OCTOBER 28, 2021
MODIFIED FOR SR400 PHASE 1
BRIDGE DESIGN-BUILD PROJECT

SS GEOTECHNICAL DATA REPORT

Georgia Department of Transportation

[redacted]
Project No [redacted] PI# 0001757
Fulton [redacted] Counties, Georgia

PREPARED FOR:
AECOM
1360 Peachtree Street NE, Suite 500
Atlanta, Georgia 30309

AECOM Project 60558412
NOVA Project Number 2018089 - Task Order 5

February 21, 2020 (Revision 1)

NOVA
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NOVA

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AECOM
1360 Peachtree Street NE, Suite 500
Atlanta, Georgia 30309

OCTOBER 28, 2021
BODY OF REPORT REDACTED TO ONLY INCLUDE THE INFORMATION NEEDED FOR THE SR400 BRIDGE DESIGN BUILD PROJECT.

Attention: Scott A. Gero, P.E. - Project Manager

Subject: SS Geotechnical Data Report
[redacted]
Project No [redacted] **PI No. 0001757**
Fulton and Forsyth Counties, Georgia
AECOM Project 60558412 – Task Order 5
NOVA Project Number 2018089

Dear Mr. Gero,

NOVA Engineering and Environmental, LLC (NOVA) has completed the Soil Survey (SS) Geotechnical Data Report (GDR) associated with the [redacted] project in Fulton [redacted] Counties, Georgia. This work has been performed under AECOM Task Order 5 of this project (Purchase Order Number 102551) and in general accordance with GDOT requirements as modified based on scoping meetings with HNTB and United Consulting.

An OMAT search for historical BFI reports and a Pavement Evaluation Study was previously completed under Task Order 3 of this project. A Bridge Foundation Investigation (BFI) GDR and [redacted] were performed under Task Order 5 and submitted under separate cover.

We thank you for the opportunity to assist you with this project and look forward to working with you on future projects.

Sincerely,
NOVA ENGINEERING AND ENVIRONMENTAL LLC

Yude Chen, P.E.
Project Engineer

Eric K. Tay, P.E.
Senior Engineer

J. Stephen Willenborg, P.E.
Project Manager

Randall L. Bagwell, P.E.
Project Principal

GEORGIA REGISTERED # 26477 PROFESSIONAL ENGINEER RANDALL L. BAGWELL

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Atterberg Limits, Grain Size Analysis, and Moisture Content

GDT 810.2

California Bearing Ratio

[redacted]

SPT HAMMERS ENERGY CALIBRATIONS

TTL - 597 CME 45B (SN 307114)

TTL - 619 CME 45B (SN 317534)

TTL - CME 550X (SN 371903)

IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT

[redacted]

2. SOIL SURVEY INVESTIGATION

This SS GDR includes the results of geotechnical explorations performed in support of the design of roadway foundations and embankments on the project. The geotechnical explorations consisted of conducting Standard Penetration Test (SPT) borings for anticipated fill areas and auger borings in anticipated cut areas within the proposed SR 400 widening footprint, depending on accessibility. NB borings are those conducted for the northbound lanes and SB borings are those conducted for the southbound lanes. SPT borings were generally drilled to approximately 1 to 1.5 times the height of the anticipated new fill or a minimum of 5 feet unless shallow refusal was encountered. Auger only borings were generally drilled to approximately 5 feet deeper than the anticipated cut and/or ditch depths unless shallow refusal was encountered. The cut and fill depths were estimated based on available drawings provided and/or visual observations of the surrounding topography relative to existing roadway finished grades. The soil survey explorations were generally conducted along the SR 400 corridor[redacted]; additional details where test (SPT and Auger) borings were conducted are presented in Section 4 of this report.

3. GENERAL GEOLOGY

The site is located in the Piedmont Geologic Region, a broad northeasterly trending province underlain by crystalline rocks up to 600 million years old. The Piedmont Region is bounded by the Blue Ridge Range of the Appalachian Mountains to the northwest, and by the leading edge of Coastal Plain sediments, commonly referred to as the "Fall Line" to the southeast. Numerous episodes of crystal deformation have produced varying degrees of metamorphism, folding and shearing in the underlying rock. The resulting metamorphic rock types in the project area are predominantly a series of Precambrian-Paleozoic age.

Residual soils in the region are primarily derived from the in-situ parent rock by chemical weathering. The extent of the weathering is influenced by the mineral composition of the rock and defects such as fissures, faults and fractures. The residual profile can generally be divided into three zones:

- An upper zone near the ground surface consisting of red clays and clayey silts which have undergone the most advanced weathering,
- An intermediate zone of less weathered micaceous sandy silts and silty sands, frequently described as "saprolite", whose mineralogy, texture and banded appearance reflects the structure of the original rock, and
- A transitional zone between soil and rock termed partially weathered rock (PWR).

The boundaries between zones of soil, partially weathered rock, and bedrock are erratic and poorly defined. Weathering is often more advanced next to fractures and joints that transmit water, and in mineral bands. Boulders and rock lenses are sometimes encountered within PWR or soil matrix. Consequently, significant fluctuations in depths to materials may occur over short horizontal distances.

The General Project Geology Map is shown as Figure 2 of Appendix A.

4. FIELD EXPLORATION

The number of borings, their locations, and the proposed depth for each boring were determined by reviewing available subsurface exploration data, proposed locations of the new planned bridges/walls and the new roadway plans, profiles, and cross-sections to define the proposed cut and fill heights, in general accordance with GDOT requirements as modified based on scoping meetings with HNTB and United Consulting. Test boring locations were based on proposed SR 400 roadway widening layouts provided by AECOM at the time of the field exploration. Boring locations were placed at regular intervals within the proposed SR 400 widening footprint at select locations. Test boring locations were established in the field by NOVA personnel using a handheld GPS device, and measuring distances from permanent site landmarks. Therefore, the locations noted should be considered approximate. Some boring locations were offset to drill "rig-accessible" areas based on site grades, or located at safe distances from marked utility lines at the time of drilling. Please refer to Figures 3-1 through 3-40 of Appendix A for the approximate boring locations drilled. The proposed SR 400 construction centerline is included on these figures. Please note that proposed roadway alignment layout, configurations, or other information may have changed after the field exploration was completed.

Utilities at the proposed boring locations were located by calling Georgia 811 prior to completing the test borings. GDOT Intelligent Transportation System (ITS) buried fiber optics cables were not located by Georgia 811. NOVA coordinated with the GDOT ITS Department and were provided pdf drawings of the Advanced Traffic Management System (ATMS) Plans for the project corridor. NOVA's field engineers met with GDOT ITS Supervisor and personnel from the GDOT Traffic Management Center (TMC) on site at several locations to review fiber optic line plans. Some of the boring locations required Private Utility Locator services to locate utilities. Hand clearing/dozer clearing was required to access some of the boring locations.

Our drilling subcontractor, TTL, performed all test borings under the supervision of Accura Engineering's field engineer. Borings were drilled with All-Terrain Vehicles (ATV) or truck mounted drill-rigs equipped with hollow-stem continuous flight augers. The SPT N-values were obtained using automatic hammers. Calibration information for the SPT hammers utilized on this project are included as Attachments to this report. The SPTs were conducted using a standard 1.4-inch I.D., 2.0-inch O.D., split-tube sampler per ASTM D1586 and were performed at depth intervals in general accordance with GDOT OMAT guidelines. Representative portions

of the soil samples, obtained from the sampler, were placed in air-tight glass jars and transported to our laboratory for further evaluation and testing.

Auger refusal occurs when very hard or very dense material, frequently boulders or the upper surface of bedrock, is encountered and cannot be penetrated by a power auger. In some cases, when auger refusal was encountered at shallow depths that were not supported by the surficial features, offset borings were performed to confirm auger refusal and/or the presence of partially weathered rock (PWR) at deeper depths. Partially weathered rock (PWR) is a transitional material between soil and the underlying parent rock that is defined as residual materials that exhibit a standard penetration resistance (SPT N-value) exceeding 100 bpf.

It should be noted that the SPT N-value in fill materials may be amplified or result in auger refusal by the presence of graded aggregate base, rock fragments, treated or cemented subgrade materials, or other very hard materials.

The groundwater levels reported on the Test Boring Records represent measurements made at the completion of the test borings or the next day after boring completion, where noted. The soil test borings were backfilled immediately upon completion with soil cuttings and patched with asphalt/concrete as needed.

Coordinates and elevations of the boring locations were surveyed and provided by ACCURA Engineering after the borings were completed. The coordinates and elevations at the borings are based on North American Datum of 1983 (NAD 83 CORS94) and North American Vertical Datum of 1988 (NAVD 88), respectively.

5. SOIL CLASSIFICATION AND LABORATORY TESTING

Soil Classification: Soil classification provides a general guide to the engineering properties of various soil types and enables the engineer to apply past experience to current problems. Samples obtained during drilling operations were classified by an engineer using visual-manual procedures in general accordance with ASTM D2488. The soils were classified according to relative density/consistency (based on SPT N-values), color and composition. Visual classification is confirmed/corrected based on the laboratory test results from representative soil samples obtained from each major soil layer. The final soil classification descriptions included on the "Test Boring Records" are based on using the Unified Soil Classification System in general accordance with ASTM D2487.

Laboratory Testing: The following laboratory testing were performed on representative soil samples collected during the field exploration to assist in the soil classification, and to provide pavement support and soil corrosivity data:

- Grain Size Analysis – ASTM D6913
- Moisture Content – ASTM D2216

- Atterberg Limits – ASTM D4318
- Materials Class Testing – GDT 810.2
- California Bearing Ratio – ASTM D1883
- Soil Resistivity – AASHTO T 288
- pH of Soils – ASTM D 4972

Grain Size Analysis: The grain size analysis consists of determining the amounts of various sizes of soil particles using a series of standard sieve openings. The percentage of soil, by weight, passing the individual sieves is then recorded and typically presented in a graphical and/or tabular format. The percentage of fines passing through the No. 200 sieve is generally considered to represent the amount of silt and clay of the tested soil sample. The sieve analysis tests were conducted in general accordance with ASTM D6913 - Standard Test Methods for Particle Size Distribution Using Sieve Analysis.

