | 50/2" | | | | 50/2" | >>● |
| 822.2 | | | | 93.5 | SS-21 | 50/1.5" | | | | 50/1.5" | >>● |
| 817.2 | 100.0 | BORING TERMINATED AT 100 FEET | | 98.5 | SS-22 | 50/1.5" | | | | 50/1.5" | >>● |

LEGEND

| SAMPLER TYPE | | DRILLING METHOD | |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon | NQ - Rock Core, 1-7/8" | HSA - Hollow Stem Auger | RW - Rotary Wash |
| UD - Undisturbed Sample | CU - Cuttings | CFA - Continuous Flight Augers | RC - Rock Core |
| AWG - Rock Core, 1-1/8" | CT - Continuous Tube | DC - Driving Casing | |

SC.DOT 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT_JNA.GPJ SCDOT_DATATEMPLATE.GDT 9/30/24

Appendix B – Laboratory Testing

S-23-40 BRO South Saluda River | Greenville County, SC
Terracon Project No. 8623P180 | SCDOT Project ID: P041160



Appendix B

Laboratory Testing

Exhibit B-1 – Laboratory Testing Description
Summary of Laboratory Data (2 Pages)
Laboratory Data Sheets (12 Pages)

Note: All exhibits are one page unless noted above.

Exhibit B-1 – Laboratory Testing Description

S-23-40 BRO South Saluda River | Greenville County, SC
Terracon Project No. 8623P180 | SCDOT Project ID: P041160



Laboratory Testing Description

The samples collected during the field exploration were taken to our laboratory for additional testing. The laboratory testing scope was developed by the SCDOT and laboratory assignment was performed by Terracon. The laboratory tests were conducted on selected soil samples from the borings and the bulk sample locations. The test results are presented in this appendix.

The laboratory test results were used to confirm the soil descriptions presented on the boring logs in Appendix A. Laboratory tests were performed in general accordance with the applicable ASTM, AASHTO, SCDOT or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

| | | |
|---|---------------------------|----------------------------|
| ■ | Moisture Content | AASHTO T265/(ASTM D2216) |
| ■ | Atterberg Limits | AASHTO T89/T90(ASTM D4318) |
| ■ | Wash 200 | AASHTO T11/(ASTM D1140) |
| ■ | Proctor (Standard effort) | AASHTO T99/ (ASTM D698) |
| ■ | Triaxial Shear CU w/ PP | AASHTO T297/(ASTM D4767) |
| ■ | Grain Size Distribution | ASTM D6913 |
| ■ | Hydrometer | ASTM D7928 |
| ■ | Corrosion Series | AASHTO D422 |
| | | AASHTO T289/ASTM G51 |
| | | AASHTO T290/ASTM C1580 |
| | | AASHTO T291 |

Summary of Laboratory Results

| Boring ID | Depth (Ft.) | Soil Classification USCS & AASHTO | Liquid Limit | Plastic Limit | Plasticity Index | % Gravel | % Sand | % Fines | % Silt | % Clay | Water Content (%) | Proctor Dry Density (pcf)/Opt. Moisture (%) |
|-----------|-------------|---|-----------------|------------------|---------------------|----------|--------|---------|--------|--------|-------------------------|---|
| S-23-40-1 | 2-4 | CLAYEY SAND(SC) / A-6 (2) | 32 | 20 | 12 | 3.1 | 54.3 | 42.6 | | | 18.3 | |
| S-23-40-1 | 4-6 | CLAYEY SAND(SC) / A-4 (0) | 29 | 20 | 9 | | | | | | 20.9 | |
| S-23-40-1 | 6-8 | SILTY SAND(SM) / A-4 (0) | | | | 0.6 | 58.9 | 40.5 | | | 25.2 | |
| S-23-40-1 | 8-10 | SILTY SAND(SM) / A-2-6 (0) | 40 | 29 | 11 | 1.1 | 72.9 | 26.0 | 20.5 | 5.5 | 42.9 | |
| S-23-40-1 | 13.5-15 | SILTY SAND(SM) / A-4 (0) | | | | 0.1 | 62.2 | 37.7 | 26.7 | 11.0 | 35.9 | |
| S-23-40-1 | 18.5-20 | POORLY GRADED SAND with SILT(SP-SM) / A-2-4 (0) | | | | | | | | | 12.8 | |
| S-23-40-1 | 28.5-30 | POORLY GRADED SAND with SILT(SP-SM) / A-2-4 (0) | | | | | | | | | 17.6 | |
| S-23-40-1 | 38.5-40 | SILTY SAND(SM) / A-2-4 (0) | | | | | | | | | 18.1 | |
| S-23-40-1 | 43.5-45 | SILTY SAND(SM) / A-2-4 (0) | | | | | | | | | 28.5 | |
| S-23-40-2 | 18-20 | POORLY GRADED SAND(SP) / A-1-b (0) | | | | | | | | | 14.6 | |
| S-23-40-2 | 20-22 | POORLY GRADED SAND(SP) / A-1-b (0) | | | | 0.8 | 97.4 | 1.7 | 0.9 | 0.9 | 26.1 | |
| S-23-40-2 | 22-24 | WELL GRADED SAND with SILT(SW-SM) / A-1-b (0) | | | | 5.0 | 88.6 | 6.4 | | | 14.6 | |
| S-23-40-2 | 29.5-31 | SILTY SAND(SM) / A-2-4 (0) | | | | 0.5 | 68.0 | 31.5 | | | 17.1 | |
| S-23-40-2 | 34.5-36 | SILTY SAND(SM) / A-2-4 (0) | | | | | | | | | 16.6 | |
| S-23-40-2 | 39.5-41 | SILTY SAND(SM) / A-2-4 (0) | | | | | | | | | 14.6 | |
| S-23-40-3 | 2-4 | SILTY SAND(SM) / A-2-4 (0) | | | | 3.1 | 70.0 | 26.8 | | | 16.6 | |
| S-23-40-3 | 4-6 | CLAYEY SAND(SC) / A-2-6 (1) | 36 | 21 | 15 | | | | | | 18.1 | |
| S-23-40-3 | 6-8 | SILTY SAND(SM) / A-2-4 (0) | | | | | | | | | 17.8 | |
| S-23-40-3 | 8-10 | SILTY SAND(SM) / A-4 (0) | | | | 0.5 | 61.3 | 38.2 | | | 28.4 | |

Summary of Laboratory Results

| Boring ID | Depth (Ft.) | Soil Classification USCS & AASHTO | Liquid Limit | Plastic Limit | Plasticity Index | % Gravel | % Sand | % Fines | % Silt | % Clay | Water Content (%) | Proctor Dry Density (pcf)/Opt. Moisture (%) |
|--------------------|-------------|--|--------------|---------------|------------------|----------|--------|---------|--------|--------|-------------------|---|
| S-23-40-3 | 13.5-15 | SANDY SILT(ML) / A-5 (5) | 42 | 32 | 10 | 0.0 | 39.1 | 60.9 | 44.2 | 16.7 | 51.6 | |
| S-23-40-3 | 18.5-20 | SILTY SAND(SM) / A-2-4 (0) | | | | | | | | | 38.9 | |
| S-23-40-3 | 23.5-25 | SILTY SAND with GRAVEL(SM) / A-1-b (0) | | | | 34.5 | 51.7 | 13.9 | | | 9.4 | |
| S-23-40-3 | 28.5-30 | SILTY SAND(SM) / A-2-4 (0) | | | | | | | | | 12.0 | |
| S-23-40-3 | 33.5-34.96 | SILTY SAND(SM) / A-2-4 (0) | | | | | | | | | 15.3 | |
| S-23-40-1/3 Offset | 0-5 | SILTY SAND(SM) / A-4 (0) | NP | NP | NP | 4.4 | 52.3 | 43.3 | | | | 111.0 / 15.4 |
| | | | | | | | | | | | | |
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INDEX PROPERTIES VERSUS DEPTH

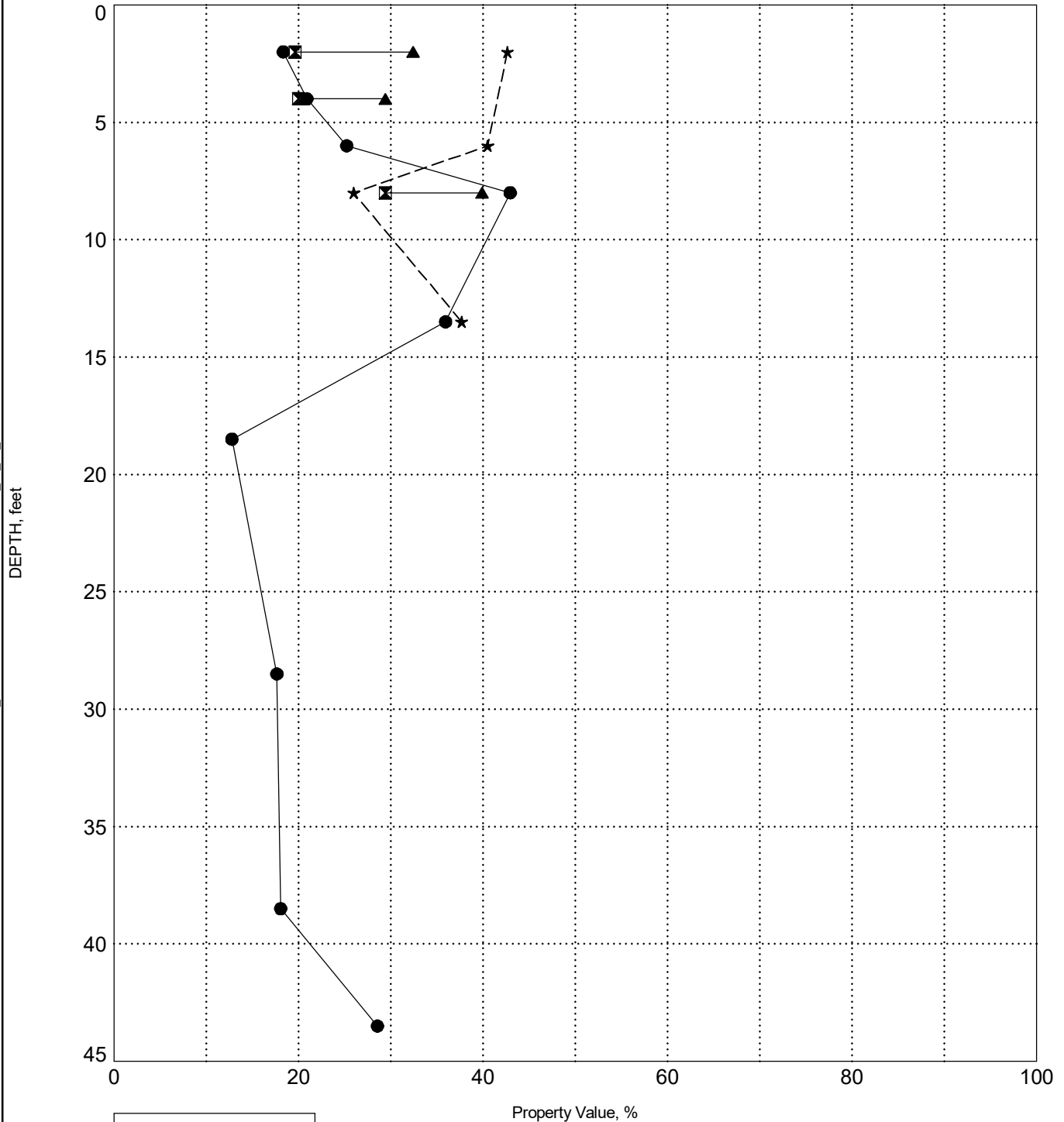
PROJECT ID P041160

PROJECT NAME S-23-40 BRO South Saluda River

PROJECT COUNTY Greenville

SURFACE ELEVATION: 917.0

BORING S-23-40-1



| LEGEND | |
|--------|---------------|
| ● | Water Content |
| ⊠ | Plastic Limit |
| ▲ | Liquid Limit |
| ★ | Fines |



INDEX PROPERTIES VERSUS DEPTH

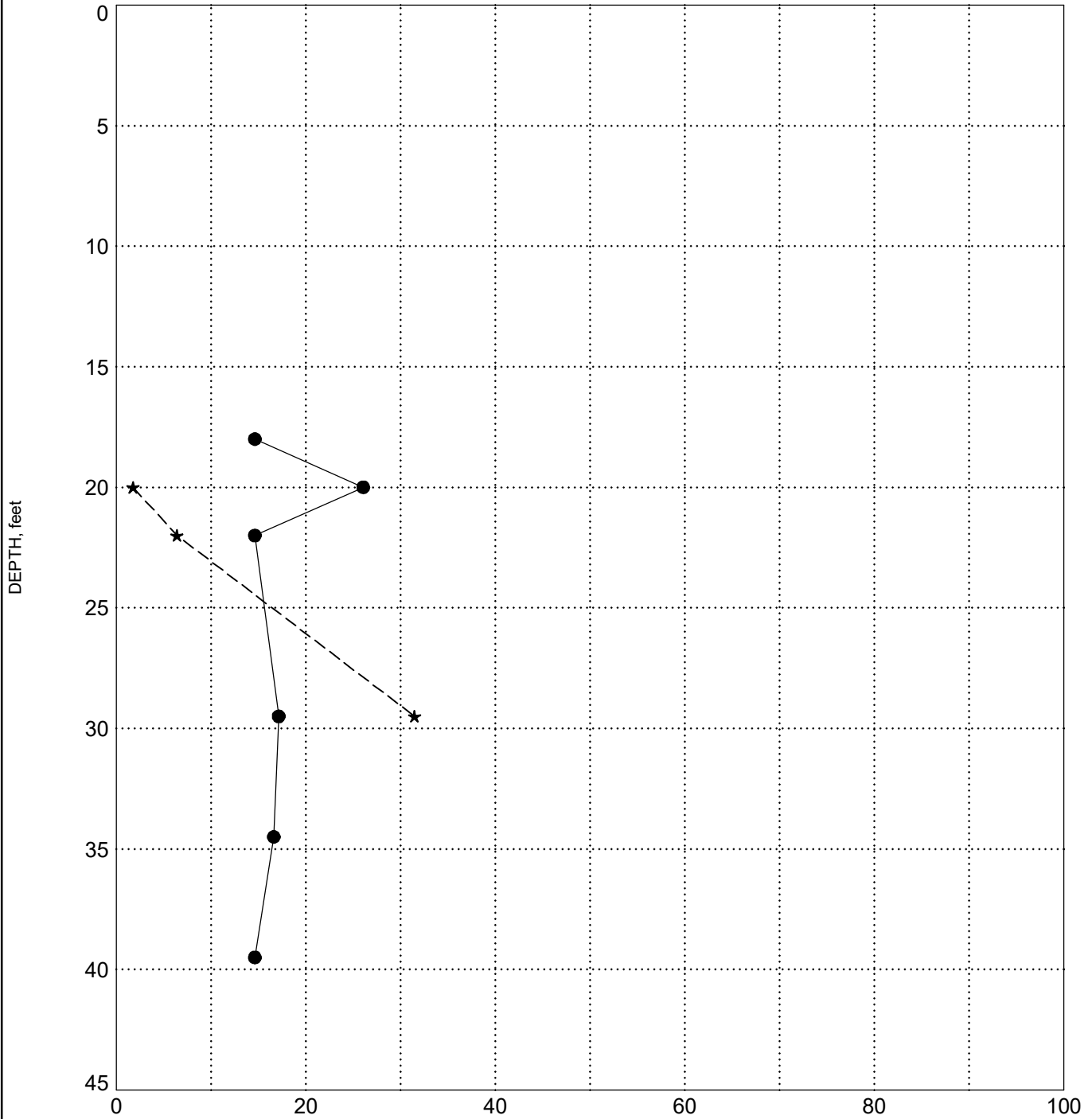
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PROJECT NAME S-23-40 BRO South Saluda River

PROJECT COUNTY Greenville

SURFACE ELEVATION: 917.5

BORING S-23-40-2



| LEGEND | |
|--------|---------------|
| ● | Water Content |
| ✕ | Plastic Limit |
| ▲ | Liquid Limit |
| ★ | Fines |



INDEX PROPERTIES VERSUS DEPTH

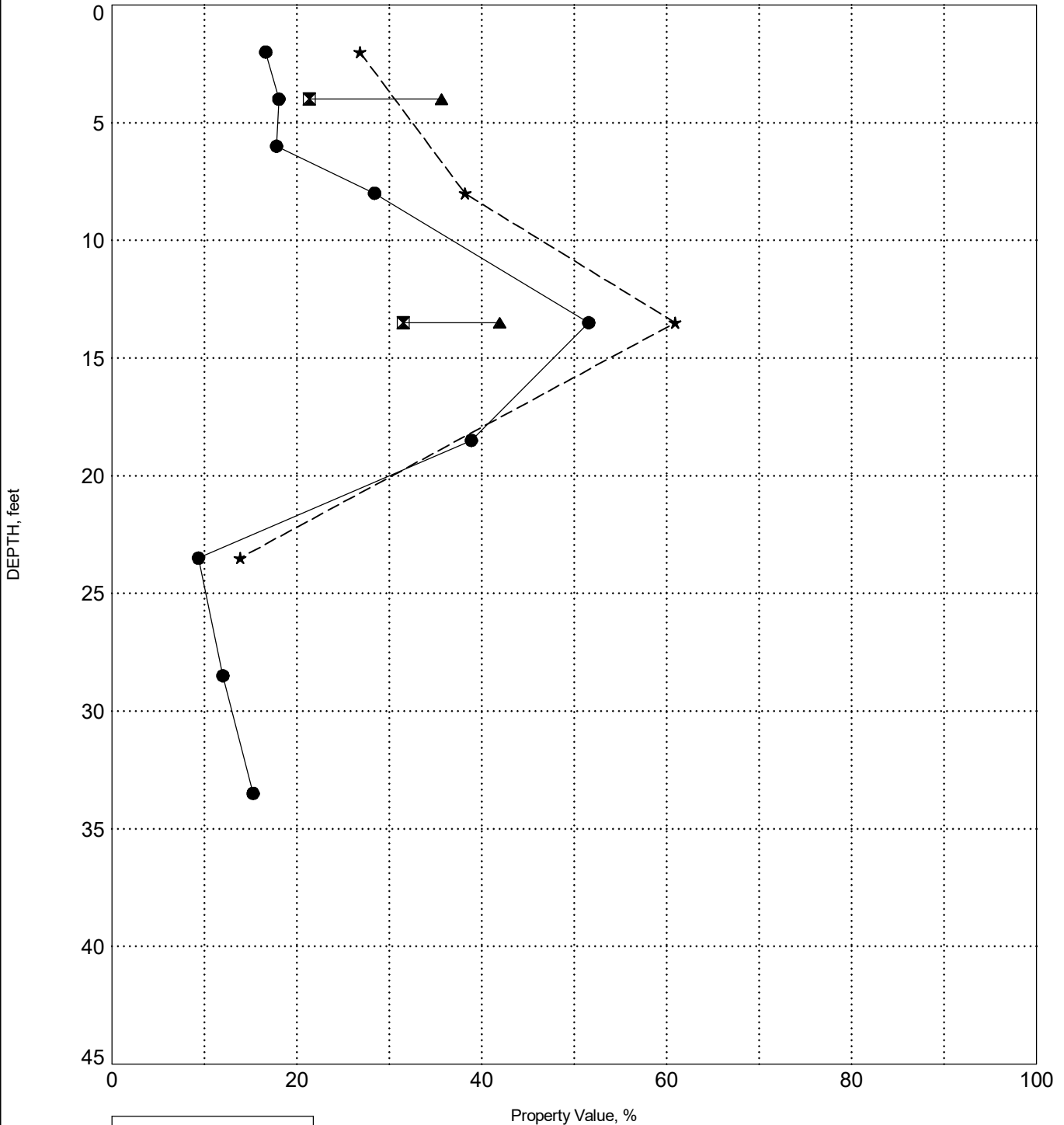
PROJECT ID P041160

PROJECT NAME S-23-40 BRO South Saluda River

PROJECT COUNTY Greenville

SURFACE ELEVATION: 917.2

BORING S-23-40-3



| LEGEND | |
|--------|---------------|
| ● | Water Content |
| ⊠ | Plastic Limit |
| ▲ | Liquid Limit |
| ★ | Fines |



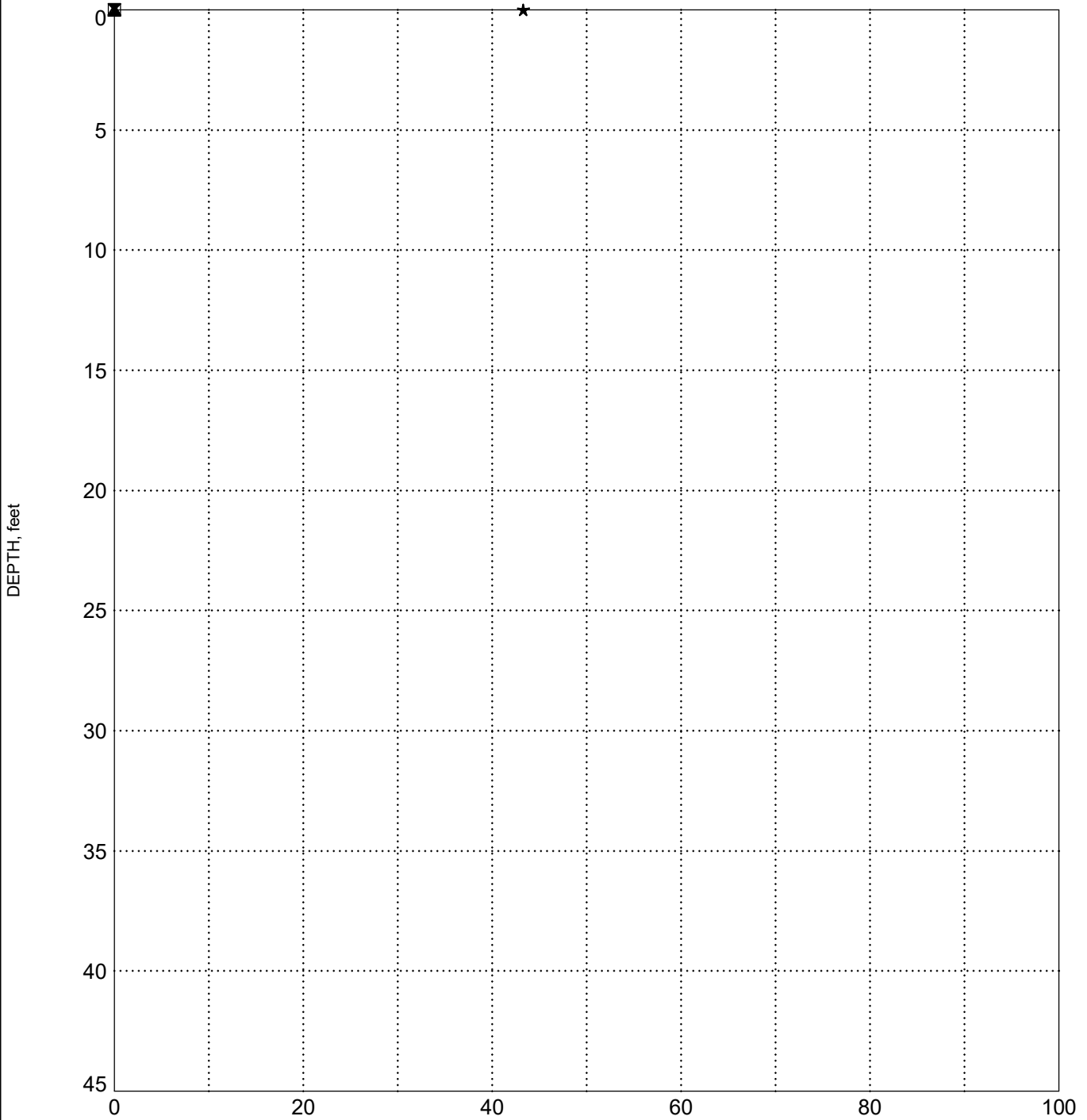
INDEX PROPERTIES VERSUS DEPTH

PROJECT ID P041160

PROJECT NAME S-23-40 BRO South Saluda River

PROJECT COUNTY Greenville

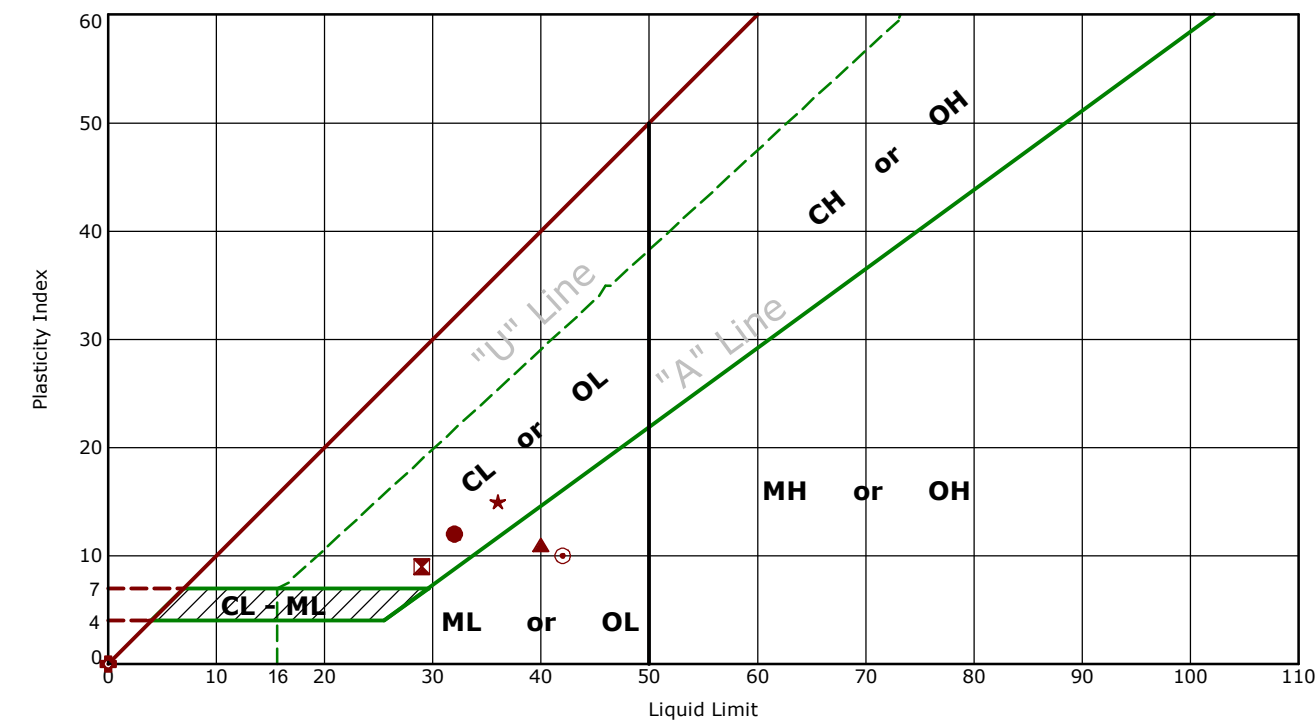
BORING S-23-40-1/3 Offset



| LEGEND | |
|--------|---------------|
| ● | Water Content |
| ☒ | Plastic Limit |
| ▲ | Liquid Limit |
| ★ | Fines |

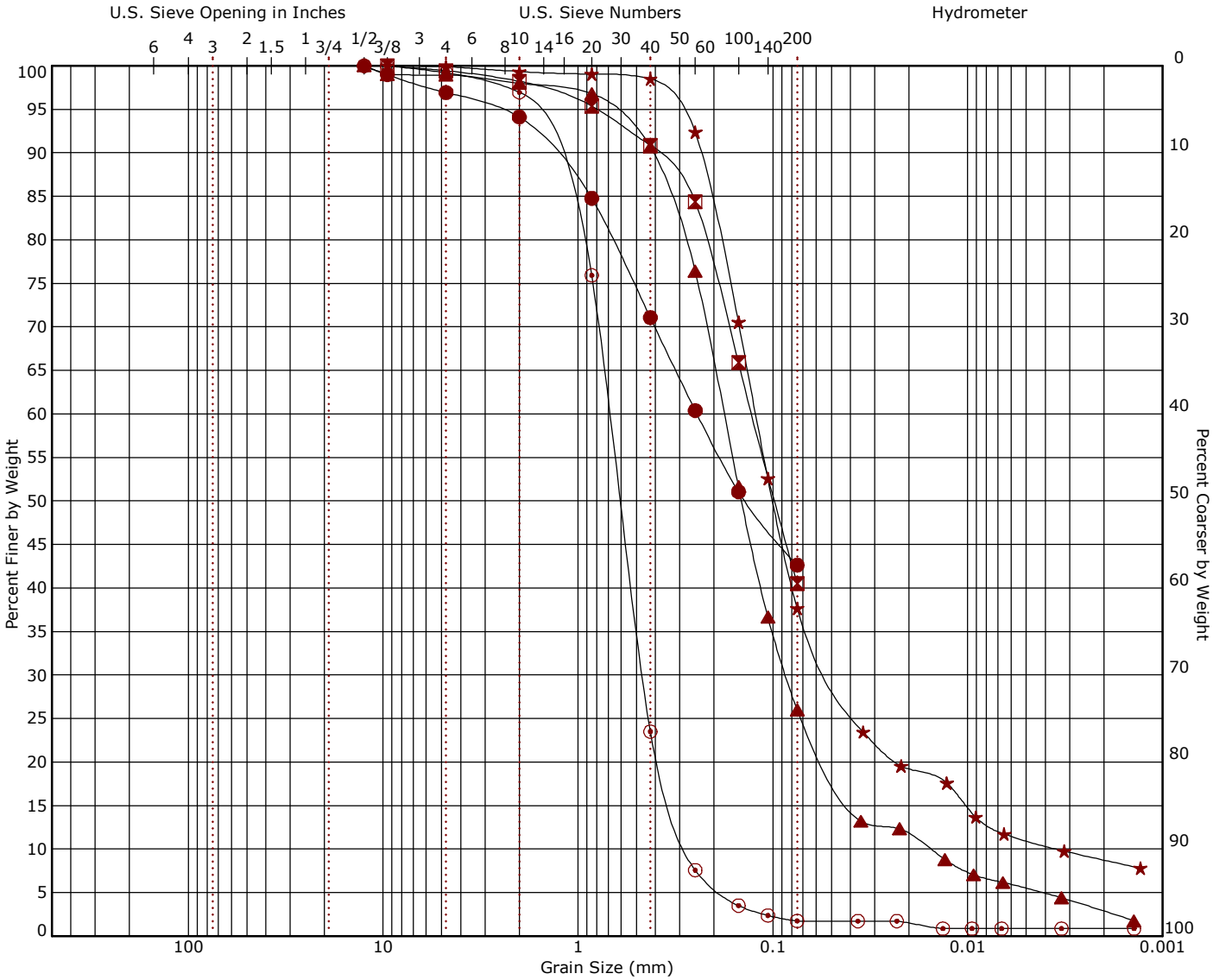
Atterberg Limit Results

ASTM D4318



| | Boring ID | Depth (Ft) | LL | PL | PI | Fines | AASHTO | Description |
|---|--------------------|------------|----|----|----|-------|-----------|-------------|
| ● | S-23-40-1 | 2 - 4 | 32 | 20 | 12 | 42.6 | A-6 (2) | CLAYEY SAND |
| ⊠ | S-23-40-1 | 4 - 6 | 29 | 20 | 9 | | A-4 (0) | CLAYEY SAND |
| ▲ | S-23-40-1 | 8 - 10 | 40 | 29 | 11 | 26.0 | A-2-6 (0) | SILTY SAND |
| ★ | S-23-40-3 | 4 - 6 | 36 | 21 | 15 | | A-2-6 (1) | CLAYEY SAND |
| ⊙ | S-23-40-3 | 13.5 - 15 | 42 | 32 | 10 | 60.9 | A-5 (5) | SANDY SILT |
| ⊕ | S-23-40-1/3 Offset | 0 - 5 | NP | NP | NP | 43.3 | A-4 (0) | SILTY SAND |
| | | | | | | | | |
| | | | | | | | | |
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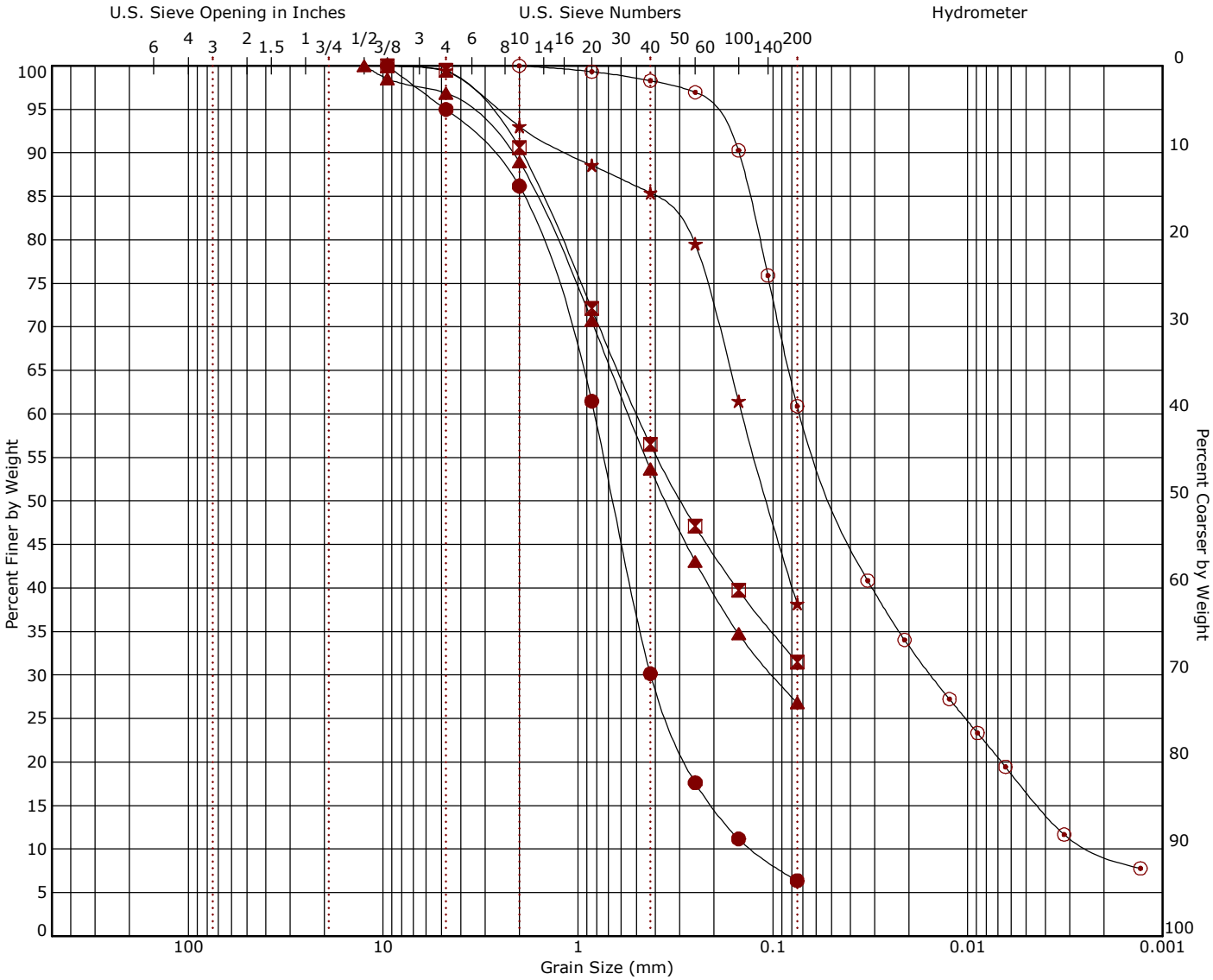
Grain Size Distribution
ASTM D422 / ASTM C136