Moisture Content: In a given soil-air-water matrix, the moisture content is the ratio expressed as a percentage of the weight of water to the weight of the soil particles. These tests were conducted in general accordance with ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

Atterberg Limits: The Atterberg Limits are different descriptions of the moisture content of fine-grained soils as it transitions between a solid to a liquid-state. For classification purposes the two primary Atterberg Limits used are the Plastic Limit (PL) and the Liquid Limit (LL). The Plasticity Index (PI) is also calculated for soil classification, which is defined as the difference between Liquid Limit and Plastic Limit. The Plastic Limit (PL) is the moisture content at which a soil transitions from a semisolid state to a plastic state. The Liquid Limit (LL) is defined as the moisture content at which a soil transitions from a plastic state to a liquid state. Atterberg Limits tests were performed in general accordance with ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

California Bearing Ratio: The California Bearing Ratio (CBR) is used to determine the strength of subgrade, subbase, or base course materials, including recycled materials for use in the design of road pavements. The test method is primarily intended for, but not limited to, evaluating the strength of materials having maximum particle sizes less than ¾-in. The CBR value obtained in this test can be used to determine the soil support value (SSV) to be used in pavement design. CBR tests were performed in general accordance with ASTM D1883 - Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils.

Materials Class Testing: The GDOT materials class is used for roadway construction per GDOT Section 810.2 requirements of the GDOT Standard Specifications Construction of Transportation Systems. These tests were typically conducted on bulk soil samples from auger only borings in potential cut areas. The GDT 810.2 testing consists of three (3) tests to determine soil gradation (GDT 4 Method), volume change (GDT 6 Method), and maximum density (GDT 7 or GDT 67 Method). The material classes are generally divided into six (6)

major classes: Class I through Class VI. Class I through Class III are further subdivided by description and physical property per GDOT specifications

Soil Resistivity: Soil resistivity is used to determine the corrosivity of soil and identify the conditions under which the corrosion of metals or concrete in soil may be accentuated. Resistivity is a measure of the resistance to flow of electrical current through the soil. Resistivity, the inverse of conductivity, is measured in units of ohm-centimeters. The soil resistivity tests were performed in general accordance with AASHTO T 288 - Standard Method of Test for Determining Minimum Laboratory Soil Resistivity

pH: pH is an expression of the concentration of dissociated hydrogen ions present in an aqueous solution. pH values range from 1 to 14, with values below 7 indicating acidic conditions and values above 7 indicating alkaline conditions. This test is performed using a calibrated electronic pH meter with a sensing probe. The meter is calibrated by immersing the probe in a solution with a known pH. These tests were performed in general accordance with ASTM D 4972 - Standard Test Method for pH of Soils.

6. GEOTECHNICAL EXPLORATION DATA

6.1 SUBSURFACE DATA

The results of the soil survey study are presented and attached to this report. [redacted]

Tables 1 and 2 provide a summary of the soil survey boring locations and field exploration quantities for the widening of the northbound and southbound roadways, respectively. The approximate boring locations are shown on Figures 3-1 through 3-40 of Appendix A. The results of the field exploration, USCS soil classifications, and laboratory tests results are presented in Test Boring Records in Appendix B. The Test Boring Records include Atterberg limits (Plastic Limit and Liquid Limit) and moisture content within the “Graphic Depiction” of the log.

Table 1. Summary of Soil Survey Borings and Quantities - Northbound Widening

Boring No.	Location		Ground Surface Elevation (feet-NAVD 88)	Boring Depth (feet)	SPT or Auger Only	Total SPT	Bulk Sample
	Latitude	Longitude					
[redacted]							
NB-19	33.96862345	-84.34814622	1055.1	30	Auger Only	-	3
NB-20	33.96977145	-84.34766881	1048.1	25	Auger Only	-	2
[redacted]							

[redacted]

Table 1. Summary of Soil Survey Borings and Quantities - Northbound Widening

Boring No.	Location		Ground Surface Elevation (feet-NAVD 88)	Boring Depth (feet)	SPT or Auger Only	Total SPT	Bulk Sample
	Latitude	Longitude					
[redacted]							
NB-78	34.05861370	-84.27734383	1060.2	25	SPT	7	-
NB-79	34.06096205	-84.27553167	1080.6	15	SPT	5	-
NB-80	34.06265329	-84.27449901	1082.1	25	Auger Only	-	2
NB-81	34.06250362	-84.27480314	1076.8	15	SPT	5	-
[redacted]							

Table 2. Summary of Soil Survey Borings and Quantities – Southbound Widening

Boring No.	Location		Ground Surface Elevation (feet-NAVD 88)	Boring Depth (feet)	SPT or Auger Only	Total SPT	Bulk Sample
	Latitude	Longitude					
[redacted]							
SB-16	33.96972000	-84.34831900	1046.0	30	SPT	8	-
SB-17	33.96817394	-84.34907642	1034.9	15	SPT	5	-
SB-18	33.96950981	-84.34872791	1051.6	25	Auger Only	-	3
SB-19	33.96971688	-84.34830030	1038.3	15	SPT	5	-
[redacted]							
SB-30	33.98985385	-84.33908753	1070.5	20	Auger Only	-	2
SB-31	33.98994524	-84.33882612	1051.0	5	SPT	2	-

[redacted]

Table 2. Summary of Soil Survey Borings and Quantities – Southbound Widening

Boring No.	Location		Ground Surface Elevation (feet-NAVD 88)	Boring Depth (feet)	SPT or Auger Only	Total SPT	Bulk Sample
	Latitude	Longitude					
SB-32	33.99228353	-84.33847257	1030.2	5	SPT	2	-
SB-33	33.99225319	-84.33832111	1025.3	5	SPT	2	-
[redacted]							

Table 2. Summary of Soil Survey Borings and Quantities – Southbound Widening

Boring No.	Location		Ground Surface Elevation (feet-NAVD 88)	Boring Depth (feet)	SPT or Auger Only	Total SPT	Bulk Sample
	Latitude	Longitude					
[redacted]							
SB-84	34.05834938	-84.27877992	1049.7	10	SPT	4	-
SB-85	34.05969118	-84.27709772	1073.1	15	Auger Only	-	1
SB-86	34.06098478	-84.27620583	1082.1	15	Auger Only	-	1
SB-87	34.06277780	-84.27527665	1074.3	15	SPT	5	-
SB-88	34.06275855	-84.27527714	1075.2	10	SPT	4	-
[redacted]							

Table 3. Laboratory Testing Quantities – Northbound Widening

Boring No.	Liquid Limit	Plastic Limit	Grain Size	USCS Classification	Moisture Content	GDT 810.2	CBR	pH Analysis	Resistivity
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
NB-19	1	1	1	1	1	3	1	0	0
NB-20	0	0	0	0	0	2	0	0	0
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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Table 3. Laboratory Testing Quantities – Northbound Widening

Boring No.	Liquid Limit	Plastic Limit	Grain Size	USCS Classification	Moisture Content	GDT 810.2	CBR	pH Analysis	Resistivity
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
NB-78	1	1	1	1	1	0	0	0	0
NB-79	1	1	1	1	1	0	0	0	0
NB-80	0	0	0	0	0	2	0	0	0
NB-81	1	1	1	1	1	0	0	0	0
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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Table 4. Laboratory Testing Quantities – <u>Southbound Widening</u>

Boring No.	Liquid Limit	Plastic Limit	Grain Size	USCS Classification	Moisture Content	GDT 810.2	CBR	pH Analysis	Resistivity
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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SB-16	1	1	1	1	1	0	0	0	0
SB-17	1	1	1	1	1	0	0	0	0
SB-18	1	1	1	1	1	3	1	0	0
SB-19	1	1	1	1	1	0	0	0	0
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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SB-30	1	1	1	1	1	2	0	0	0
SB-31	1	1	1	1	1	0	0	0	0

[redacted] [redacted]

Table 4. Laboratory Testing Quantities – <u>Southbound Widening</u>

Boring No.	Liquid Limit	Plastic Limit	Grain Size	USCS Classification	Moisture Content	GDT 810.2	CBR	pH Analysis	Resistivity
SB-32	1	1	1	1	1	0	0	0	0
SB-33	1	1	1	1	1	0	0	0	0
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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[redacted] [redacted]

Table 4. Laboratory Testing Quantities – Southbound Widening

Boring No.	Liquid Limit	Plastic Limit	Grain Size	USCS Classification	Moisture Content	GDT 810.2	CBR	pH Analysis	Resistivity
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SB-84	1	1	1	1	1	0	0	0	0
SB-85	1	1	1	1	1	1	0	0	0
SB-86	0	0	0	0	0	1	0	0	0
SB-87	1	1	1	1	1	0	0	0	0
SB-88	1	1	1	1	1	0	0	0	0
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted] [redacted]

7. LIMITATIONS

This report includes the summary of the data collection effort per the authorized scope of the work and is based on generally accepted geotechnical engineering practices. The stratification lines and depth designations on the Test Boring Records represent approximate boundaries between various subsurface strata. Actual transitions between soil strata may be gradual. No warranties/guarantees are expressed or implied.

This report is intended for the sole use of AECOM, HNTB and the Georgia Department of Transportation. The scope of work performed during this study was developed for purposes specifically intended by AECOM, HNTB and the Georgia Department of Transportation and may not satisfy other users' requirements. Use of this report or the data included herein will be at the sole risk of any third-party user. NOVA is not responsible or liable for the interpretation by others of the data in this report, nor their conclusions, recommendations or opinions.

Fill soils on site may not have documentation relating to their type, placement and compaction effort. Therefore, variability of soils and compaction efforts in the existing fill soils encountered in the borings should be expected. Selection of engineering properties based on SPT N-values in the fill soils should consider the variability in soil type, placement, and compaction effort. Our scope of work was limited to the exploration as detailed herein. When atypical conditions in the fill soils such as high N-values are reported, additional assessment and/or exploration of these conditions may be necessary prior to including these atypical aspects in the design.

Our professional services have been performed, our findings obtained and presented in accordance with generally accepted geotechnical engineering principles and practices in the State of Georgia. This report is intended to be a geotechnical data report with no engineering conclusions or recommendations provided. Please see the attached "Important Information about This Geotechnical Engineering Report" for details.