| | Cobbles | Gravel | | Sand | | | Silt or Clay | | | | |
|-------------|------------|---------------------|-----------------|-----------------|-----------------|-----------|--------------|-------|--------|-------|-------|
| | | coarse | fine | coarse | medium | fine | | | | | |
| Boring ID | Depth (Ft) | USCS Classification | | | USCS | AASHTO | LL | PL | PI | Cc | Cu |
| ● S-23-40-1 | 2 - 4 | CLAYEY SAND | | | SC | A-6 (2) | 32 | 20 | 12 | | |
| ▣ S-23-40-1 | 6 - 8 | SILTY SAND | | | SM | A-4 (0) | | | | | |
| ▲ S-23-40-1 | 8 - 10 | SILTY SAND | | | SM | A-2-6 (0) | 40 | 29 | 11 | 2.60 | 11.34 |
| ★ S-23-40-1 | 13.5 - 15 | SILTY SAND | | | SM | A-4 (0) | | | | 5.70 | 35.21 |
| ⊙ S-23-40-2 | 20 - 22 | POORLY GRADED SAND | | | SP | A-1-b (0) | | | | 1.15 | 2.54 |
| Boring ID | Depth (Ft) | D ₁₀₀ | D ₆₀ | D ₃₀ | D ₁₀ | %Cobbles | %Gravel | %Sand | %Fines | %Silt | %Clay |
| ● S-23-40-1 | 2 - 4 | 12.5 | 0.245 | | | 0.0 | 3.1 | 54.3 | 42.6 | | |
| ▣ S-23-40-1 | 6 - 8 | 9.5 | 0.128 | | | 0.0 | 0.6 | 58.9 | 40.5 | | |
| ▲ S-23-40-1 | 8 - 10 | 12.5 | 0.178 | 0.085 | 0.016 | 0.0 | 1.1 | 72.9 | | 20.5 | 5.5 |
| ★ S-23-40-1 | 13.5 - 15 | 9.5 | 0.122 | 0.049 | 0.003 | 0.0 | 0.1 | 62.2 | | 26.7 | 11.0 |
| ⊙ S-23-40-2 | 20 - 22 | 9.5 | 0.689 | 0.463 | 0.271 | 0.0 | 0.8 | 97.4 | | 0.9 | 0.9 |

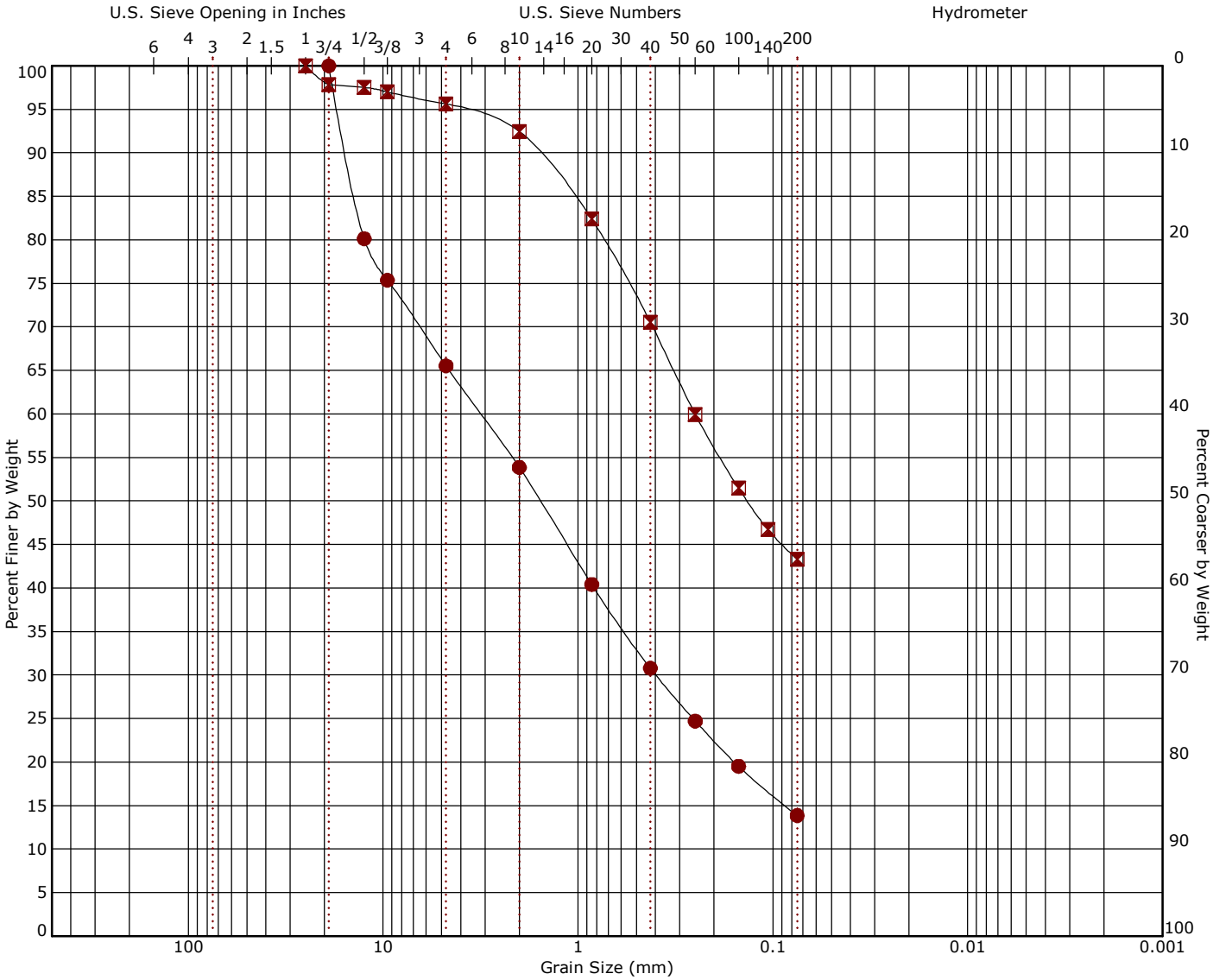
Grain Size Distribution

ASTM D422 / ASTM C136



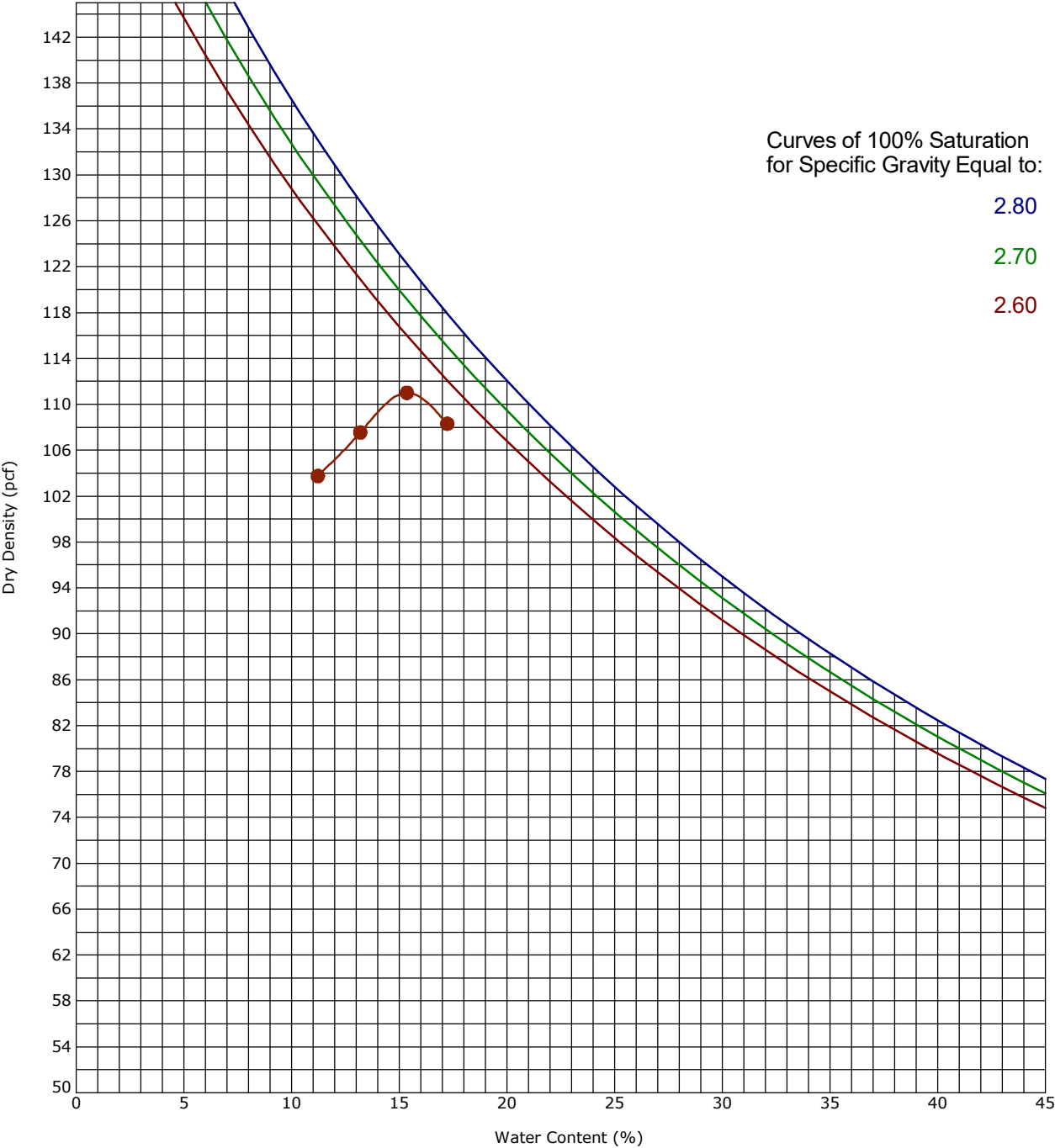
| | Cobbles | Gravel | | Sand | | | Silt or Clay | | | | | |
|-------------|------------|----------------------------|-----------------|-----------------|-----------------|----------|--------------|-------|--------|-------|-------|-------|
| | | coarse | fine | coarse | medium | fine | | | | | | |
| Boring ID | Depth (Ft) | USCS Classification | | | | USCS | AASHTO | LL | PL | PI | Cc | Cu |
| ● S-23-40-2 | 22 - 24 | WELL GRADED SAND with SILT | | | | SW-SM | A-1-b (0) | | | | 1.71 | 6.50 |
| ⊠ S-23-40-2 | 29.5 - 31 | SILTY SAND | | | | SM | A-2-4 (0) | | | | | |
| ▲ S-23-40-3 | 2 - 4 | SILTY SAND | | | | SM | A-2-4 (0) | | | | | |
| ★ S-23-40-3 | 8 - 10 | SILTY SAND | | | | SM | A-4 (0) | | | | | |
| ⊙ S-23-40-3 | 13.5 - 15 | SANDY SILT | | | | ML | A-5 (5) | 42 | 32 | 10 | 1.51 | 33.26 |
| Boring ID | Depth (Ft) | D ₁₀₀ | D ₆₀ | D ₃₀ | D ₁₀ | %Cobbles | %Gravel | %Sand | %Fines | %Silt | %Clay | |
| ● S-23-40-2 | 22 - 24 | 9.5 | 0.823 | 0.422 | 0.127 | 0.0 | 5.0 | 88.6 | 6.4 | | | |
| ⊠ S-23-40-2 | 29.5 - 31 | 9.5 | 0.497 | | | 0.0 | 0.5 | 68.0 | 31.5 | | | |
| ▲ S-23-40-3 | 2 - 4 | 12.5 | 0.549 | 0.099 | | 0.0 | 3.1 | 70.0 | 26.8 | | | |
| ★ S-23-40-3 | 8 - 10 | 9.5 | 0.144 | | | 0.0 | 0.5 | 61.3 | 38.2 | | | |
| ⊙ S-23-40-3 | 13.5 - 15 | 2 | 0.072 | 0.015 | 0.002 | 0.0 | 0.0 | 39.1 | | 44.2 | 16.7 | |

Grain Size Distribution
ASTM D422 / ASTM C136

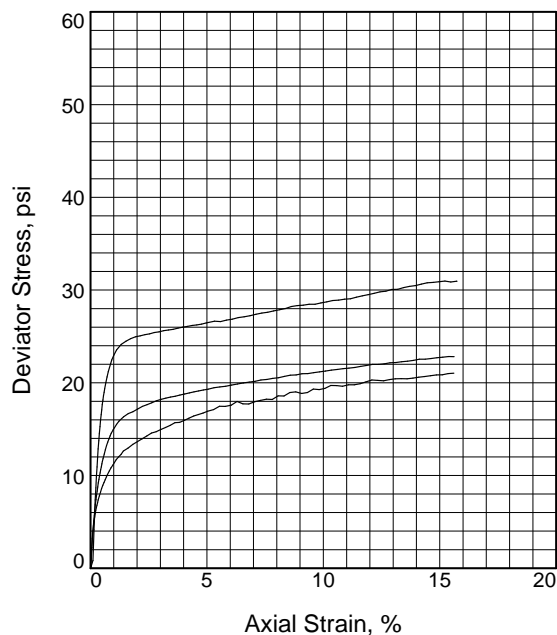
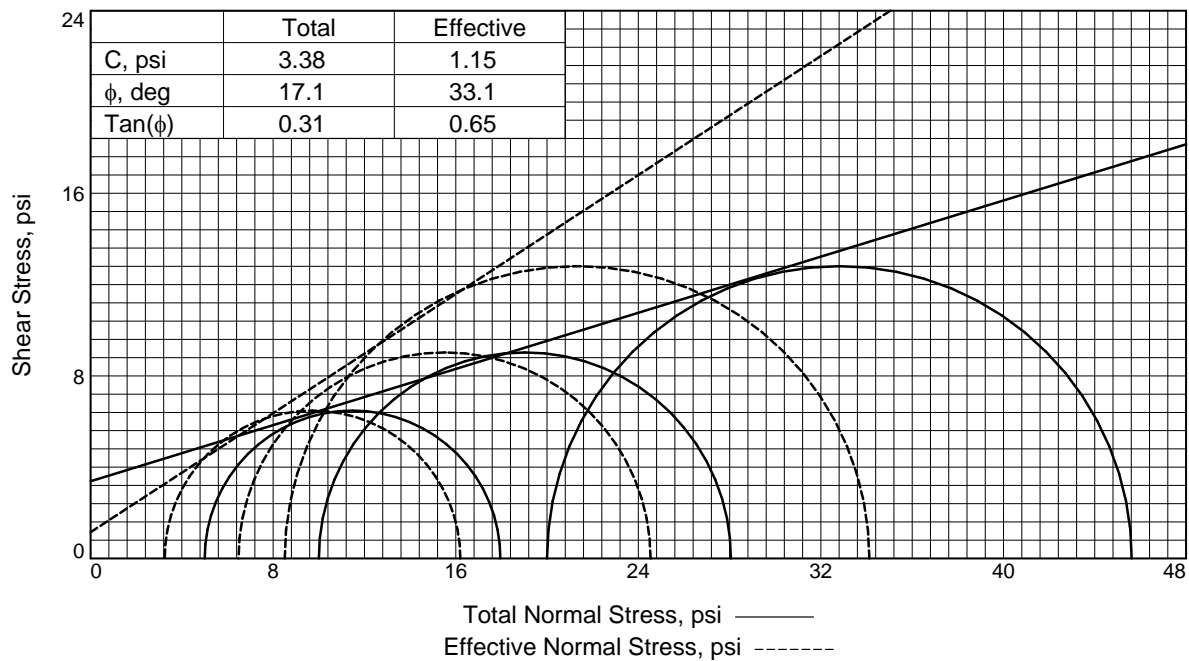


Moisture-Density Relationship

ASTM D698-Method B



| Boring ID | | Depth (Ft) | | Description of Materials | | | |
|--------------------|--------------------|------------|----|--------------------------|--------------------|---------------------------|---------------------------|
| S-23-40-1/3 Offset | | 0 - 5 | | SILTY SAND(SM) | | | |
| Fines (%) | Fraction > mm size | LL | PL | PI | Test Method | Maximum Dry Density (pcf) | Optimum Water Content (%) |
| 43 | 0.0 | NP | NP | NP | ASTM D698-Method B | 111.0 | 15.4 |



| Sample No. | | 1 | 2 | 3 |
|-------------------------------|------------------|--------|--------|--------|
| Initial | Water Content, % | 15.4 | 15.7 | 15.5 |
| | Dry Density, pcf | 105.5 | 105.6 | 105.6 |
| | Saturation, % | 69.4 | 71.0 | 70.1 |
| | Void Ratio | 0.5971 | 0.5964 | 0.5955 |
| | Diameter, in. | 2.80 | 2.80 | 2.80 |
| | Height, in. | 5.62 | 5.62 | 5.62 |
| At Test | Water Content, % | 20.2 | 20.8 | 19.4 |
| | Dry Density, pcf | 109.0 | 108.0 | 110.7 |
| | Saturation, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.5467 | 0.5604 | 0.5227 |
| | Diameter, in. | 2.76 | 2.77 | 2.75 |
| | Height, in. | 5.58 | 5.58 | 5.54 |
| Strain rate, in./min. | | 0.001 | 0.001 | 0.001 |
| Back Pressure, psi | | 50.0 | 50.0 | 50.0 |
| Cell Pressure, psi | | 55.0 | 60.0 | 70.0 |
| Fail. Stress, psi | | 13.0 | 18.1 | 25.6 |
| Excess Pore Pr., psi | | 1.8 | 3.5 | 11.5 |
| Ult. Stress, psi | | 20.9 | 22.8 | 30.9 |
| Excess Pore Pr., psi | | -2.2 | 1.2 | 9.4 |
| $\bar{\sigma}_1$ Failure, psi | | 16.2 | 24.5 | 34.1 |
| $\bar{\sigma}_3$ Failure, psi | | 3.2 | 6.5 | 8.5 |

Type of Test:

CU with Pore Pressures

Sample Type: Remolded

Description: Silty Sand (SM)

LL= NV

PI= NP

Specific Gravity= 2.7

Remarks: Specimens were remolded to approximately 95% MDD at optimum water content.

Figure _____

Client: HNTB North Carolina PC

Project: S-23-40 BRO South Saluda River

Source of Sample: S-23-40-1/3 Offset **Depth:** 0-5'

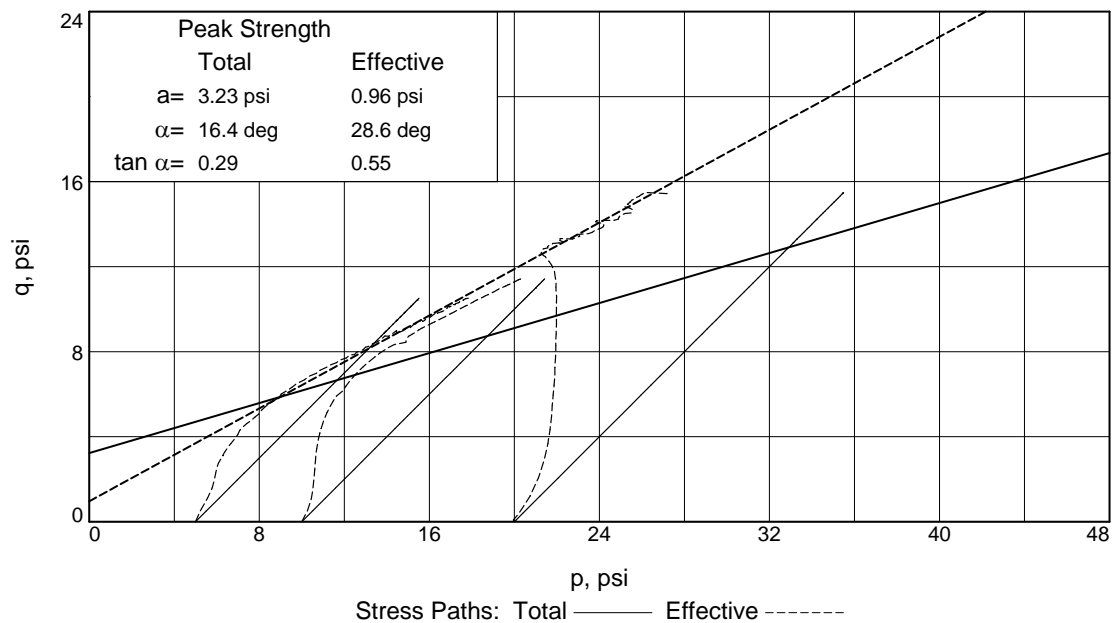
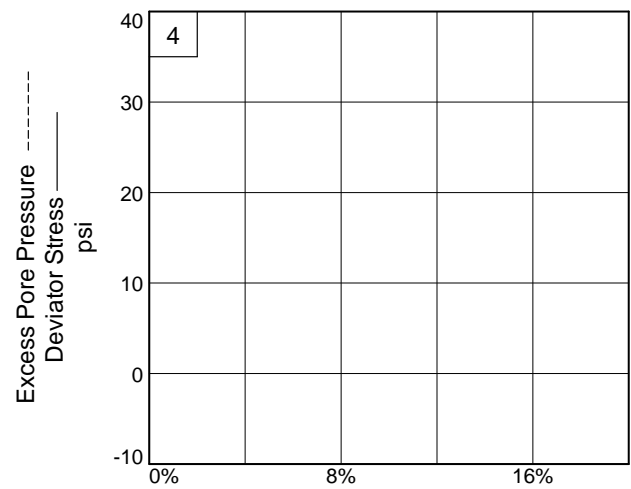
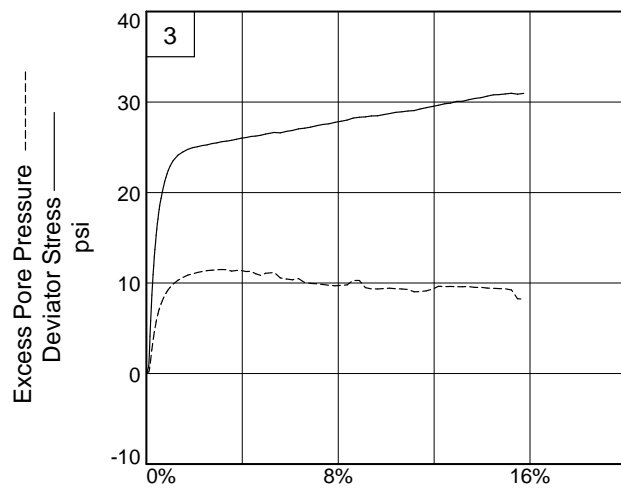
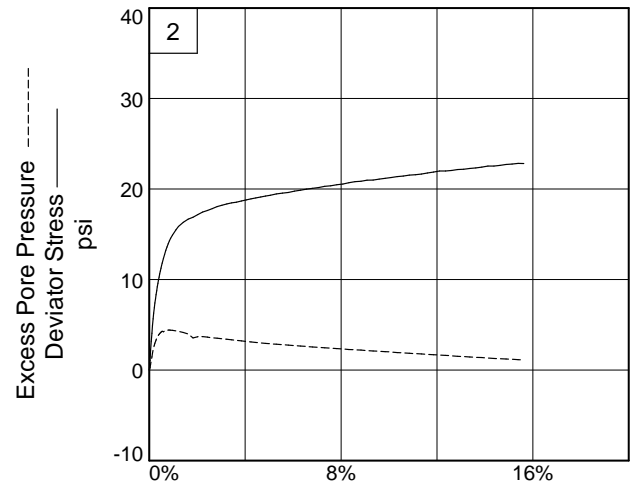
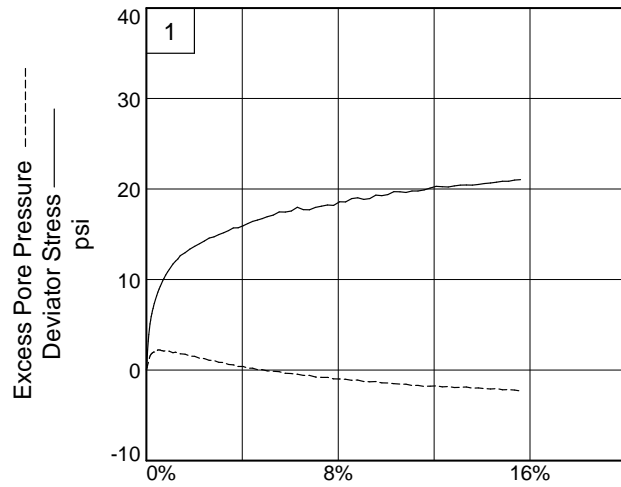
Proj. No.: 8623P180

Date Sampled: N/A

TRIAXIAL SHEAR TEST REPORT

Terracon Consultants, Inc.

Chattanooga, TN



Client: HNTB North Carolina PC

Project: S-23-40 BRO South Saluda River

Source of Sample: S-23-40-1/3 Offset **Depth:** 0-5'

Project No.: 8623P180

Figure _____

Terracon Consultants, Inc.

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393



Client

HNTB North Carolina PC

Project

S-23-40 BRO South Saluda River

Sample Submitted By: Terracon (86)

Date Received: 8/29/2024

Lab No.: 24-0289

Results of Corrosion Analysis

| | |
|--|-----------|
| Sample Number | S-23-40-1 |
| Sample Location | -- |
| Sample Depth (ft.) | 2.0-20.0 |
| pH Analysis, AASHTO T289 | 5.94 |
| Water Soluble Sulfate (SO4), AASHTO T290 (mg/kg) | 47 |
| Chlorides, AASHTO T291, (mg/kg) | 133 |
| Saturated Minimum Resistivity, AASHTO T288, (ohm-cm) | 7370 |

Analyzed By

A handwritten signature in black ink, appearing to read 'N. Campo'.

Nathan Campo
Laboratory Coordinator

The tests were performed in general accordance with applicable ASTM and AWWA test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

Appendix C – Supporting Documents

S-23-40 BRO South Saluda River | Greenville County, SC
Terracon Project No. 8623P180 | SCDOT Project ID: P041160



Appendix C

Supporting Documents

Rig Calibration Report – DR#554 (5 Pages)

Rig Calibration Report – DR#1327 (8 Pages)

Note: All exhibits are one page unless noted above.

For Borings S-23-40-1 and S-23-40-3

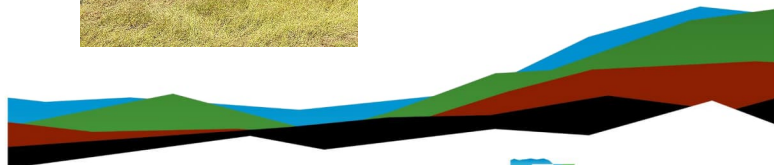
SPT Automatic Hammer Energy Measurement Report

Drill Rig Model: GeoProbe 3126

Drill Rig Serial Number: 3126TTS52010006

Asset Number: DR#554

August 21, 2023



Prepared for:

Terracon
Greenville-Spartanburg, South Carolina



July 19, 2023

Terracon
72 Pointe Circle
Greenville, South Carolina 29607

Attn: Maggie McKenney
E: m.mckenney@terracon.com

Re: SPT Automatic Hammer Energy Measurement Report
Rig Serial Number: 3126TTS52010006
Terracon Project Number: DYXX0500

Dear Ms. McKenney:

This report provides the Energy Transfer Ratio (ETR) for the Standard Penetration Testing (SPT) automatic hammer as summarized below:

Table 1: Hammer Efficiency Summary

| Drill Rig Make/Model | Drill Rig Serial Number | Drill Rig Year | Asset Number | Energy Transfer Ratio (ETR) | Hammer Efficiency Correction (Ce) |
|----------------------|-------------------------|----------------|--------------|-----------------------------|-----------------------------------|
| GeoProbe 3126 | 3126TTS52010006 | 2021 | GP#554 | 88.5% ± 4.2% | 1.48 |

If you have any questions concerning this summary, or if we may be of further service, please contact us.

James P. Smith

James P. Smith
National Manager of Equipment & Training

Rob Kramer

Rob Kramer
Group Manager Geophysics

Attachments:

Exhibit A: PDA SPT Analyzer Results
Exhibit B: PDA Equipment Calibration

Facilities | Environmental | **Geotechnical** | Materials |



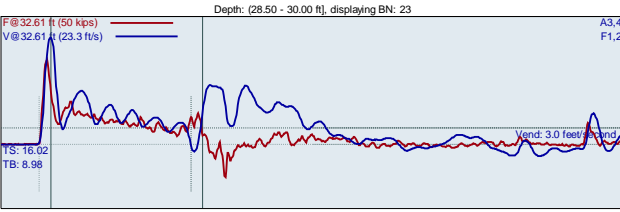
MEASUREMENT SUMMARY

| ITEM | DESCRIPTION |
|-------------------------------|---|
| Drill Rig Owner | Terracon Greenville-Spartanburg - Greenville, SC |
| Drill Rig Operator | Brett Burnett; Terracon Exploration Services |
| Testing Date | 08/21/2023 |
| Testing Location | Spartanburg, SC |
| Boring Identification | B-1 |
| Hammer Type | 140 pounds (automatic) |
| Boring Method | Hollow Stem Auger |
| Drill Rods | <ul style="list-style-type: none"> AWJ 1-3/4" outside diameter 3/16" wall thickness |
| Calibration Testing Equipment | <ul style="list-style-type: none"> 2-foot AWJ rod instrumented w/ two strain gauges and two accelerometers Model SPT Analyzer™ (PDA) |
| ASTM Methods Used | <p>ASTM D1586, Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils</p> <p>ASTM D4633-16, Standard Method for Energy Measurement for Dynamic Penetrometers</p> |
| SPT Calibration Personnel | Jim Smith, National Manager of Equipment and Training |

Exhibit A

PDA SPT Analyzer Results

GP554-3126 28.5/30
JIM SMITH Interval start: 8/21/2023
TB-1
AR: 1.20 in/2 SP: 0.492 k/ft3
LE: 32.61 ft EM: 30000 ksi
WS: 16807.9 fts



F1 : [648AWJ1] 226.21 PDICAL (1) FF1
F2 : [648AWJ2] 225.58 PDICAL (1) FF1
A3 (PR): [K4483] 410.187 mv/6.4v/5000g (1) VF1
A4 (PR): [K10491] 421.907 mv/6.4v/5000g (1) VF1

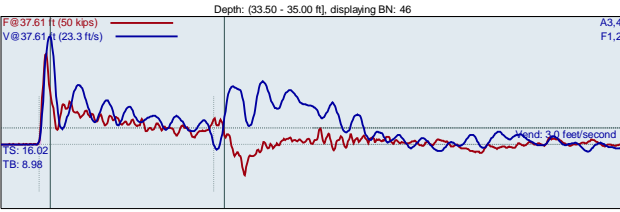
FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute
EFV: Maximum Energy
ETR: Energy Transfer Ratio - Rated

| BL# | BC /6" | FMX kips | VMX ft/s | BPM bpm | EFV ft-lb | ETR % |
|-----|-----------|-------------|-------------|------------|--------------|----------|
| 1 | 6 | 40 | 19.4 | 1.9 | 234 | 84.1 |
| 2 | 6 | 39 | 19.2 | 51.9 | 232 | 83.4 |
| 3 | 6 | 25 | 16.9 | 52.7 | 274 | 78.2 |
| 4 | 6 | 28 | 17.9 | 52.4 | 273 | 77.9 |
| 5 | 6 | 32 | 19.6 | 52.6 | 294 | 83.9 |
| 6 | 6 | 27 | 17.3 | 53.1 | 268 | 76.5 |
| 7 | 8 | 38 | 19.0 | 52.7 | 289 | 82.5 |
| 8 | 8 | 39 | 19.6 | 52.4 | 305 | 87.2 |
| 9 | 8 | 36 | 19.2 | 52.7 | 290 | 82.8 |
| 10 | 8 | 28 | 18.2 | 52.5 | 292 | 83.4 |
| 11 | 8 | 38 | 19.0 | 53.0 | 293 | 83.8 |
| 12 | 8 | 35 | 19.4 | 52.6 | 282 | 80.4 |
| 13 | 8 | 36 | 19.1 | 52.9 | 299 | 85.3 |
| 14 | 8 | 34 | 19.8 | 52.8 | 307 | 87.7 |
| 15 | 11 | 34 | 19.5 | 52.7 | 307 | 87.6 |
| 16 | 11 | 33 | 19.5 | 52.9 | 299 | 85.6 |
| 17 | 11 | 36 | 19.4 | 52.7 | 308 | 88.1 |
| 18 | 11 | 37 | 18.5 | 52.8 | 320 | 91.4 |
| 19 | 11 | 32 | 19.6 | 52.9 | 301 | 86.1 |
| 20 | 11 | 39 | 18.7 | 52.9 | 301 | 85.9 |
| 21 | 11 | 26 | 17.5 | 52.8 | 277 | 79.1 |
| 22 | 11 | 30 | 19.1 | 52.6 | 306 | 87.4 |
| 23 | 11 | 33 | 19.5 | 52.7 | 298 | 85.1 |
| 24 | 11 | 35 | 19.9 | 52.4 | 303 | 86.5 |
| 25 | 11 | 36 | 19.4 | 53.1 | 313 | 89.6 |

| | | | | | |
|-------------|----|------|------|-----|------|
| Average | 34 | 19.2 | 52.8 | 299 | 85.6 |
| Std Dev | 3 | 0.6 | 0.2 | 10 | 3.0 |
| Maximum | 39 | 19.9 | 53.1 | 320 | 91.4 |
| Minimum | 26 | 17.5 | 52.4 | 277 | 79.1 |
| N-value: 19 | | | | | |

Sample Interval Time: 27.36 seconds.