APPENDIX A

FIGURES

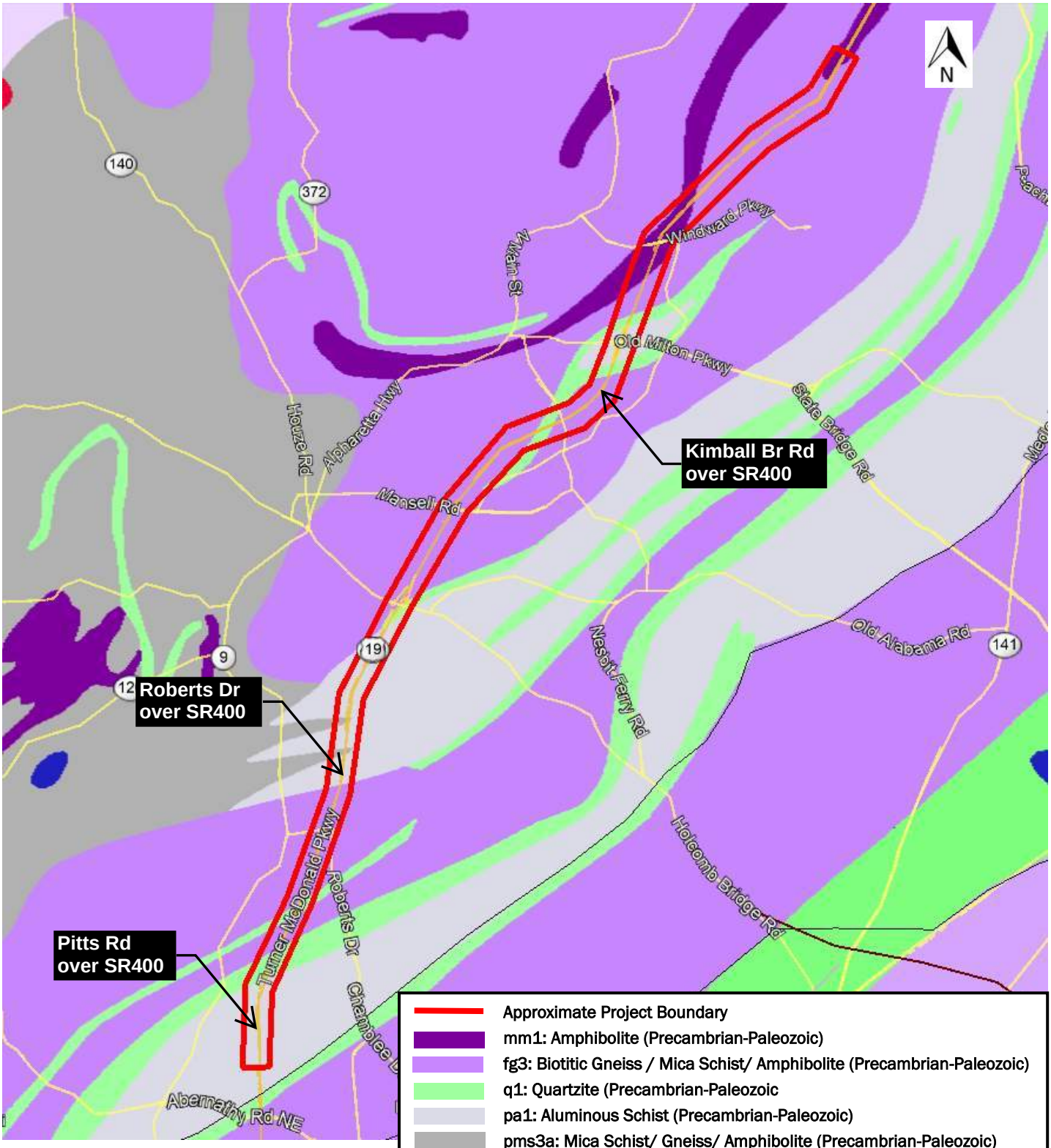

FIGURE 2
GENERAL PROJECT GEOLOGY MAP
Source: USGS Geologic Maps of US States
https://mrdata.usgs.gov/geology/state
Scale: NTS

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PROFESSIONAL | PRACTICAL | PROVEN

[redacted] –
PI No. 0001757
SS GEOTECHNICAL DATA REPORT
Fulton & Forsyth Counties, Georgia
NOVA Project Number 2018089 –
Task Order 5

APPROXIMATE LOCATIONS OF NOVA SOIL TEST BORINGS
SR 400 CENTERLINE STATIONS

FIGURE 3-5
STATION 195+00 TO 215+00
BORING LOCATION PLAN
SOURCE: Google Earth Aerial Photos
SCALE: Not to Scale

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[redacted] – PI No. 0001757
SOIL SURVEY GEOTECHNICAL DATA REPORT
Fulton[redacted]Counties, Georgia
NOVA Project Number 2018089 - Task Order 5

APPROXIMATE LOCATIONS OF NOVA SOIL TEST BORINGS
SR 400 CENTERLINE STATIONS

FIGURE 3-8
STATION 280+00 TO 300+00
BORING LOCATION PLAN
SOURCE: Google Earth Aerial Photos
SCALE: Not to Scale

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[redacted] – PI No. 0001757
SOIL SURVEY GEOTECHNICAL DATA REPORT
Fulton[redacted] Counties, Georgia
NOVA Project Number 2018089 - Task Order 5

APPENDIX B

SUBSURFACE DATA

Northbound Boring logs

KEY TO SYMBOLS AND CLASSIFICATIONS

Drilling Symbols

	Split Spoon Sample
	Bulk Sample
	SPT Sample
	Undisturbed Sample (UD)
	Standard Penetration Resistance (ASTM D1586)
	Water Table at least 24 Hours after Drilling
	Water Table 1 Hour or less after Drilling
100/2”	Number of Blows (100) to Drive the Spoon a Number of Inches (2)
NX, NQ	Core Barrel Sizes: 2⅛- and 2-Inch Diameter Rock Core, Respectively
REC	Percentage of Rock Core Recovered
RQD	Rock Quality Designation – Percentage of Recovered Core Segments 4 or more Inches Long
	Loss of Drilling Water
MC	Moisture Content Test Performed
N/E	Not Encountered
N/M	Not Measured
	Caving

Strata Symbols

	Paving
	Gravel /Graded Aggregate Base
	Fill
	Clayey Sand
	Silty Sand
	Sandy Silt/Silt
	Low Plasticity Clay
	Partially Weathered Rock
	High Plasticity Clay
	Topsoil
	Alluvium
	Poorly Graded Sand with Silt

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CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

	Number of Blows, "N"	Approximate Relative Density
	0 – 4	Very Loose
	5 – 10	Loose
SANDS	11 – 30	Medium Dense
	31 – 50	Dense
	Over 50	Very Dense

	Number of Blows, "N"	Approximate Consistency
	0 – 2	Very Soft
	3 – 4	Soft
SILTS	5 – 8	Firm
and	9 – 15	Stiff
CLAYS	16 – 30	Very Stiff
	31 – 50	Hard
	Over 50	Very Hard

DRILLING PROCEDURES

Soil sampling and standard penetration testing performed in accordance with ASTM D1586. The standard penetration resistance is the number of blows of a 140 pound hammer falling 30 inches to drive a 2-inch O.D., 1⅜-inch I.D. split spoon sampler one foot. The undisturbed sampling procedure is described by ASTM D1587.

SOIL CLASSIFICATION CHART

COARSE GRAINED SOILS	**GRAVELS**	Clean Gravel less than 5% fines	GW	Well graded gravel
			GP	Poorly graded gravel
		Gravels with Fines more than 12% fines	GM	Silty gravel
			GC	Clayey gravel
	SANDS	Clean Sand less than 5% fines	SW	Well graded sand
			SP	Poorly graded sand
		Sands with Fines more than 12% fines	SM	Silty sand
			SC	Clayey sand
FINE GRAINED SOILS	**SILTS AND CLAYS** Liquid Limit less than 50	Inorganic	CL	Lean clay
			ML	Silt
		Organic	OL	Organic clay and silt
	SILTS AND CLAYS Liquid Limit 50 or more	Inorganic	CH	Fat clay
			MH	Elastic silt
		Organic	OH	Organic clay and silt
HIGHLY ORGANIC SOILS		Organic matter, dark color, organic odor	PT	Peat

PARTICLE SIZE IDENTIFICATION

GRAVELS	Coarse	¾ inch to 3 inches
	Fine	No. 4 to ¾ inch
SANDS	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40
SILTS AND CLAYS		Passing No. 200

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TEST BORING RECORD NB-19

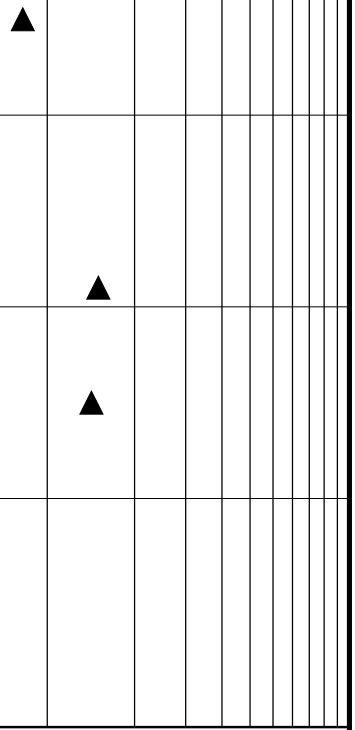
PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 207+75 R128'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 33.96862345
LONGITUDE: -84.34814622
ELEVATION: 1055.1 feet
LOGGED BY: D. Sam
DATE: 6/27/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description
0	1055	FILL: Gray silty medium to fine SAND (IIB4)
5	1050	
10	1045	
15	1040	
20	1035	RESIDUUM: Gray micaceous silty coarse to fine SAND (IA3)
25	1030	Gray silty medium to fine SAND (IA3)
30	1025	Boring Terminated at 30 ft.
35	1020	

Graphic | Groundwater | Sample Type | N-Value

Graphic Depiction
BLOW COUNT
NATURAL MOISTURE
PLASTIC LIMIT — LIQUID LIMIT
10 20 30 40 60 100



This information pertains only to this boring and should not be interpreted as being indicative of the site.