GP554-3126 28.5/30
JIM SMITH Interval start: 8/21/2023
TB-1
AR: 1.20 in/2 SP: 0.492 k/ft3
LE: 37.61 ft EM: 30000 ksi
WS: 16807.9 fts

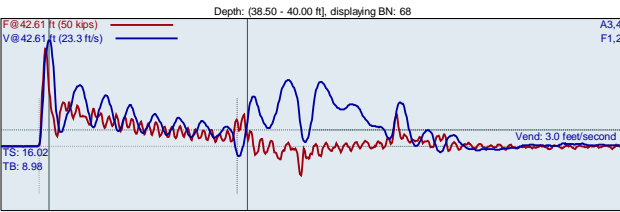


F1 : [648AWJ1] 226.21 PDICAL (1) FF1
F2 : [648AWJ2] 225.58 PDICAL (1) FF1
A3 (PR): [K4483] 410.187 mv/6.4v/5000g (1) VF1
A4 (PR): [K10491] 421.907 mv/6.4v/5000g (1) VF1

| BL# | BC /6" | FMX kips | VMX ft/s | BPM bpm | EFV ft-lb | ETR % |
|-------------|-----------|-------------|-------------|------------|--------------|----------|
| 26 | 5 | 38 | 19.1 | 1.9 | 302 | 86.4 |
| 27 | 5 | 35 | 18.9 | 52.0 | 301 | 86.1 |
| 28 | 5 | 29 | 18.8 | 52.0 | 299 | 85.5 |
| 29 | 5 | 35 | 19.2 | 52.7 | 299 | 85.5 |
| 30 | 5 | 37 | 19.4 | 52.5 | 297 | 84.8 |
| 31 | 8 | 37 | 19.5 | 52.4 | 307 | 87.7 |
| 32 | 8 | 26 | 16.4 | 52.7 | 282 | 80.5 |
| 33 | 8 | 34 | 19.5 | 52.4 | 307 | 87.6 |
| 34 | 8 | 40 | 19.1 | 52.2 | 307 | 87.6 |
| 35 | 8 | 37 | 19.4 | 52.6 | 299 | 85.5 |
| 36 | 8 | 40 | 20.6 | 52.4 | 321 | 91.7 |
| 37 | 8 | 41 | 19.6 | 52.8 | 308 | 87.9 |
| 38 | 8 | 40 | 19.8 | 52.7 | 313 | 89.5 |
| 39 | 10 | 34 | 20.2 | 52.2 | 323 | 92.2 |
| 40 | 10 | 32 | 19.4 | 52.8 | 297 | 84.9 |
| 41 | 10 | 36 | 19.8 | 52.6 | 311 | 88.8 |
| 42 | 10 | 37 | 19.7 | 52.5 | 317 | 90.7 |
| 43 | 10 | 35 | 20.0 | 52.6 | 324 | 92.6 |
| 44 | 10 | 38 | 19.5 | 52.7 | 308 | 88.1 |
| 45 | 10 | 34 | 20.1 | 52.4 | 322 | 92.0 |
| 46 | 10 | 35 | 19.7 | 52.4 | 322 | 92.0 |
| 47 | 10 | 37 | 19.9 | 52.6 | 314 | 89.7 |
| 48 | 10 | 37 | 19.8 | 52.7 | 332 | 94.8 |
| Average | | 36 | 19.6 | 52.6 | 312 | 89.1 |
| Std Dev | | 3 | 0.8 | 0.2 | 12 | 3.3 |
| Maximum | | 41 | 20.6 | 52.8 | 332 | 94.8 |
| Minimum | | 26 | 16.4 | 52.2 | 282 | 80.5 |
| N-value: 18 | | | | | | |

Sample Interval Time: 25.16 seconds.

GP554-3126
JIM SMITH
TB-1
AR: 1.20 in/2
LE: 42.61 ft
WS: 16807.9 ft/s
28.5-30
Interval start: 8/21/2023
SP: 0.492 kft/s
EM: 30000 ksi



| | | | | | | |
|--------------------------------------|-----------|---|-------------|------------|--------------|----------|
| F1 : [648AWJ1] 226.21 PDICAL (1) FF1 | | A3 (PR): [K4483] 410.187 mm/6.4v/5000g (1) VF1 | | | | |
| F2 : [648AWJ2] 225.58 PDICAL (1) FF1 | | A4 (PR): [K10491] 421.907 mm/6.4v/5000g (1) VF1 | | | | |
| BL# | BC /6" | FMX kips | VMX ft/s | BPM bpm | EFV ft-lb | ETR % |
| 49 | 5 | 34 | 19.6 | 1.9 | 307 | 87.6 |
| 50 | 5 | 34 | 19.3 | 52.0 | 301 | 86.1 |
| 51 | 5 | 27 | 16.5 | 52.7 | 278 | 79.4 |
| 52 | 5 | 33 | 19.9 | 52.5 | 310 | 88.6 |
| 53 | 5 | 29 | 17.7 | 52.7 | 288 | 82.2 |
| 54 | 8 | 29 | 18.6 | 52.5 | 295 | 84.2 |
| 55 | 8 | 23 | 15.6 | 52.9 | 287 | 82.0 |
| 56 | 8 | 34 | 20.1 | 52.6 | 323 | 92.2 |
| 57 | 8 | 28 | 18.1 | 52.8 | 295 | 84.3 |
| 58 | 8 | 38 | 18.8 | 53.1 | 312 | 89.1 |
| 59 | 8 | 35 | 19.2 | 52.6 | 329 | 94.0 |
| 60 | 8 | 36 | 19.3 | 52.9 | 327 | 93.3 |
| 61 | 8 | 40 | 19.7 | 52.8 | 323 | 92.4 |
| 62 | 9 | 35 | 18.8 | 53.0 | 320 | 91.3 |
| 63 | 9 | 37 | 19.1 | 52.7 | 320 | 91.3 |
| 64 | 9 | 35 | 19.9 | 52.9 | 327 | 93.4 |
| 65 | 9 | 29 | 18.8 | 52.7 | 314 | 89.7 |
| 66 | 9 | 35 | 19.7 | 53.0 | 342 | 97.8 |
| 67 | 9 | 36 | 19.9 | 52.8 | 331 | 94.5 |
| 68 | 9 | 38 | 19.3 | 52.8 | 335 | 95.8 |
| 69 | 9 | 36 | 19.9 | 52.5 | 325 | 92.9 |
| 70 | 9 | 39 | 19.5 | 52.9 | 329 | 94.0 |
| Average | | 34 | 19.1 | 52.8 | 320 | 91.3 |
| Std Dev | | 4 | 1.0 | 0.2 | 15 | 4.1 |
| Maximum | | 40 | 20.1 | 53.1 | 342 | 97.8 |
| Minimum | | 23 | 15.6 | 52.5 | 287 | 82.0 |
| N-value: 17 | | | | | | |

Sample Interval Time: 23.91 seconds.

Summary of SPT Test Results

| | | | | | | | |
|---|---------|---|-------|---------|---------|---------|---------|
| Project: GP554-3126, Test Date: 8/21/2023 | | EFV: Maximum Energy ETR: Energy Transfer Ratio - Rated | | | | | |
| FMX: Maximum Force | | | | | | | |
| VMX: Maximum Velocity | | | | | | | |
| BPM: Blows/Minute | | | | | | | |
| Length | Blows | N | N60 | Average | Average | Average | Average |
| ft | Applied | Value | Value | FMX | VMX | BPM | EFV |
| | /6" | | | kips | ft/s | bpm | ft-lb |
| 32.61 | 6-8-11 | 19 | 28 | 34 | 19.2 | 52.8 | 299 |
| 37.61 | 5-8-10 | 18 | 26 | 36 | 19.6 | 52.6 | 312 |
| 42.61 | 5-8-9 | 17 | 25 | 34 | 19.1 | 52.8 | 320 |
| Overall Average Values: | | | | 35 | 19.3 | 52.7 | 310 |
| Standard Deviation: | | | | 4 | 0.8 | 0.2 | 15 |
| Overall Maximum Value: | | | | 41 | 20.6 | 53.1 | 342 |
| Overall Minimum Value: | | | | 23 | 15.6 | 52.2 | 277 |



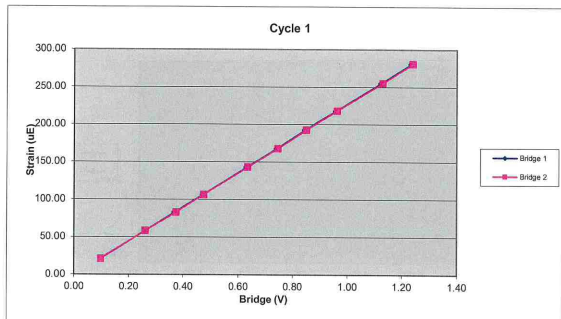
Exhibit B
PDA Equipment Calibration



| 648AWJ | | Cycle 1 | | |
|--------|------------|-------------|--------------|--------------|
| Sample | Force (lb) | Strain (µE) | Bridge 1 (V) | Bridge 2 (V) |
| 1 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 799.99 | 21.12 | 0.10 | 0.10 |
| 3 | 2111.63 | 58.22 | 0.26 | 0.26 |
| 4 | 2997.39 | 82.70 | 0.37 | 0.37 |
| 5 | 3848.07 | 106.26 | 0.47 | 0.47 |
| 6 | 5131.83 | 143.07 | 0.63 | 0.63 |
| 7 | 6017.79 | 167.81 | 0.74 | 0.75 |
| 8 | 6872.07 | 192.74 | 0.85 | 0.85 |
| 9 | 7783.57 | 218.15 | 0.96 | 0.96 |
| 10 | 9136.93 | 255.02 | 1.12 | 1.13 |
| 11 | 10026.70 | 280.73 | 1.24 | 1.24 |

| Bridge 1 | | Bridge 2 | |
|---------------------------|----------|---------------------------|----------|
| Force Calibration (lb/V) | 8120.30 | Force Calibration (lb/V) | 8089.75 |
| Offset | -4.24 | Offset | -2.24 |
| Correlation | 0.999998 | Correlation | 0.999995 |
| Strain Calibration (µE/V) | 228.56 | Strain Calibration (µE/V) | 227.70 |
| Offset | -1.57 | Offset | -1.51 |
| Correlation | 0.999991 | Correlation | 0.999983 |

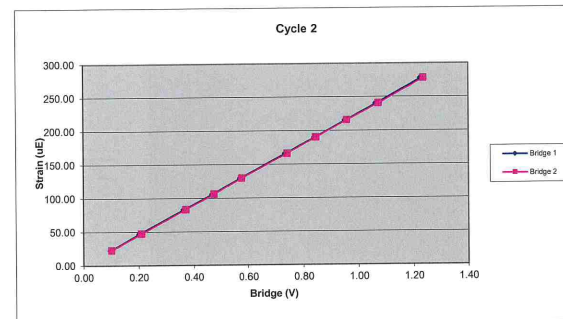
| Force Strain Calibration | |
|--------------------------|----------|
| EA (Kips) | 35527.98 |
| Offset | 51.69 |
| Correlation | 0.999986 |



| 648AWJ | | Cycle 2 | | |
|--------|------------|-------------|--------------|--------------|
| Sample | Force (lb) | Strain (µE) | Bridge 1 (V) | Bridge 2 (V) |
| 1 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 805.54 | 22.23 | 0.10 | 0.10 |
| 3 | 1679.81 | 47.04 | 0.20 | 0.21 |
| 4 | 2989.11 | 83.03 | 0.37 | 0.37 |
| 5 | 3830.62 | 105.81 | 0.47 | 0.47 |
| 6 | 4658.00 | 129.50 | 0.57 | 0.58 |
| 7 | 5984.74 | 165.81 | 0.74 | 0.74 |
| 8 | 6848.87 | 189.76 | 0.84 | 0.84 |
| 9 | 7747.90 | 215.15 | 0.95 | 0.96 |
| 10 | 8674.21 | 240.08 | 1.07 | 1.07 |
| 11 | 9994.82 | 277.48 | 1.23 | 1.24 |

| Bridge 1 | | Bridge 2 | |
|---------------------------|----------|---------------------------|----------|
| Force Calibration (lb/V) | 8127.14 | Force Calibration (lb/V) | 8103.79 |
| Offset | 10.37 | Offset | -14.59 |
| Correlation | 0.999997 | Correlation | 0.999997 |
| Strain Calibration (µE/V) | 225.29 | Strain Calibration (µE/V) | 224.64 |
| Offset | 0.36 | Offset | -0.33 |
| Correlation | 0.999990 | Correlation | 0.999992 |

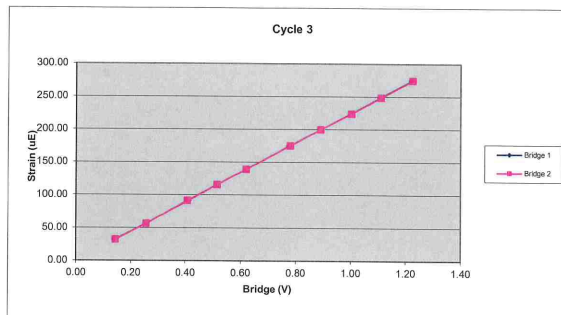
| Force Strain Calibration | |
|--------------------------|----------|
| EA (Kips) | 36073.41 |
| Offset | -2.66 |
| Correlation | 0.999993 |



| 648AWJ | | Cycle 3 | | |
|--------|------------|-------------|--------------|--------------|
| Sample | Force (lb) | Strain (µE) | Bridge 1 (V) | Bridge 2 (V) |
| 1 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 1153.24 | 31.90 | 0.14 | 0.14 |
| 3 | 2056.55 | 56.28 | 0.26 | 0.26 |
| 4 | 3310.19 | 91.18 | 0.41 | 0.41 |
| 5 | 4155.51 | 115.51 | 0.51 | 0.51 |
| 6 | 5035.81 | 139.16 | 0.62 | 0.62 |
| 7 | 6303.78 | 175.10 | 0.78 | 0.78 |
| 8 | 7221.91 | 199.87 | 0.89 | 0.89 |
| 9 | 8120.94 | 223.92 | 1.00 | 1.00 |
| 10 | 9001.15 | 248.68 | 1.11 | 1.11 |
| 11 | 9931.66 | 274.33 | 1.22 | 1.23 |

| Bridge 1 | | Bridge 2 | |
|---------------------------|----------|---------------------------|----------|
| Force Calibration (lb/V) | 8132.32 | Force Calibration (lb/V) | 8118.57 |
| Offset | -20.37 | Offset | -15.36 |
| Correlation | 0.999998 | Correlation | 0.999997 |
| Strain Calibration (µE/V) | 224.79 | Strain Calibration (µE/V) | 224.41 |
| Offset | -0.57 | Offset | -0.43 |
| Correlation | 0.999984 | Correlation | 0.999985 |

| Force Strain Calibration | |
|--------------------------|----------|
| EA (Kips) | 36175.62 |
| Offset | 0.42 |
| Correlation | 0.999984 |



Bridge Excitation (V) 5
Shunt Resistor (ohm) 60.4k

| Calibration Factors | | 648AWJ | |
|---------------------|----------|-------------------------|--------|
| Bridge 1 (µE/V) | 226.21 | Bridge 2 (µE/V) | 225.58 |
| EA Factor (Kips) | 35925.67 | Area (in ²) | 1.20 |

Calibrated by: *Aht*
Calibrated Date: 3/3/2022

Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

Traceable to N.I.S.T.

Accelerometer Calibration Certificate
Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.
Calibration performed on 26Oct2021

Serial No: K4483 Temperature: 22.1 °C
Model: PR Humidity: 45%
Calibrated on: Channel 3 on 8G 5161 LE

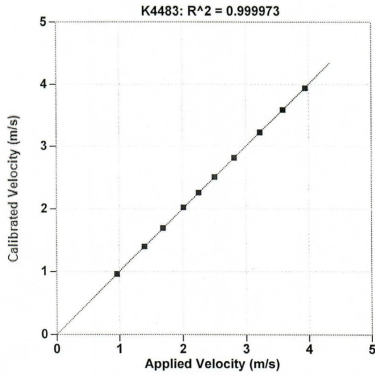
PDA CALIBRATION FACTOR
410.2 mv/5000g
(62.0 μ v/g)
R²: 0.999973 [Chip programmed]

Operator: William Johnson

Signed

Ref Acc 1: 690961 Cal on: 27Jan2021
978 g's/volt
Ref Acc 2: 691321 Cal on: 09Feb2021
960 g's/volt

Reference accelerometer calibrations are traceable to
the United States National Institute of Standards and
Technology (NIST).



Date printed: 26Oct2021, version: 2020.30.170 0.57

Accelerometer Calibration Certificate
Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.
Calibration performed on 25Jan2022

Serial No: K10491 Temperature: 19.3 °C
Model: PR Humidity: 30%
Calibrated on: Channel 3 on 8G 5161 LE

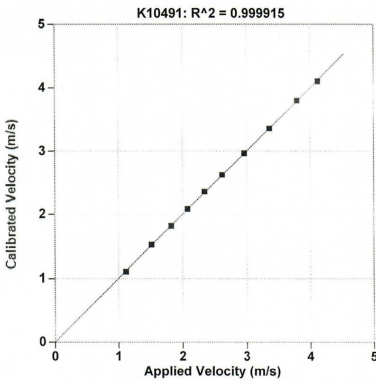
PDA CALIBRATION FACTOR
421.9 mv/5000g
(84.4 μ v/g)
R²: 0.999915 [Chip programmed]

Operator: William Johnson

Signed

Ref Acc 1: 691321 Cal on: 09Feb2021
960 g's/volt
Ref Acc 2: 690961 Cal on: 27Jan2021
978 g's/volt

Reference accelerometer calibrations are traceable to
the United States National Institute of Standards and
Technology (NIST).



Date printed: 25Jan2022, version: 2020.30.170 0.05

For Boring S-23-40-2

SPT Automatic Hammer Energy Measurement Report

Drill Rig Model: Geoprobe 3126GT

Drill Rig Serial Number: 3126S5V224106

Asset Number: DR#1327

September 13, 2024

September 13, 2024

Terracon Consultants Inc.
72 Pointe Circle
Greenville, SC 29615

Attn: Nitin Dudani
E: nitin.dudani@terracon.com

Re: SPT Automatic Hammer Energy Measurement Report
Rig No: 1327
Terracon Project Number: 73245115

Dear Mr. Dudani:

This report provides the Energy Transfer Ratio (ETR) for the Standard Penetration Testing (SPT) automatic hammer as summarized below:

Table 1: Hammer Efficiency Summary

| Drill Rig Make/Model | Drill Rig Serial Number | Drill Rig Year | Asset Number | Energy Transfer Ratio (ETR) | Hammer Efficiency Correction (C _e) |
|----------------------|-------------------------|----------------|--------------|-----------------------------|--|
| Geoprobe | 3126S5V224106 | 2024 | DR#1327 | 92.6% ± 1.75% | 1.54 |

*Please Note: according to ASTM standard, a minimum of three recordings should be collected at five-foot intervals no shallower than twenty feet below current ground surface (bgs). The sample intervals were obtained between 30 and 50 feet bgs.

If you have any questions concerning this summary, or if we may be of further service, please contact us.

Ryan C. Wakeford, P.E.
Geotechnical Engineer

Susheel R. Kolwalkar

Susheel R. Kolwalkar, Ph.D., P.E.
Regional Services Manager



Micah Hatch, P.E.
Geotechnical Department Manager

Attachments:

- Exhibit A: SPT Representative Blow
- Exhibit B: SPT Analyzer Literature and Equipment Calibrations
- Exhibit C: SPT Analyzer Results
- Exhibit D: Field Log
- Exhibit E: Copy of Certificate of Proficiency

Facilities | Environmental | Geotechnical | Materials |

Prepared for:

Terracon Consultants, Inc.
Greenville, South Carolina



1.0 MEASUREMENT SUMMARY

| ITEM | DESCRIPTION |
|-------------------------------|---|
| Drill Rig Owner | Terracon Consultant, Inc. – Greenville, SC |
| Drill Rig Operator | Brett Burnett: Terracon Exploration |
| Testing Date | 9/5/2024 |
| Testing Location | Sumter County, SC |
| Boring Identification | B-3 |
| Energy Measurement Depths | 30 ft, 40 ft, 45 ft, 50 ft |
| Subsurface Soils | Poorly graded sands (SP) to clayey sands (SC) |
| Hammer Type/Height | 140 pounds (automatic) with 2.5-foot drop height |
| Boring Method | Mud rotary |
| Drill Rods | <ul style="list-style-type: none"> AWJ 1-3/4" outside diameter 1- 1/4" inside diameter 1.15 in² cross sectional area 1/4" wall thickness |
| Calibration Testing Equipment | <ul style="list-style-type: none"> 2-foot AWJ rod instrumented w/ two strain gauges and two accelerometers manufactured by Pile Dynamics Inc. (PDI) SN: 746AWJ Model SPT Analyzer™ (PDA) SN: 4621 TB |
| ASTM Methods Used | ASTM D1586, Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils ASTM D4633-16, Standard Method for Energy Measurement for Dynamic Penetrometers |
| SPT Calibration Personnel | Ryan Wakeford – Intermediate PDA Proficiency, Terracon Consultants, Inc. |

2.0 PURPOSE AND SCOPE OF WORK

The North Charleston office of Terracon Consultants, Inc. conducted SPT energy measurements in accordance with ASTM D4633-16 at a site off Panola Road in Sumter County, South Carolina. Energy measurements on the rig were taken during eight samples events.

3.0 TEST RESULTS

Table 2: SPT Hammer Energy Calibration Testing Summary

| Boring | Start Depth ¹ (ft) | Rod Length ² (ft) | Rod Sections ³ | | Measured Blow Counts (blows/6 inches) | | | | SPT N _{meas} (bpf) | Soil Type ⁴ | |
|--------|----------------------------------|---------------------------------|---------------------------|------|--|------|-------|----------------------|-----------------------------------|------------------------|----------------------|
| | | | | | 2 ft | 5 ft | 10 ft | 1 st Inc. | | | 2 nd Inc. |
| | | | 28.5 | 33.7 | 0 | 6 | 0 | 4 | 5 | | 6 |
| B-3 | 38.5 | 43.7 | 0 | 8 | 0 | 7 | 10 | 10 | - | 20 | SP |
| | 43.5 | 48.7 | 0 | 9 | 0 | 4 | 5 | 7 | - | 12 | SP |
| | 48.5 | 53.7 | 0 | 10 | 0 | 4 | 4 | 7 | - | 11 | SP |

- Depth from existing ground surface to start of SPT
- Total rod length from instrumentation to bottom of sampler
- Two-foot section is instrumented and is located at top of drill rods
- Soil type visually classified by Terracon

Table 3: Energy Measurement and Analysis Summary

| Boring | Start Depth ¹ (ft) | SPT N _m (bpf) | No. of Blows ² | EMX ³ (ft-lbs) | | | | ETR ³ (%) | |
|----------|----------------------------------|--------------------------------|---------------------------------|---------------------------|------|------|-----------|----------------------|-----------|
| | | | | Max. | Min. | Ave. | Std. Dev. | Ave. | Std. Dev. |
| B-3 | 28.5 | 11 | 11 | 340 | 313 | 327 | 8.8 | 93.4 | 2.5 |
| | 38.5 | 20 | 20 | 334 | 309 | 318 | 5.6 | 90.9 | 1.6 |
| | 43.5 | 12 | 12 | 330 | 309 | 323 | 5.5 | 92.4 | 1.6 |
| | 48.5 | 11 | 11 | 334 | 320 | 328 | 4.5 | 93.7 | 1.3 |
| Average: | | | | 335 | 313 | 334 | 6.1 | 92.6 | 1.75 |

- Boring ID and depth from existing ground surface to start of SPT
- Number of blows used in energy calibration analysis; limited to measurements recorded during the second and third 6-inch sampling intervals at each depth or during the first increment if refusal were encountered
- EMX = Maximum Transferred Energy, ETR = Energy Transfer Ratio.

Table 4: Hammer Blow Rate Summary

| Boring | Start Depth ¹ (ft) | SPT N _{meas} (bpf) | No. of Blows ² | BPM ³ | | | |
|----------|----------------------------------|-----------------------------------|---------------------------------|------------------|------|------|-----------|
| | | | | Max. | Min. | Ave. | Std. Dev. |
| B-3 | 28.5 | 11 | 11 | 53.8 | 53.1 | 53.5 | 0.2 |
| | 38.5 | 20 | 20 | 53.7 | 53.0 | 53.4 | 0.1 |
| | 43.5 | 12 | 12 | 53.6 | 53.2 | 53.4 | 0.1 |
| | 48.5 | 11 | 11 | 53.8 | 53.1 | 53.4 | 0.2 |
| Average: | | | | 53.7 | 53.1 | 53.4 | 0.2 |

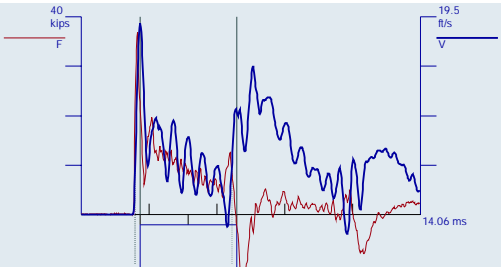
1. Boring ID and depth from existing ground surface to start of SPT.
2. Number of blows used in energy calibration analysis. Limited to measurements recorded during the second and third 6-inch sampling intervals at each depth or during the 1st increment if refusal conditions were encountered.
3. BPM = Blows per minute

Exhibit A

SPT Representative Blow

GRL Engineers, Inc.
GEOPROBE 3126GT
28.5-30
B3
PDA Operator: RW

Pile Driving Analyzer ® (PDA)
Version: 2022.35.2



BN 13
05Sep2024 10:07:23 AM

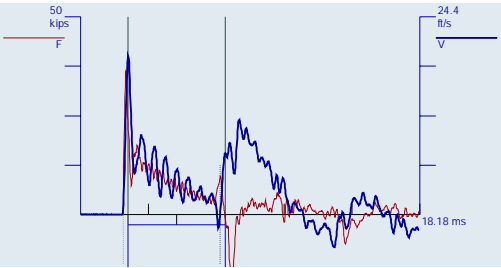
| | |
|-----|-----------|
| CSX | 32.1 ksi |
| DMX | 1.11 in |
| EFV | 331 ft-lb |
| ETR | 94.7 % |
| BPM | 53.8 bpm |
| RAT | 1.0 |
| VMX | 18.9 ft/s |
| FMX | 37 kips |
| DFN | 1.00 in |
| MEX | 1070 µE |
| AMX | 3001 g/s |
| FVP | 0.6 |

| | |
|----|-------------------------|
| LE | 33.70 ft |
| AR | 1.15 in ² |
| EM | 30000 ksi |
| SP | 0.492 k/ft ³ |
| WS | 16807.9 ft/s |
| WC | 16766.2 ft/s |
| JC | 0.90 |
| JF | 1.00 |

| | |
|-------------------|-------------------------------|
| F1: [746AWJ1] | 222.05 PDICAL (1) FF1 |
| F2: [746AWJ2] | 222.19 PDICAL (1) FF1 |
| A3 (PR): [K14007] | 407.233 mv/6.4v/5000g (1) VF1 |
| A4 (PR): [K14006] | 375.226 mv/6.4v/5000g (1) VF1 |

GRL Engineers, Inc.
GEOPROBE 3126GT
38.5-40
B3
PDA Operator: RW

Pile Driving Analyzer ® (PDA)
Version: 2022.35.2

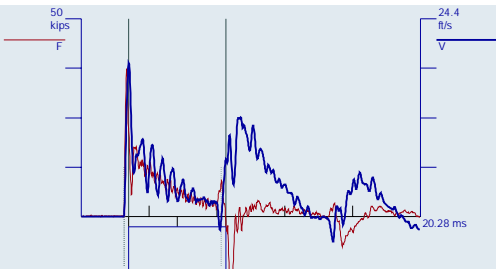


BN 25
05Sep2024 10:24:35 AM

| | |
|-----|-----------|
| CSX | 31.7 ksi |
| DMX | 0.66 in |
| EFV | 324 ft-lb |
| ETR | 92.6 % |
| BPM | 53.4 bpm |
| RAT | 1.1 |
| VMX | 19.6 ft/s |
| FMX | 36 kips |
| DFN | 0.60 in |
| MEX | 1056 µE |
| AMX | 3358 g/s |

| | |
|----|-------------------------|
| LE | 43.70 ft |
| AR | 1.15 in ² |
| EM | 30000 ksi |
| SP | 0.492 k/ft ³ |
| WS | 16807.9 ft/s |
| WC | 16807.7 ft/s |
| JC | 0.90 |
| JF | 1.00 |

| | |
|-------------------|-------------------------------|
| F1: [746AWJ1] | 222.05 PDICAL (1) FF1 |
| F2: [746AWJ2] | 222.19 PDICAL (1) FF1 |
| A3 (PR): [K14007] | 407.233 mv/6.4v/5000g (1) VF1 |
| A4 (PR): [K14006] | 375.226 mv/6.4v/5000g (1) VF1 |

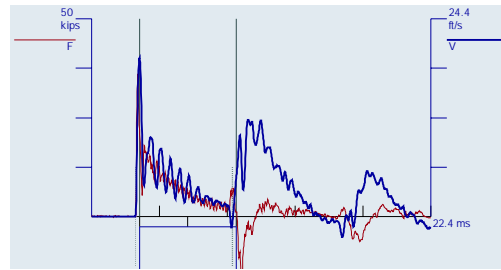


BN 14
 05Sep2024 10:32:57 AM

CSX 32.6 ksi
 DMX 0.91 in
 EFV 325 ft-lb
 ETR 92.8 %
 BPM 53.4 bpm
 RAT 1.0
 VMX 19.0 ft/s
 FMX 37 kips
 DFN 0.86 in
 MEX 1086 µE
 AMX 3426 g's

LE 48.70 ft
 AR 1.15 in²
 EM 30000 ksi
 SP 0.492 k/ft³
 WS 16807.9 ft/s
 WC 16793.1 ft/s
 JC 0.90
 JF 1.00

F1: [746AWJ1] 222.05 PDICAL (1) FF1
 F2: [746AWJ2] 222.19 PDICAL (1) FF1
 A3 (PR): [K14007] 407.233 mm/6.4v/5000g (1) VF1
 A4 (PR): [K14006] 375.226 mm/6.4v/5000g (1) VF1



BN 13
 05Sep2024 10:42:13 AM

CSX 31.5 ksi
 DMX 1.01 in
 EFV 320 ft-lb
 ETR 91.4 %
 BPM 53.7 bpm
 RAT 1.1
 VMX 19.6 ft/s
 FMX 36 kips
 DFN 0.86 in
 MEX 1049 µE
 AMX 4077 g's

LE 53.70 ft
 AR 1.15 in²
 EM 30000 ksi
 SP 0.492 k/ft³
 WS 16807.9 ft/s
 WC 16781.3 ft/s
 JC 0.90
 JF 1.00

F1: [746AWJ1] 222.05 PDICAL (1) FF1
 F2: [746AWJ2] 222.19 PDICAL (1) FF1
 A3 (PR): [K14007] 407.233 mm/6.4v/5000g (1) VF1
 A4 (PR): [K14006] 375.226 mm/6.4v/5000g (1) VF1



SPT Analyzer

SPT Analyzer

Measures the energy transferred into an instrumented SPT rod during a Standard Penetration Test (SPT)

Reliable. Simplified. Rugged.

The SPT Analyzer determines the energy transferred by SPT hammers using force and velocity measurements, for improved reliability of SPT N-values.

What is SPT?

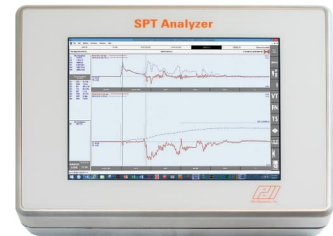
The Standard Penetration Test (SPT) is a widely-employed soil exploration tool that involves using an SPT hammer to drive a split sampler at the bottom of a drill string to obtain soil samples. The number of blows required to penetrate the last 300mm (1ft) is the "N value" which is related to soil strength.

Why measure the energy transferred by the SPT hammer?

Several different types of SPT hammers are used to conduct Standard Penetration Tests. Their varying efficiencies influence the N value. The measured N value is normalized by multiplying it by the ratio of the measured energy transferred to the rod to 60% of the theoretical potential energy. The normalization compensates for the variability of the efficiencies of different SPT hammer types, and improves the reliability of soil strength estimates used in geotechnical applications.