Auger only

NOVA

TEST BORING RECORD NB-20

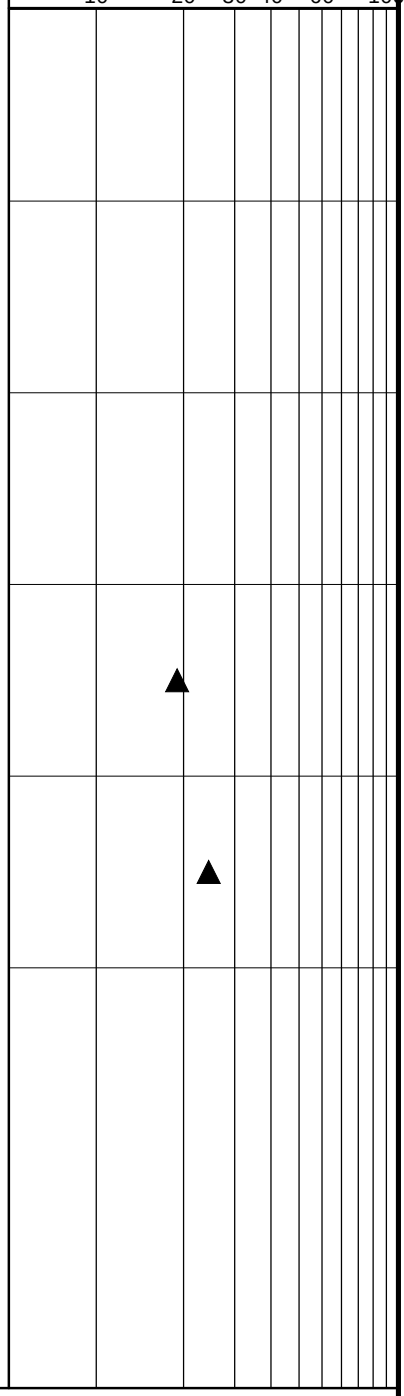
PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 212+13 R101'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 33.96977145
LONGITUDE: -84.34766881
ELEVATION: 1048.1 feet
LOGGED BY: D. Sam
DATE: 6/27/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0		TOPSOIL: 8 inches				
		FILL: Red silty medium to fine SAND (IIB4)				
	1045					
5						
	1040					
10						
	1035					
15						
	1030					
20		RESIDUUM: Light brown silty medium to fine SAND (IIB3)				
	1025					
25		Boring Terminated at 25 ft.				
	1020					
30						
	1015					
35						

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100



This information pertains only to this boring and should not be interpreted as being indicative of the site.

Auger only

NOVA

TEST BORING RECORD NB-79

PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 628+40 R103'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 34.06096205
LONGITUDE: -84.27553167
ELEVATION: 1080.6 feet
LOGGED BY: S. Nixon
DATE: 2/27/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0	1080	TOPSOIL: 3 inches				
		FILL: Firm to soft reddish brown medium to fine sandy SILT (ML)				5
5	1075					4
		RESIDUUM: Loose orange silty medium to fine SAND, trace mica (SM)				9
		Dense pink silty medium to fine SAND, trace mica (SM)				43
10	1070					
15	1065					31
		Boring Terminated at 15 ft.				
20	1060					
25	1055					
30	1050					
35	1045					

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100

This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

TEST BORING RECORD NB-80

PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 635+22 R150'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 34.06265329
LONGITUDE: -84.27449901
ELEVATION: 1082.1 feet
LOGGED BY: D. Sam
DATE: 3/28/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value	Graphic Depiction
0							
		TOPSOIL: 3 inches					
		FILL: Red brown fine sandy SILT (IIB4)					
	1080						
5							
	1075						
10							
	1070						
15							
		RESIDUUM: Red fine sandy SILT (IIB3)					
	1065						
20							
	1060						
25							
		Boring Terminated at 25 ft.					
	1055						
30							
	1050						
35							

Graphic Depiction: ● BLOW COUNT, ▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Auger only

NOVA

TEST BORING RECORD NB-81

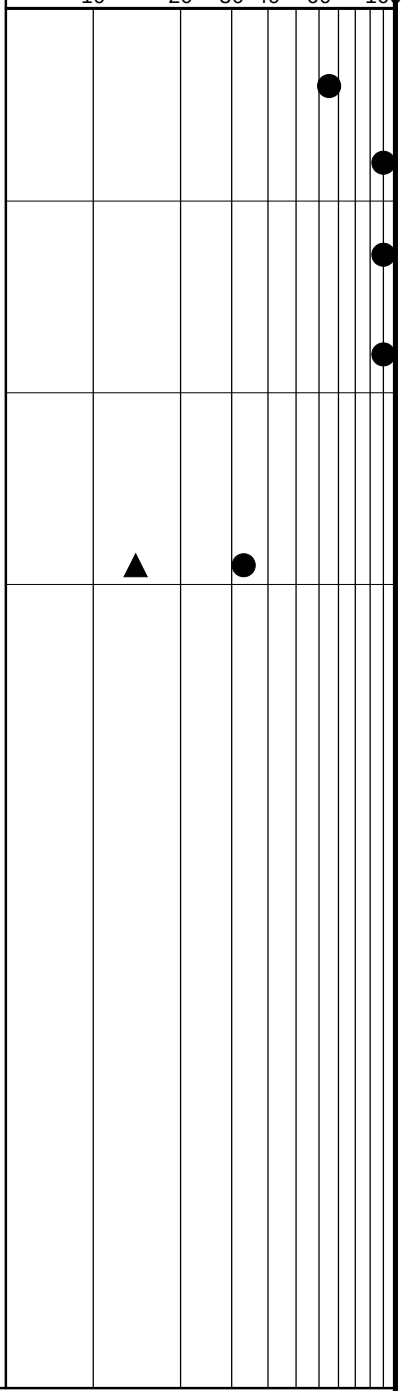
PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 634+45 R86'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 34.06250362
LONGITUDE: -84.27480314
ELEVATION: 1076.8 feet
LOGGED BY: S. Nixon
DATE: 2/27/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0						
		TOPSOIL: 3 inches				
	1075	RESIDUUM: Very dense pink silty medium to fine SAND with mica (SM)				65
5		PARTIALLY WEATHERED ROCK: Sampled as very dense red silty medium to fine SAND, trace rock fragments				100/ 10"
	1070					100/ 10"
10						100/ 10"
	1065					
15		RESIDUUM: Dense yellowish red silty coarse to fine SAND (SM)				33
		Boring Terminated at 15 ft.				
	1060					
20						
	1055					
25						
	1050					
30						
	1045					
35						

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100



This information pertains only to this boring and should not be interpreted as being indicative of the site.

Southbound Boring logs

KEY TO SYMBOLS AND CLASSIFICATIONS

Drilling Symbols

	Split Spoon Sample
	Bulk Sample
	SPT Sample
	Undisturbed Sample (UD)
	Standard Penetration Resistance (ASTM D1586)
	Water Table at least 24 Hours after Drilling
	Water Table 1 Hour or less after Drilling
100/2”	Number of Blows (100) to Drive the Spoon a Number of Inches (2)
NX, NQ	Core Barrel Sizes: 2⅛- and 2-Inch Diameter Rock Core, Respectively
REC	Percentage of Rock Core Recovered
RQD	Rock Quality Designation – Percentage of Recovered Core Segments 4 or more Inches Long
	Loss of Drilling Water
MC	Moisture Content Test Performed
N/E	Not Encountered
N/M	Not Measured
	Caving

Strata Symbols

	Paving
	Gravel /Graded Aggregate Base
	Fill
	Clayey Sand
	Silty Sand
	Sandy Silt/Silt
	Low Plasticity Clay
	Partially Weathered Rock
	High Plasticity Clay
	Topsoil
	Alluvium
	Poorly Graded Sand with Silt

NOVA

CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

	Number of Blows, "N"	Approximate Relative Density
	0 – 4	Very Loose
	5 – 10	Loose
SANDS	11 – 30	Medium Dense
	31 – 50	Dense
	Over 50	Very Dense

	Number of Blows, "N"	Approximate Consistency
	0 – 2	Very Soft
	3 – 4	Soft
SILTS	5 – 8	Firm
and	9 – 15	Stiff
CLAYS	16 – 30	Very Stiff
	31 – 50	Hard
	Over 50	Very Hard

DRILLING PROCEDURES

Soil sampling and standard penetration testing performed in accordance with ASTM D1586. The standard penetration resistance is the number of blows of a 140 pound hammer falling 30 inches to drive a 2-inch O.D., 1⅜-inch I.D. split spoon sampler one foot. The undisturbed sampling procedure is described by ASTM D1587.

SOIL CLASSIFICATION CHART

COARSE GRAINED SOILS	**GRAVELS**	Clean Gravel less than 5% fines	GW	Well graded gravel
			GP	Poorly graded gravel
		Gravels with Fines more than 12% fines	GM	Silty gravel
			GC	Clayey gravel
	SANDS	Clean Sand less than 5% fines	SW	Well graded sand
			SP	Poorly graded sand
		Sands with Fines more than 12% fines	SM	Silty sand
			SC	Clayey sand
FINE GRAINED SOILS	**SILTS AND CLAYS** Liquid Limit less than 50	Inorganic	CL	Lean clay
			ML	Silt
		Organic	OL	Organic clay and silt
	SILTS AND CLAYS Liquid Limit 50 or more	Inorganic	CH	Fat clay
			MH	Elastic silt
		Organic	OH	Organic clay and silt
HIGHLY ORGANIC SOILS		Organic matter, dark color, organic odor	PT	Peat

PARTICLE SIZE IDENTIFICATION

GRAVELS	Coarse	¾ inch to 3 inches
	Fine	No. 4 to ¾ inch
SANDS	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40
SILTS AND CLAYS		Passing No. 200

NOVA

NOVA

TEST BORING RECORD SB-16

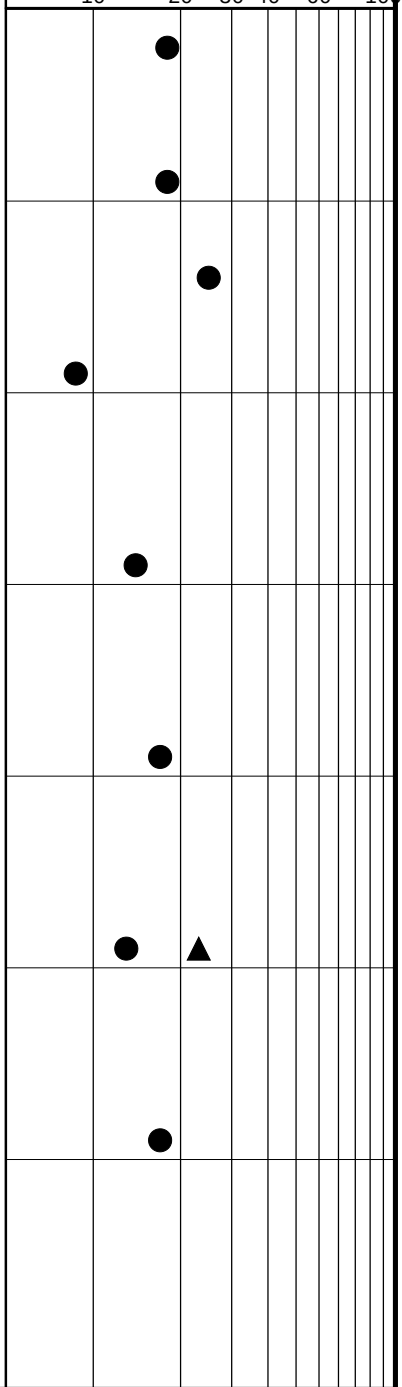
PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 205+14 L124'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: ▽ 25' AFTER 24 HOURS: ▼ 25' CAVING> C 29'

PROJECT NO.: 2018089
LATITUDE: 33.96972000
LONGITUDE: -84.34831900
ELEVATION: 1046.0 feet
LOGGED BY: D. Sam
DATE: 8/2/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0						
	1045	FILL: Medium dense brown silty fine SAND with mica and rock fragments (SM)				18
5						18
	1040					25
10		FILL: Loose to medium dense brown silty medium to fine SAND with mica (SM)				8
	1035					
15						14
	1030					
20		RESIDUUM: Medium dense brown micaceous silty medium to fine SAND (SM)				17
	1025					
25				▼		13
	1020					
30				C		17
	1015	Boring Terminated at 30 ft.				
35						

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100



This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

TEST BORING RECORD SB-17

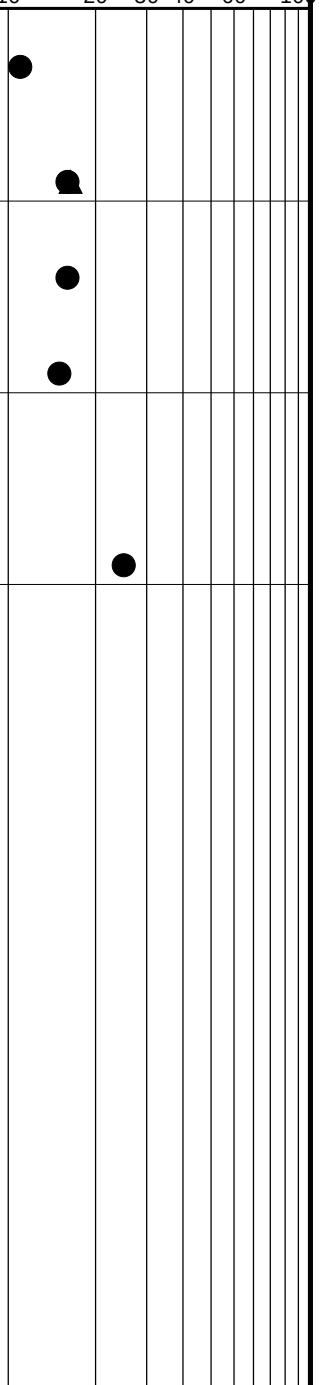
PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 205+09 L68'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 33.96817394
LONGITUDE: -84.34907642
ELEVATION: 1034.9 feet
LOGGED BY: D. Sam
DATE: 5/29/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0		TOPSOIL: 6 inches				
		FILL: Medium dense brown silty medium to fine SAND, trace mica and rock fragments (SM)				11
5	1030	RESIDUUM: Medium dense brown silty coarse to fine SAND (SM)				16
						16
10	1025					15
15	1020	Boring Terminated at 15 ft.				25
20	1015					
25	1010					
30	1005					
35	1000					

Graphic Depiction

BLOW COUNT
NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100



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NOVA

TEST BORING RECORD SB-18

PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 210+00 L157'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 33.96950981
LONGITUDE: -84.34872791
ELEVATION: 1051.6 feet
LOGGED BY: D. Sam
DATE: 8/2/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value	Graphic Depiction
0							
	1050	FILL: Light brown clayey medium to fine SAND (IIB4)					
5							
	1045						
10							
	1040						
15		RESIDUUM: Grayish brown silty medium to fine SAND (IIIC1)					
	1035						
20		Brown silty medium to fine SAND (IIB3)					
	1030						
25		Boring Terminated at 25 ft.					
	1025						
30							
	1020						
35							

Graphic Depiction
● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Auger only

NOVA

TEST BORING RECORD SB-19

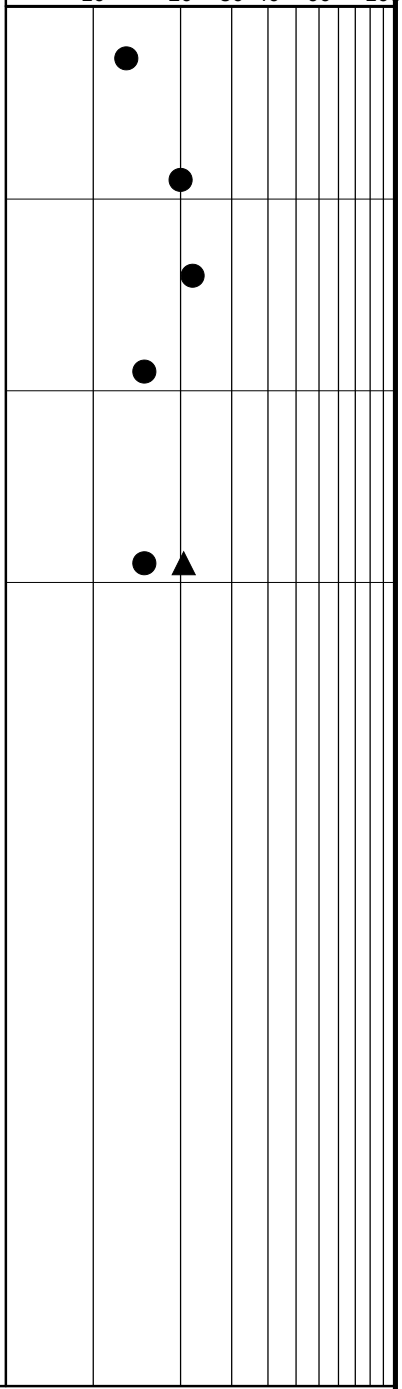
PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 211+28 L68'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 33.96971688
LONGITUDE: -84.34830030
ELEVATION: 1038.3 feet
LOGGED BY: D. Sam
DATE: 5/29/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0						
		TOPSOIL: 4 inches				
		FILL: Medium dense brown red silty medium to fine SAND, trace mica and rock fragments (SM)				13
	1035					
5						20
						22
	1030					
10						15
	1025	RESIDUUM: Medium dense dark brown silty coarse to fine SAND (SM)				
15						15
		Boring Terminated at 15 ft.				
	1020					
20						
	1015					
25						
	1010					
30						
	1005					
35						

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100



This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

TEST BORING RECORD SB-30

PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 289+91 L151'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 33.98985385
LONGITUDE: -84.33908753
ELEVATION: 1070.5 feet
LOGGED BY: D. Sam
DATE: 4/8/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value	Graphic Depiction
0	1070	TOPSOIL: 3 inches RESIDUUM: Brown silty medium to fine SAND (IIB4)					
5	1065						
10	1060						
15	1055						
20	1050	Boring Terminated at 20 ft.					
25	1045						
30	1040						
35	1035						

Graphic Depiction: ● BLOW COUNT, ▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Auger only

NOVA

TEST BORING RECORD SB-31

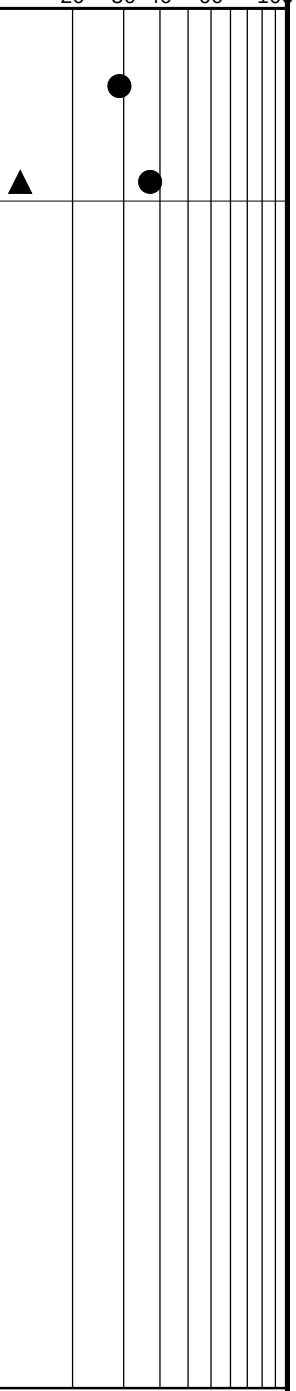
PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 290+42 L82'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 33.98994524
LONGITUDE: -84.33882612
ELEVATION: 1051.0 feet
LOGGED BY: D. Sam
DATE: 3/14/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0	1050	TOPSOIL: 2 inches RESIDUUM: Medium dense to dense dark brown silty coarse to fine SAND with gravel (SM)				29
5	1045	Boring Terminated at 5 ft.				37
10	1040					
15	1035					
20	1030					
25	1025					
30	1020					
35						