The SPT Analyzer is furnished with a 0.6m sub assembly (or section) of an SPT rod (AW, NW or other type) instrumented with two strain gage bridges, and calibrated by Pile Dynamics. Once in the field, two accelerometers are bolted to the rod section. The instrumented section is inserted at the top of the drill string between the hammer and the existing sampling rod. The sensors on the rod are connected to the SPT Analyzer.

Smart Sensor technology allows the SPT Analyzer to read the rod instrumentation, obtaining the sensor calibration and rod cross sectional area.



- Calculates energy transferred by SPT hammers using force and velocity measurements
- Determines N Value to help improve reliability of soil strength estimates
- Offers simplified reporting and analysis option to speed testing results
- Operates in English, SI, or Metric units



Exhibit B

SPT Analyzer Literature and Equipment Calibrations

EN ISO 22486-3:2005/ASTM Compliant

The SPT Analyzer is compliant with EN ISO 22476-3:2005. ASTM D1586 recommends normalizing results from any SPT test using energy measurements. When these tests are performed to determine the liquefaction potential of sands, ASTM D6066 not only recommends but mandates the normalization. ASTM D4633 states that the only acceptable method of determining energy for normalization of N values is by force and velocity measurements.

These quantities are input to the SPT Analyzer automatically. This significantly simplifies the initial test setup.

The strain gages and accelerometers obtain the force and velocity signals necessary for the calculation of transferred energy to the drill string for each hammer blow. The energy is displayed in real time on the SPT Analyzer screen.

Output

SPT Analyzer data is stored and transferred to a computer via USB memory stick. The software furnished with the SPT Analyzer has a Report Creation Option that makes it quick and easy to summarize results and create output graphs of Force, Velocity, Energy and Displacement versus Time, as well as numerical, statistical, and graphical results for each data set. The software is fully customizable.



Pile Dynamics, Inc. (PDI) is the world leader in developing, manufacturing and supplying state of the art QA/QC products and systems for the deep foundations industry. The company is headquartered in Cleveland, Ohio, USA, with offices and representatives worldwide. For additional information visit us at www.pile.com or contact info@pile.com.

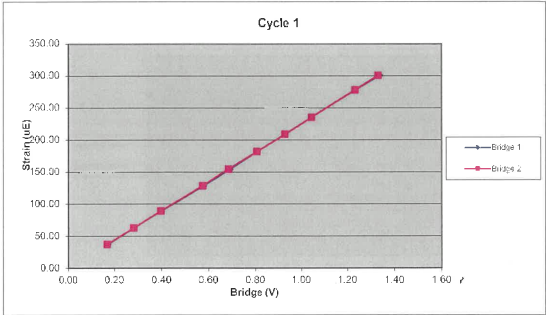
www.pile.com | +1 (216) 831-6131 | info@pile.com



| 746AWJ | | Cycle 1 | | |
|--------|------------|-------------|--------------|--------------|
| Sample | Force (lb) | Strain (µE) | Bridge 1 (V) | Bridge 2 (V) |
| 1 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 1296.93 | 37.22 | 0.17 | 0.17 |
| 3 | 2135.32 | 62.74 | 0.28 | 0.28 |
| 4 | 3028.79 | 89.39 | 0.40 | 0.40 |
| 5 | 4377.09 | 128.61 | 0.58 | 0.57 |
| 6 | 5243.07 | 154.57 | 0.69 | 0.68 |
| 7 | 6143.17 | 181.90 | 0.81 | 0.81 |
| 8 | 7067.05 | 208.93 | 0.93 | 0.93 |
| 9 | 7958.18 | 235.42 | 1.04 | 1.05 |
| 10 | 9380.66 | 278.02 | 1.23 | 1.23 |
| 11 | 10161.74 | 300.76 | 1.34 | 1.33 |

| Bridge 1 | | Bridge 2 | |
|---------------------------|----------|---------------------------|----------|
| Force Calibration (lb/V) | 7605.07 | Force Calibration (lb/V) | 7606.74 |
| Offset | -0.16 | Offset | 12.66 |
| Correlation | 0.999997 | Correlation | 0.999999 |
| Strain Calibration (µE/V) | 225.99 | Strain Calibration (µE/V) | 226.04 |
| Offset | -1.01 | Offset | -0.83 |
| Correlation | 0.999989 | Correlation | 0.999992 |

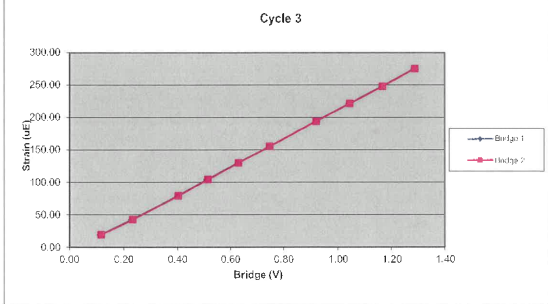
| Force Strain Calibration | |
|--------------------------|----------|
| EA (Kips) | 33651.50 |
| Offset | 33.98 |
| Correlation | 0.999994 |



| 746AWJ | | Cycle 3 | | |
|--------|------------|-------------|--------------|--------------|
| Sample | Force (lb) | Strain (µE) | Bridge 1 (V) | Bridge 2 (V) |
| 1 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 838.16 | 19.27 | 0.11 | 0.12 |
| 3 | 1786.75 | 42.28 | 0.23 | 0.23 |
| 4 | 3083.67 | 79.12 | 0.40 | 0.40 |
| 5 | 3943.80 | 104.13 | 0.51 | 0.51 |
| 6 | 4839.52 | 129.87 | 0.63 | 0.63 |
| 7 | 5750.14 | 155.24 | 0.75 | 0.75 |
| 8 | 7079.92 | 194.22 | 0.92 | 0.92 |
| 9 | 8007.70 | 221.43 | 1.04 | 1.06 |
| 10 | 8943.28 | 247.95 | 1.17 | 1.17 |
| 11 | 9871.55 | 275.44 | 1.29 | 1.29 |

| Bridge 1 | | Bridge 2 | |
|---------------------------|----------|---------------------------|----------|
| Force Calibration (lb/V) | 7659.96 | Force Calibration (lb/V) | 7667.39 |
| Offset | 13.76 | Offset | -1.59 |
| Correlation | 0.999999 | Correlation | 0.999998 |
| Strain Calibration (µE/V) | 219.43 | Strain Calibration (µE/V) | 219.64 |
| Offset | -7.95 | Offset | -8.39 |
| Correlation | 0.999934 | Correlation | 0.999939 |

| Force Strain Calibration | |
|--------------------------|----------|
| EA (Kips) | 34904.41 |
| Offset | 291.93 |
| Correlation | 0.999935 |



Accelerometer Calibration Certificate
Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.
Calibration performed on MAY 16 2024

Serial No: K14006 Temperature: 24.0 °C
Model: PR Humidity: 42%
Calibrated on: Channel 3 on 8G 5161 LE

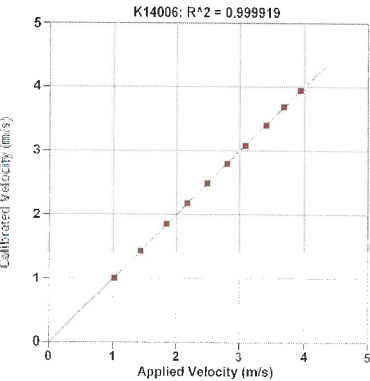
PDA CALIBRATION FACTOR
375.2 mv/5000g
(75.0 μ v/g)
R²: 0.999919 [Chip programmed]

Operator: William Johnson

Signed

Ref Acc 1: 78268! Cal on: 11Jan2024
986 g/s/volt
Ref Acc 2: 78270! Cal on: 11Jan2024
971 g/s/volt

Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



Version 2020 09 11 16 42 17

Accelerometer Calibration Certificate
Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.
Calibration performed on MAY 16 2024

Serial No: K14007 Temperature: 23.8 °C
Model: PR Humidity: 42%
Calibrated on: Channel 4 on 8G 5161 LE

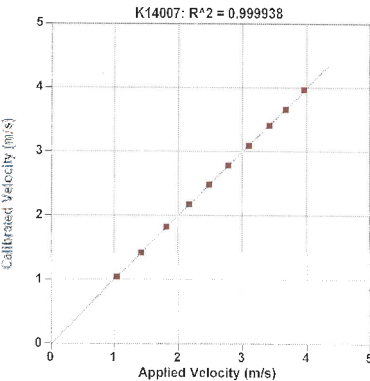
PDA CALIBRATION FACTOR
407.2 mv/5000g
(81.4 μ v/g)
R²: 0.999938 [Chip programmed]

Operator: William Johnson

Signed

Ref Acc 1: 78268! Cal on: 11Jan2024
986 g/s/volt
Ref Acc 2: 78270! Cal on: 11Jan2024
971 g/s/volt

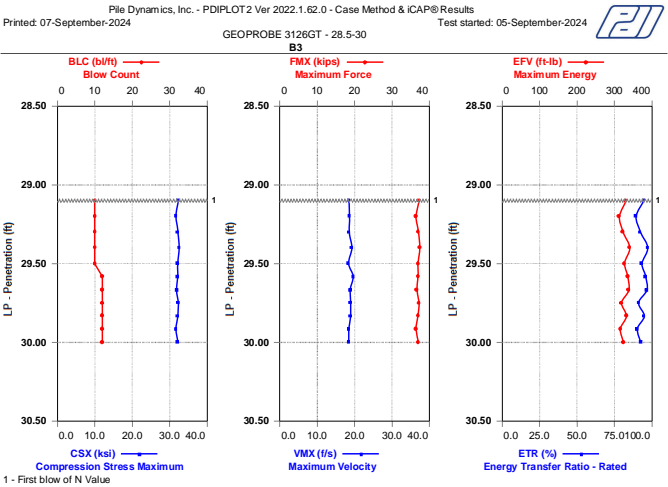
Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



Version 2020 06 16 16 42 06



Exhibit C
SPT Analyzer Results



Case Method & iCAP® Results

GEOPROBE 3126GT - 28.5-30

B3

OP: RW Date: 05-September-2024
AR: 1.15 in² SP: 0.492 klf/ft
LE: 33.70 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

FMX: Maximum Force BPM: Blows/Minute
VMX: Maximum Velocity DMX: Maximum Displacement
EMX: Maximum Energy DFN: Final Displacement
EFV: Maximum Energy CSX: Compression Stress Maximum
ETR: Energy Transfer Ratio - Rated

| BL# | Depth ft | BLC b/ft | FMX kips | VMX f/s | EMX ft-lb | EFV ft-lb | ETR (%) | BPM bpm | DMX in | DFN in | CSX ksi |
|-----------|-------------|-------------|-------------|------------|--------------|--------------|------------|------------|-----------|-----------|------------|
| 5 | 29.10 | 10 | 37 | 18.4 | 331.0 | 331.0 | 94.6 | 53.1 | 1.58 | 1.20 | 32.3 |
| 6 | 29.20 | 10 | 36 | 18.7 | 312.7 | 312.7 | 89.3 | 53.4 | 1.47 | 1.20 | 31.7 |
| 7 | 29.30 | 10 | 37 | 18.5 | 323.0 | 323.0 | 92.3 | 53.6 | 1.54 | 1.20 | 32.2 |
| 8 | 29.40 | 10 | 37 | 19.2 | 340.4 | 340.4 | 97.3 | 53.4 | 1.57 | 1.20 | 32.5 |
| 9 | 29.50 | 10 | 37 | 18.4 | 326.6 | 326.6 | 93.3 | 53.5 | 1.48 | 1.20 | 32.1 |
| 10 | 29.58 | 12 | 37 | 19.6 | 335.5 | 335.5 | 95.9 | 53.3 | 1.41 | 1.00 | 32.1 |
| 11 | 29.67 | 12 | 37 | 18.8 | 338.0 | 338.0 | 96.6 | 53.7 | 1.58 | 1.00 | 31.8 |
| 12 | 29.75 | 12 | 37 | 18.9 | 318.3 | 318.3 | 90.9 | 53.5 | 1.37 | 1.00 | 32.3 |
| 13 | 29.83 | 12 | 37 | 18.9 | 331.4 | 331.4 | 94.7 | 53.8 | 1.11 | 1.00 | 32.1 |
| 14 | 29.92 | 12 | 36 | 18.5 | 315.2 | 315.2 | 90.1 | 53.8 | 1.09 | 1.00 | 31.7 |
| 15 | 30.00 | 12 | 37 | 18.4 | 324.1 | 324.1 | 92.6 | 53.6 | 1.07 | 1.00 | 32.1 |
| Average | | | 37 | 18.8 | 326.9 | 326.9 | 93.4 | 53.5 | 1.39 | 1.09 | 32.1 |
| Std. Dev. | | | 0 | 0.4 | 8.8 | 8.8 | 2.5 | 0.2 | 0.19 | 0.10 | 0.3 |
| Maximum | | | 37 | 19.6 | 340.4 | 340.4 | 97.3 | 53.8 | 1.58 | 1.20 | 32.5 |
| Minimum | | | 36 | 18.4 | 312.7 | 312.7 | 89.3 | 53.1 | 1.07 | 1.00 | 31.7 |

Total number of blows analyzed: 11

BL# Sensors

5-15 F1: [746AWJ1] 222.1 (1.00); F2: [746AWJ2] 222.2 (1.00); A3: [K14007] 407.2 (1.00);
A4: [K14006] 375.2 (1.00)

BL# Comments

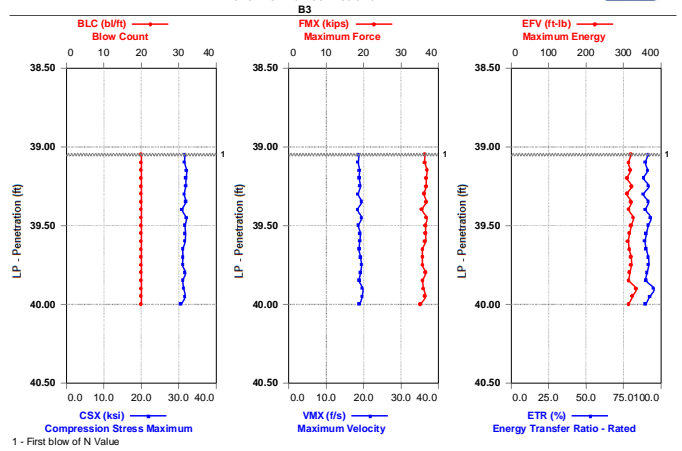
5 First blow of N Value

Time Summary

Drive 15 seconds 10:07 AM - 10:07 AM BN 1 - 15

GEOPROBE 3126GT - 38.5-40

Test started: 05-September-2024



Case Method & iCAP® Results

GEOPROBE 3126GT - 38.5-40

B3

OP: RW Date: 05-September-2024
AR: 1.15 in² SP: 0.492 klf/ft
LE: 43.70 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

FMX: Maximum Force BPM: Blows/Minute
VMX: Maximum Velocity DMX: Maximum Displacement
EMX: Maximum Energy DFN: Final Displacement
EFV: Maximum Energy CSX: Compression Stress Maximum
ETR: Energy Transfer Ratio - Rated

| BL# | Depth ft | BLC b/ft | FMX kips | VMX f/s | EMX ft-lb | EFV ft-lb | ETR (%) | BPM bpm | DMX in | DFN in | CSX ksi |
|-----------|-------------|-------------|-------------|------------|--------------|--------------|------------|------------|-----------|-----------|------------|
| 7 | 39.05 | 20 | 36 | 18.7 | 320.4 | 320.4 | 91.5 | 53.3 | 0.91 | 0.60 | 31.6 |
| 8 | 39.10 | 20 | 36 | 18.5 | 313.6 | 313.6 | 89.6 | 53.2 | 0.65 | 0.60 | 31.6 |
| 9 | 39.15 | 20 | 37 | 18.9 | 318.4 | 318.4 | 91.0 | 53.4 | 0.66 | 0.60 | 32.1 |
| 10 | 39.20 | 20 | 37 | 18.9 | 309.8 | 309.8 | 88.5 | 53.5 | 0.64 | 0.60 | 31.9 |
| 11 | 39.25 | 20 | 37 | 19.1 | 321.4 | 321.4 | 91.8 | 53.2 | 0.93 | 0.60 | 31.9 |
| 12 | 39.30 | 20 | 36 | 18.5 | 309.3 | 309.3 | 88.4 | 53.5 | 0.64 | 0.60 | 31.5 |
| 13 | 39.35 | 20 | 37 | 19.5 | 320.6 | 320.6 | 91.6 | 53.0 | 0.69 | 0.60 | 31.9 |
| 14 | 39.40 | 20 | 36 | 18.4 | 314.3 | 314.3 | 89.8 | 53.3 | 0.80 | 0.60 | 30.9 |
| 15 | 39.45 | 20 | 37 | 19.5 | 326.5 | 326.5 | 93.3 | 53.5 | 0.92 | 0.60 | 32.0 |
| 16 | 39.50 | 20 | 36 | 18.6 | 320.6 | 320.6 | 91.6 | 53.5 | 1.02 | 0.60 | 31.7 |
| 17 | 39.55 | 20 | 37 | 19.1 | 316.4 | 316.4 | 90.4 | 53.7 | 0.68 | 0.60 | 31.8 |
| 18 | 39.60 | 20 | 36 | 19.0 | 312.4 | 312.4 | 89.2 | 53.3 | 0.66 | 0.60 | 31.7 |
| 19 | 39.65 | 20 | 36 | 18.8 | 315.8 | 315.8 | 90.2 | 53.5 | 0.70 | 0.60 | 31.1 |
| 20 | 39.70 | 20 | 36 | 19.2 | 320.1 | 320.1 | 91.5 | 53.4 | 0.78 | 0.60 | 31.1 |
| 21 | 39.75 | 20 | 36 | 19.5 | 320.9 | 320.9 | 91.7 | 53.3 | 0.63 | 0.60 | 31.0 |
| 22 | 39.80 | 20 | 37 | 19.2 | 317.1 | 317.1 | 90.6 | 53.5 | 0.74 | 0.60 | 31.7 |
| 23 | 39.85 | 20 | 36 | 18.8 | 315.1 | 315.1 | 90.0 | 53.5 | 0.61 | 0.60 | 31.1 |
| 24 | 39.90 | 20 | 36 | 19.7 | 333.6 | 333.6 | 95.3 | 53.5 | 0.83 | 0.60 | 31.3 |
| 25 | 39.95 | 20 | 36 | 19.6 | 323.9 | 323.9 | 92.6 | 53.4 | 0.66 | 0.60 | 31.7 |
| 26 | 40.00 | 20 | 35 | 18.9 | 313.5 | 313.5 | 89.6 | 53.5 | 0.60 | 0.60 | 30.6 |
| Average | | | 36 | 19.0 | 318.2 | 318.2 | 90.9 | 53.4 | 0.74 | 0.60 | 31.5 |
| Std. Dev. | | | 0 | 0.4 | 5.6 | 5.6 | 1.6 | 0.1 | 0.12 | 0.00 | 0.4 |
| Maximum | | | 37 | 19.7 | 333.6 | 333.6 | 95.3 | 53.7 | 1.02 | 0.60 | 32.1 |
| Minimum | | | 35 | 18.4 | 309.3 | 309.3 | 88.4 | 53.0 | 0.60 | 0.60 | 30.6 |