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100



This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

TEST BORING RECORD SB-32

PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 299+08 L131'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 33.99228353
LONGITUDE: -84.33847257
ELEVATION: 1030.2 feet
LOGGED BY: D. Sam
DATE: 3/14/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0	1030	TOPSOIL: 2 inches FILL: Stiff orange coarse to fine sandy SILT (ML)				10
5	1025	Boring Terminated at 5 ft.				12
10	1020					
15	1015					
20	1010					
25	1005					
30	1000					
35	995					

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100

This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

TEST BORING RECORD SB-33

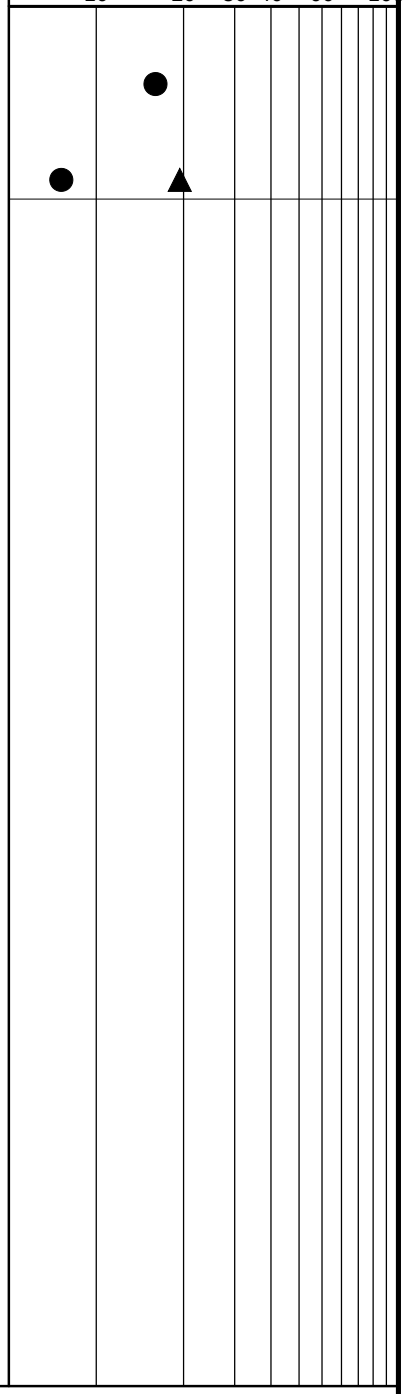
PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 299+04 L85'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 33.99225319
LONGITUDE: -84.33832111
ELEVATION: 1025.3 feet
LOGGED BY: D. Sam
DATE: 3/14/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0	1025	TOPSOIL: 2 inches				
		FILL: Medium dense dark red silty medium to fine SAND with rock fragments (SM)				16
		RESIDUUM: Loose red silty medium to fine SAND (SM)				6
5	1020	Boring Terminated at 5 ft.				
10	1015					
15	1010					
20	1005					
25	1000					
30	995					
35	990					

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100



This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

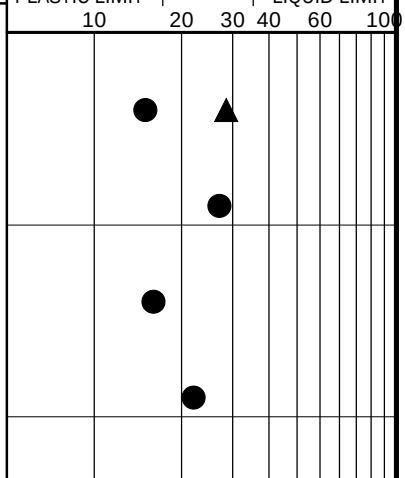
TEST BORING RECORD SB-84

PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 614+71 L93'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 34.05834938
LONGITUDE: -84.27877992
ELEVATION: 1049.7 feet
LOGGED BY: S. Nixon
DATE: 2/25/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0		TOPSOIL: 6 inches				
		RESIDUUM: Medium dense black and brown silty medium to fine SAND (SM)				15
5	1045					27
						16
10	1040					22
		Boring Terminated at 10 ft.				
15	1035					
20	1030					
25	1025					
30	1020					
35	1015					

Graphic Depiction



This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

TEST BORING RECORD SB-85

PROJECT: [redacted] PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 622+00 L87'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 34.05969118
LONGITUDE: -84.27709772
ELEVATION: 1073.1 feet
LOGGED BY: B. Rushema
DATE: 2/22/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value	Graphic Depiction
0		TOPSOIL: 2 inches					
		RESIDUUM: Reddish silty medium to fine SAND (IIB3)					
	1070						
5							
	1065						
10							
	1060						
15		Boring Terminated at 15 ft.					
	1055						
20							
	1050						
25							
	1045						
30							
	1040						
35							

Graphic Depiction: ● BLOW COUNT, ▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Auger only

NOVA

TEST BORING RECORD SB-86

PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 627+81 L88'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 34.06098478
LONGITUDE: -84.27620583
ELEVATION: 1082.1 feet
LOGGED BY: B. Rushema
DATE: 2/22/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value	Graphic Depiction
0							BLOW COUNT / NATURAL MOISTURE; PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40 60 100
		TOPSOIL: 3 inches					
		RESIDUUM: Red clayey medium to fine SAND (IIIC2)					
	1080						
5							
	1075						
10							
	1070						
15							
		Boring Terminated at 15 ft.					
	1065						
20							
	1060						
25							
	1055						
30							
	1050						
35							

Auger only

This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

TEST BORING RECORD SB-87

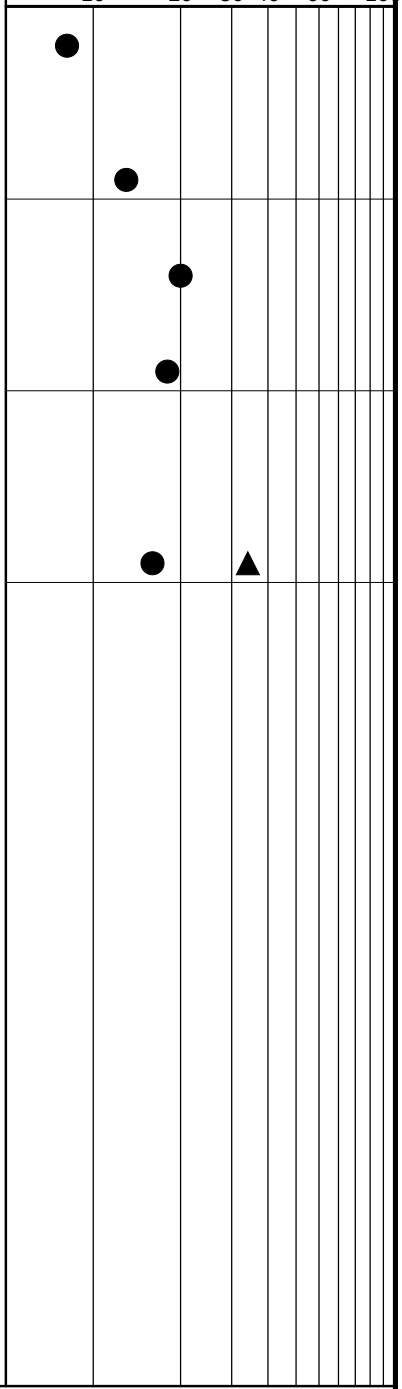
PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 634+87 L89'
DRILLER: TTL CME 550X (SN371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 34.06277780
LONGITUDE: -84.27527665
ELEVATION: 1074.3 feet
LOGGED BY: D. Sam
DATE: 8/1/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0		TOPSOIL: 3 inches				
		RESIDUUM: Loose brown micaceous silty medium to fine SAND (SM)				7
5	1070	Medium dense dark brown micaceous silty medium to fine SAND (SM)				13
						20
10	1065					18
15	1060					16
		Boring Terminated at 15 ft.				
20	1055					
25	1050					
30	1045					
35	1040					

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100



This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

TEST BORING RECORD SB-88

PROJECT: [redacted] - PI# 0001757
CLIENT: AECOM/GDOT
PROJECT LOCATION: SR 400 - Fulton and Forsyth Counties
LOCATION: STA 634+77 L81'
DRILLER: TTL CME 550X (SN 371903)
DRILLING METHOD: Hollow Stem Auger % ENERGY: 92.1
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

PROJECT NO.: 2018089
LATITUDE: 34.06275855
LONGITUDE: -84.27527714
ELEVATION: 1075.2 feet
LOGGED BY: B. Rushema
DATE: 2/22/2019

Depth (feet)	Elevation (ft-NAVD 88)	Description	Graphic	Groundwater	Sample Type	N-Value
0	1075	TOPSOIL: 2 inches				
		RESIDUUM: Firm to stiff reddish brown medium to fine sandy SILT (ML)				6
5	1070					7
						9
10	1065					12
		Boring Terminated at 10 ft.				
15	1060					
20	1055					
25	1050					
30	1045					
35	1040					

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100

This information pertains only to this boring and should not be interpreted as being indicative of the site.

APPENDIX C

LABORATORY TEST DATA

Atterberg Limits, Grain Size Analysis, and Moisture Content

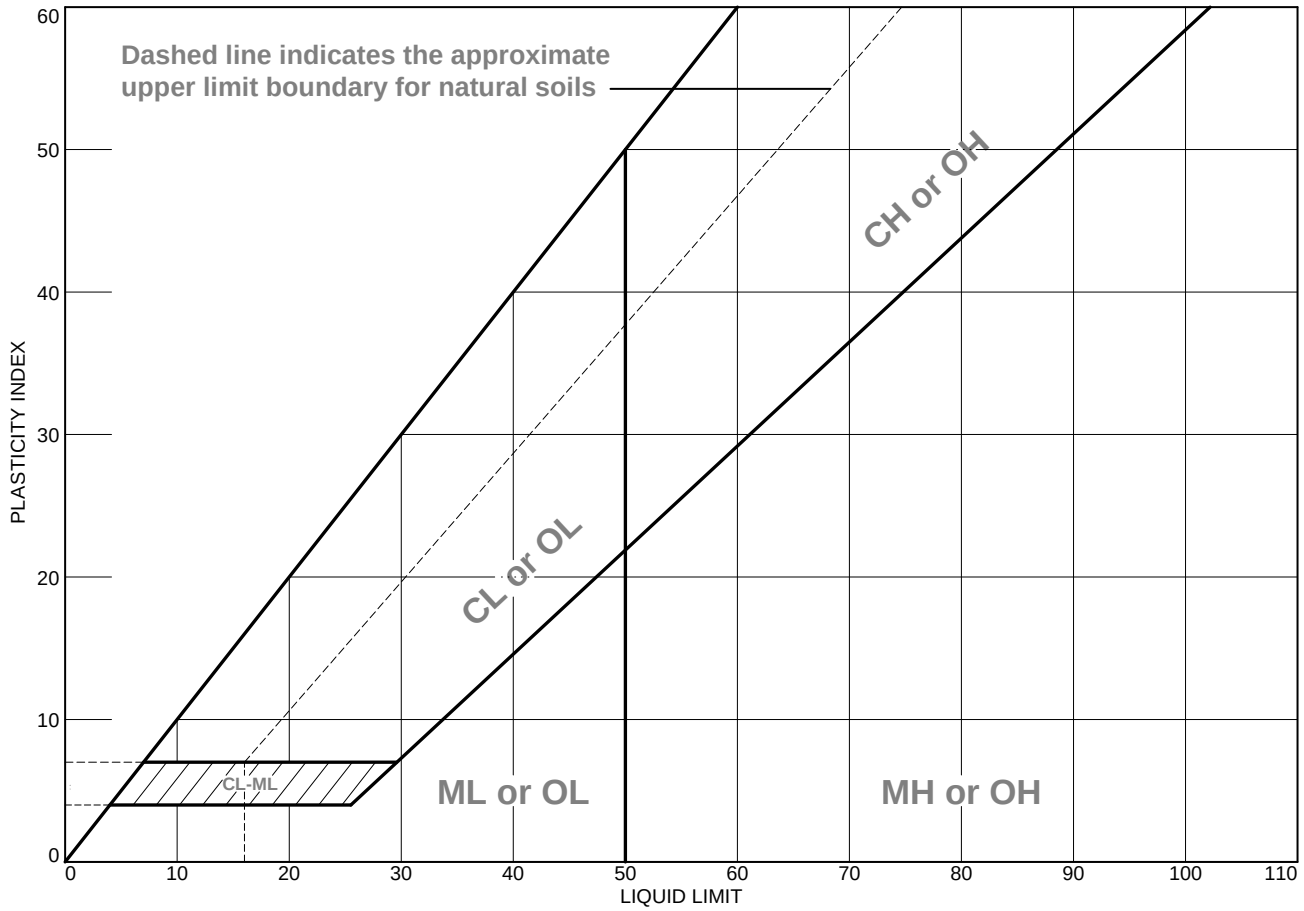
Table A: Summary of Northbound USCS Index Testing Results

BORING No.	SAMPLE DEPTH (Feet)	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT FINER #40	PERCENT FINER #200	USCS CLASSIFICATION	MOISTURE CONTENT (%)
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
NB-19	24.0-25.0	NP	NP	NP	49.7	19.8	SM	15.0
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table A: Summary of Northbound USCS Index Testing Results

BORING No.	SAMPLE DEPTH (Feet)	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT FINER #40	PERCENT FINER #200	USCS CLASSIFICATION	MOISTURE CONTENT (%)
NB-79	1.0-2.5	NP	NP	NP	84.5	58.2	ML	20.8
NB-81	13.5-15.0	NP	NP	NP	60.8	33.8	SM	14.0
[redacted]								
[redacted]								
[redacted]								
[redacted]								
[redacted]								
[redacted]								
[redacted]								
[redacted]								
[redacted]								
[redacted]								

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray micaceous silty coarse to fine SAND	NP	NP	NP	49.7	19.8	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

●**Source of Sample:** NB-19 @ 24-25 **Depth:** 24-25 **Sample Number:** NB-19

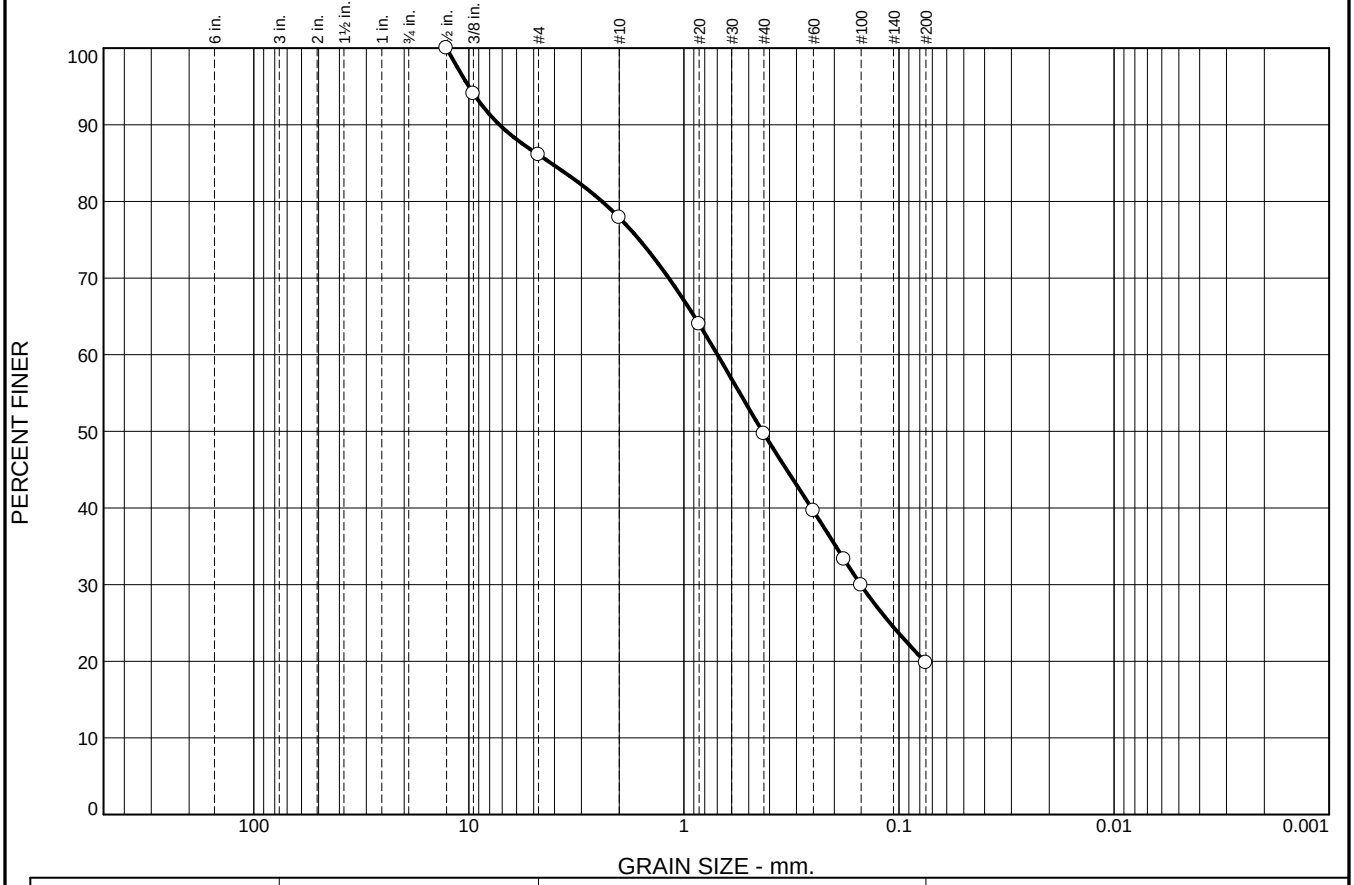
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: HW

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	13.9	8.2	28.2	29.9	19.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	4.1515	0.6984	0.4315	0.1507				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Gray micaceous silty coarse to fine SAND	7/9/19	SM	15.0

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source of Sample:** NB-19 @ 24-25 **Depth:** 24-25 **Sample Number:** NB-19

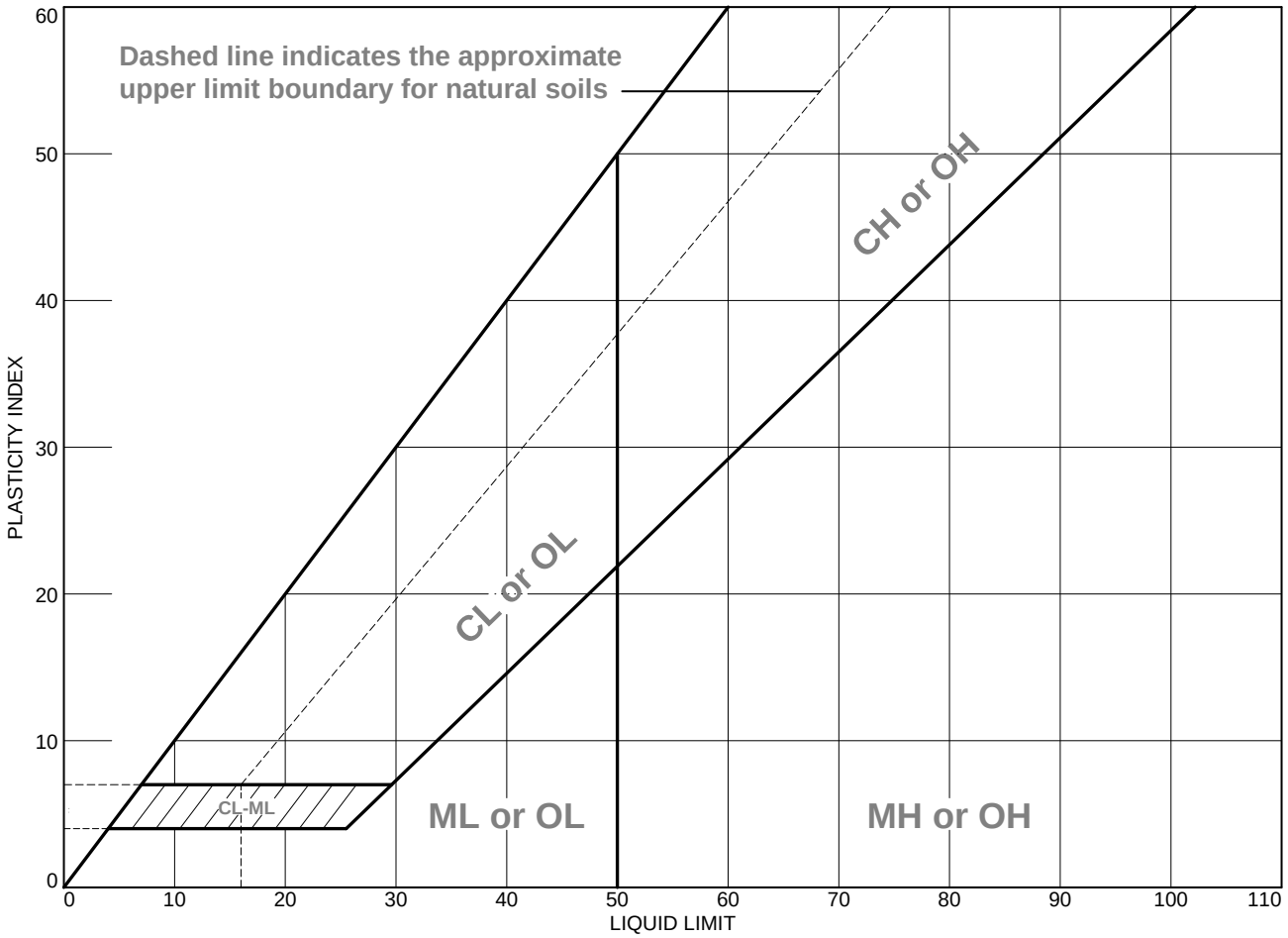
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: AB