Total number of blows analyzed: 20

BL# Sensors

7-26 F1: [746AWJ1] 222.1 (1.00); F2: [746AWJ2] 222.2 (1.00); A3: [K14007] 407.2 (1.00);
A4: [K14006] 375.2 (1.00)

BL# Comments

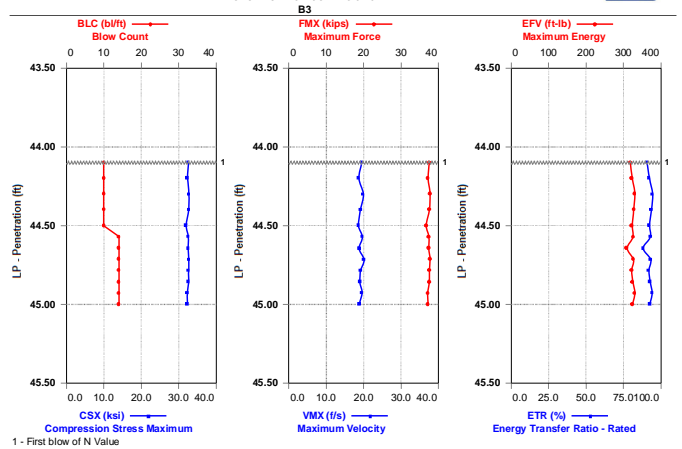
7 First blow of N Value

Time Summary

Drive 28 seconds 10:24 AM - 10:24 AM BN 1 - 26

GEOPROBE 3126GT - 43.5-45

Test started: 05-September-2024



Case Method & iCAP® Results

GEOPROBE 3126GT - 43.5-45

B3

Date: 05-September-2024

OP: RW
AR: 1.15 in²
LE: 48.70 ft
WS: 16,807.9 f/s

SP: 0.492 klf/ft³

EM: 30,000 ksi

JC: 0.00

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Maximum Energy
EFV: Maximum Energy

BPM: Blows/Minute
DMX: Maximum Displacement
DFN: Final Displacement
CSX: Compression Stress Maximum

ETR: Energy Transfer Ratio - Rated

| BL# | Depth ft | BLC b/ft | FMX kips | VMX f/s | EMX ft-lb | EFV ft-lb | ETR (%) | BPM bpm | DMX in | DFN in | CSX ksi |
|-----------|-------------|-------------|-------------|------------|--------------|--------------|------------|------------|-----------|-----------|------------|
| 5 | 44.10 | 10 | 37 | 19.5 | 317.4 | 317.4 | 90.7 | 53.2 | 1.23 | 1.19 | 32.6 |
| 6 | 44.20 | 10 | 37 | 18.7 | 322.7 | 322.7 | 92.2 | 53.3 | 1.22 | 1.20 | 32.4 |
| 7 | 44.30 | 10 | 38 | 19.9 | 330.1 | 330.1 | 94.3 | 53.4 | 1.30 | 1.20 | 32.8 |
| 8 | 44.40 | 10 | 38 | 19.2 | 327.2 | 327.2 | 93.5 | 53.5 | 1.22 | 1.20 | 32.6 |
| 9 | 44.50 | 10 | 37 | 18.6 | 323.0 | 323.0 | 92.3 | 53.5 | 1.21 | 1.20 | 32.0 |
| 10 | 44.57 | 14 | 37 | 19.7 | 325.2 | 325.2 | 92.9 | 53.4 | 0.95 | 0.85 | 32.6 |
| 11 | 44.64 | 14 | 37 | 18.8 | 309.1 | 309.1 | 88.3 | 53.6 | 0.90 | 0.85 | 32.5 |
| 12 | 44.71 | 14 | 38 | 20.1 | 326.0 | 326.0 | 93.2 | 53.5 | 1.06 | 0.86 | 32.8 |
| 13 | 44.79 | 14 | 37 | 19.2 | 321.1 | 321.1 | 91.8 | 53.4 | 1.05 | 0.86 | 32.6 |
| 14 | 44.86 | 14 | 37 | 19.0 | 324.7 | 324.7 | 92.8 | 53.4 | 0.91 | 0.86 | 32.6 |
| 15 | 44.93 | 14 | 37 | 19.5 | 329.6 | 329.6 | 94.2 | 53.5 | 0.99 | 0.86 | 32.3 |
| 16 | 45.00 | 14 | 37 | 18.8 | 323.5 | 323.5 | 92.4 | 53.4 | 0.89 | 0.86 | 32.3 |
| Average | | 37 | 19.3 | 323.3 | 323.3 | 92.4 | 53.4 | 1.08 | 1.00 | 0.92 | 32.5 |
| Std. Dev. | | 0 | 0.5 | 5.5 | 5.5 | 1.6 | 0.1 | 0.15 | 0.17 | 0.2 | 0.2 |
| Maximum | | 38 | 20.1 | 330.1 | 330.1 | 94.3 | 53.6 | 1.30 | 1.20 | 0.86 | 32.8 |
| Minimum | | 37 | 18.6 | 309.1 | 309.1 | 88.3 | 53.2 | 0.89 | 0.85 | 0.86 | 32.0 |

Total number of blows analyzed: 12

BL# Sensors

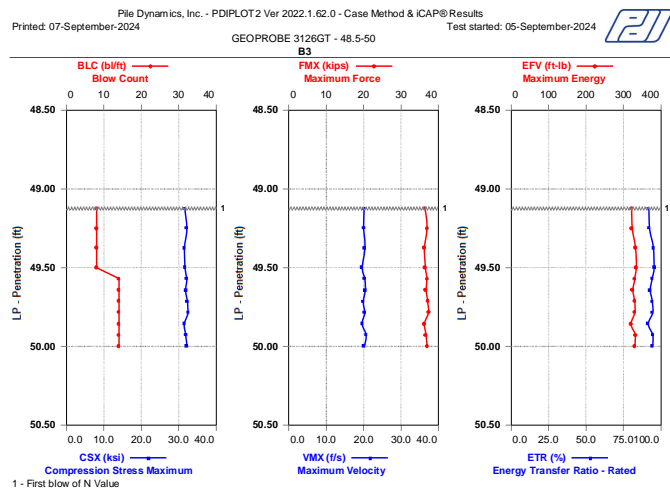
5-16 F1: [746AWJ1] 222.1 (1.00); F2: [746AWJ2] 222.2 (1.00); A3: [K14007] 407.2 (1.00);
A4: [K14006] 375.2 (1.00)

BL# Comments

5 First blow of N Value

Time Summary

Drive 16 seconds 10:32 AM - 10:33 AM BN 1 - 16



Case Method & iCAP® Results

GEOPROBE 3126GT - 48.5-50

B3

Date: 05-September-2024

OP: RW
AR: 1.15 in²
LE: 53.70 ft
WS: 16,807.9 f/s

SP: 0.492 klf/ft³

EM: 30,000 ksi

JC: 0.00

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Maximum Energy
EFV: Maximum Energy

BPM: Blows/Minute
DMX: Maximum Displacement
DFN: Final Displacement
CSX: Compression Stress Maximum

ETR: Energy Transfer Ratio - Rated

| BL# | Depth ft | BLC b/ft | FMX kips | VMX f/s | EMX ft-lb | EFV ft-lb | ETR (%) | BPM bpm | DMX in | DFN in | CSX ksi |
|-----------|-------------|-------------|-------------|------------|--------------|--------------|------------|------------|-----------|-----------|------------|
| 5 | 49.13 | 8 | 36 | 20.1 | 321.6 | 321.6 | 91.9 | 53.3 | 1.81 | 1.50 | 31.6 |
| 6 | 49.25 | 8 | 37 | 20.1 | 323.0 | 323.0 | 92.3 | 53.4 | 1.81 | 1.50 | 32.1 |
| 7 | 49.38 | 8 | 36 | 20.3 | 332.2 | 332.2 | 94.9 | 53.5 | 1.50 | 1.50 | 31.5 |
| 8 | 49.50 | 8 | 36 | 19.6 | 334.0 | 334.0 | 95.4 | 53.3 | 1.50 | 1.50 | 31.7 |
| 9 | 49.57 | 14 | 37 | 20.3 | 329.3 | 329.3 | 94.1 | 53.8 | 0.87 | 0.86 | 32.1 |
| 10 | 49.64 | 14 | 37 | 20.4 | 324.8 | 324.8 | 92.8 | 53.4 | 1.00 | 0.86 | 31.9 |
| 11 | 49.71 | 14 | 37 | 19.9 | 329.7 | 329.7 | 94.2 | 53.2 | 0.89 | 0.86 | 32.2 |
| 12 | 49.79 | 14 | 37 | 20.2 | 330.1 | 330.1 | 94.3 | 53.7 | 0.89 | 0.86 | 32.4 |
| 13 | 49.86 | 14 | 36 | 19.6 | 319.8 | 319.8 | 91.4 | 53.7 | 1.01 | 0.86 | 31.5 |
| 14 | 49.93 | 14 | 37 | 20.7 | 331.0 | 331.0 | 94.6 | 53.1 | 0.91 | 0.86 | 31.9 |
| 15 | 50.00 | 14 | 37 | 20.1 | 330.2 | 330.2 | 94.4 | 53.2 | 1.03 | 0.86 | 32.1 |
| Average | | 37 | 20.1 | 327.8 | 327.8 | 93.7 | 53.4 | 1.20 | 1.09 | 0.91 | 31.9 |
| Std. Dev. | | 0 | 0.3 | 4.5 | 4.5 | 1.3 | 0.2 | 0.36 | 0.31 | 0.3 | 0.3 |
| Maximum | | 37 | 20.7 | 334.0 | 334.0 | 95.4 | 53.8 | 1.81 | 1.50 | 0.86 | 32.4 |
| Minimum | | 36 | 19.6 | 319.8 | 319.8 | 91.4 | 53.1 | 0.87 | 0.86 | 0.86 | 31.5 |

Total number of blows analyzed: 11

BL# Sensors

5-15 F1: [746AWJ1] 222.1 (1.00); F2: [746AWJ2] 222.2 (1.00); A3: [K14007] 407.2 (1.00);
A4: [K14006] 375.2 (1.00)

BL# Comments

5 First blow of N Value

Time Summary

Drive 15 seconds 10:42 AM - 10:42 AM BN 1 - 15

Exhibit D

Field Log





SPT HAMMER CALIBRATION FIELD WORKSHEET

PROJECT NAME: 7324515
PROJECT NO.: Terracon Associates, Inc.
BORING NO.: 8-3
CLIENT:

ARRIVAL TIME:
DEPART TIME:
TOTAL TRAVEL:
TOTAL TIME:
CLIENT REP:
MILEAGE:

DATE: 9/5/24
TERRACON REP: (Signature)
PDA MODEL/SN: SPT 4621 TR
TERRACON RIG #: 1327

DRILL RIG DATA

Type/Transport: Truck
Manufacturer: Geoprobe
Model No.: 3126 GS
Serial No.: 7126554224106
Year Built: 2024
Modifications: N/A
Maint. Schedule: 50 hrs

SPT HAMMER DATA

Type: A40
Manufacturer: Geoprobe
Lifting Mechanism: Chain
Model No.: AD1131
Serial No.: 10001
Hammer Weight: 140
Hammer Operator(s): B. R. Hest

PDA INPUT DATA

Operator: OP (Signature)
Project No./Location: 7324515/
Rig Mode & SN: PN 60000/3126 GS
Hammer Type, LM, Rods: PD 420/ANJ
Drill Rod Area (in²): AR 1.15

Elastic Modulus (ksi): EM 3000
Specific Weight (kip/ft³): SP 0.492
Wave Speed (ft/sec): WS 16808
Increment Length (ft): LI 0.5
Sampling Freq. (kHz): FR 50

TRANSDUCER INFORMATION

Gage SN Calibration
F1/F3: 746 AWJ1 222.05
F2/F4: 746 AWJ2 222.19
A1/A3: K14002 407.23
A2/A4: K14006 375.83

NOTES: 286.25 + 1.875
34.36 + 25 + 10.5 = 28.78
SPLIT SPOON SAMPLER LENGTH 38' + 0.88' = 38.88'

'LE is measured from the center of the strain gauges to the bottom of split spoon sampler

SPT TESTING INFORMATION

| Start Time | Soil | Stick Up Length (ft) | Depth (ft) | | LE (ft) | Rods & Lengths | PDA Blows | | SPT Blows | | | |
|------------|------|----------------------|------------|-----|---------|----------------|-----------|-----|-----------|--------|--------|--------|
| | | | Start | End | | | Start | End | 1st 6" | 2nd 6" | 3rd 6" | 4th 6" |
| 9:55 | CL | | 27.5 | 25 | 48.7 | 5'x5 | 1 | 30 | 5 | 10 | 14 | 24 |
| 10:05 | SP | | 28.5 | 30 | 53.7 | 5'x6 | 3 | 18 | 4 | 5 | 6 | 11 |
| 10:10 | CL | | 33.5 | 35 | 58.7 | 5'x7 | 1 | 1 | 0 | 0 | 0 | 0 |
| 10:15 | SP | | 38.5 | 40 | 63.7 | 5'x8 | 3 | 30 | 7 | 10 | 10 | 20 |
| 10:25 | SP | | 43.5 | 45 | 68.7 | 5'x9 | 1 | 18 | 4 | 5 | 7 | 12 |
| 10:35 | SP | | 48.5 | 50 | 73.7 | 5'x10 | 1 | 17 | 4 | 4 | 7 | 11 |
| 10:50 | SC | | 53.5 | 55 | 78.7 | 5'x11 | 1 | 6 | 2 | 1 | 2 | 3 |
| 11:10 | CL | | 58.5 | 60 | 83.7 | 5'x12 | 1 | 2 | 0 | 0 | 0 | 1 |

Individual pairs of F or V signals versus time shall be very similar for good quality data.

If you see Force goes negative before 2L/C after impact, drill rod joints should be carefully tightened for good quality data.

PICTURE NUMBERS AND INFO:

Take Photo of Each Rigs, Boring Locations at the Site

Terracon SPT Rig Calibration Worksheet.xlsx



This documents that
Susheel R. Kolwalker
Terracon Consultants
has on March 11, 2016 achieved the rank of
EXPERT

on the **Dynamic Measurement and Analysis Proficiency Test.**

The individual identified on this document demonstrated to the degree granted above an understanding of theory, data quality evaluation, interpretation and signal matching for high strain dynamic testing of deep foundations.

The ability of the individual named to provide appropriate knowledge and advice on a specific project is not implied or warranted by the Pile Driving Contractors Association or Pile Dynamics, Inc. The Pile Driving Contractors Association or Pile Dynamics, Inc. assumes no liability for foundation testing and analysis work performed by the bearer of this certificate. This certificate can be verified at www.PDAproficiencytest.com.

(Signature)
Steven A. Hall, Executive Director
Pile Driving Contractors Association

(Signature)
Garland Likins, Senior Partner
Pile Dynamics, Inc.

No. 2005

Exhibit E

Copy of Certificate of Proficiency