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Reddish brown medium to fine sandy SILT	NP	NP	NP	84.5	58.2	ML

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

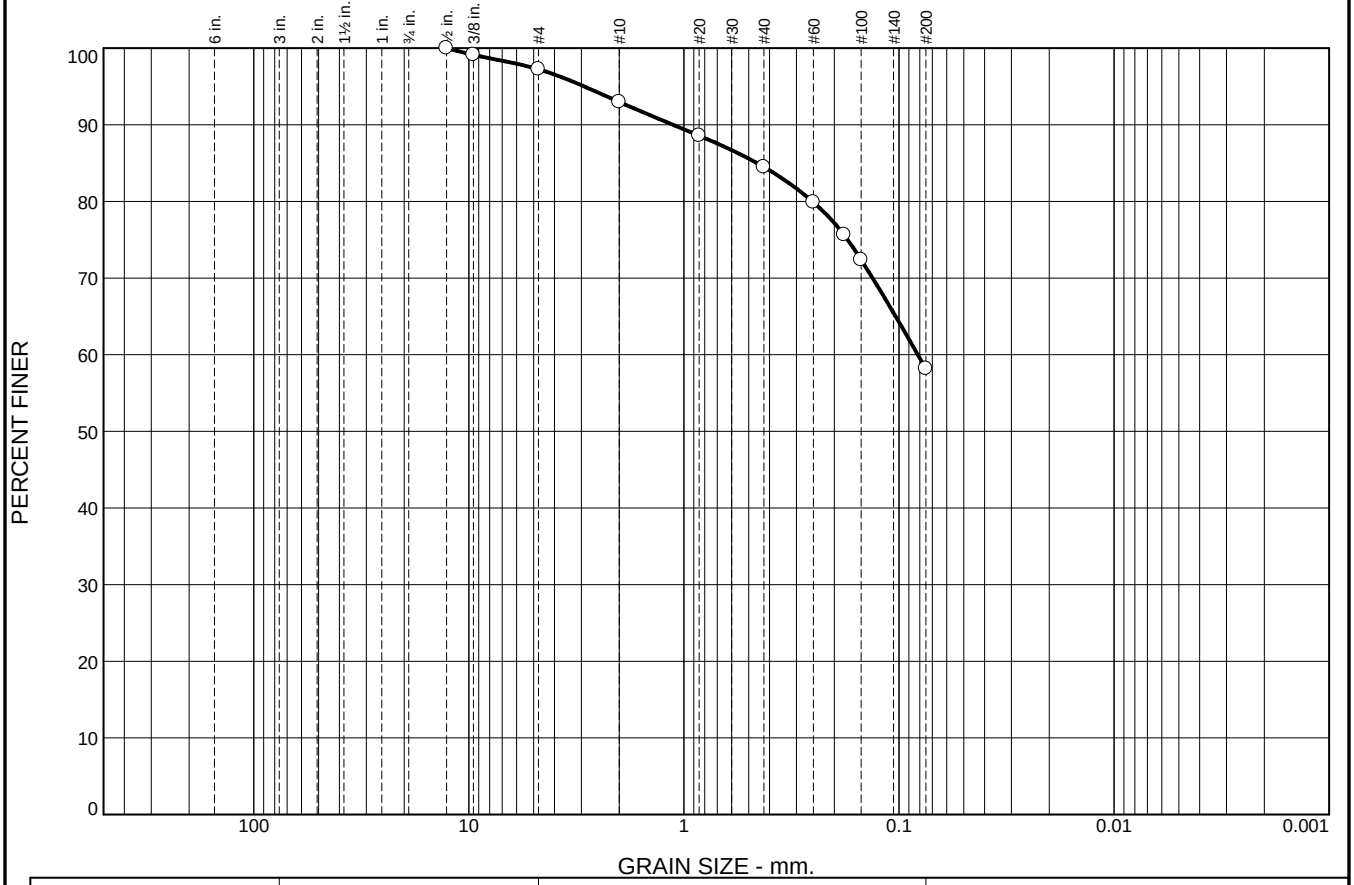
●**Source of Sample:** NB-79 @ 1-2.5 **Depth:** 1-2.5 **Sample Number:** NB-79

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.8	4.2	8.5	26.3	58.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	0.4569	0.0817						

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Reddish brown medium to fine sandy SILT	6/18/19	ML	20.8

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source of Sample:** NB-79 @ 1-2.5 **Depth:** 1-2.5 **Sample Number:** NB-79

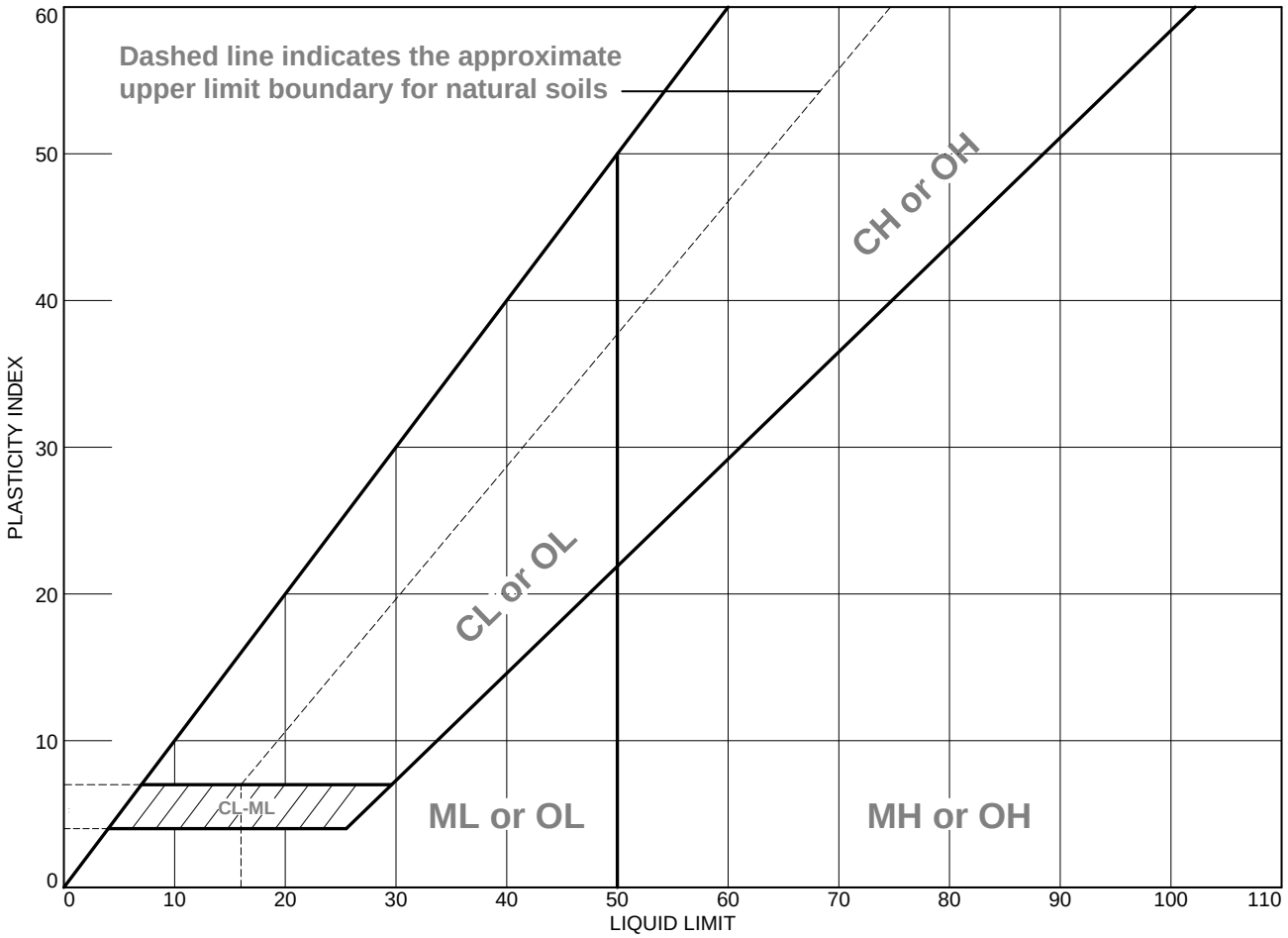
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: WAM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Yellowish red silty coarse to fine SAND	NP	NP	NP	60.8	33.8	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

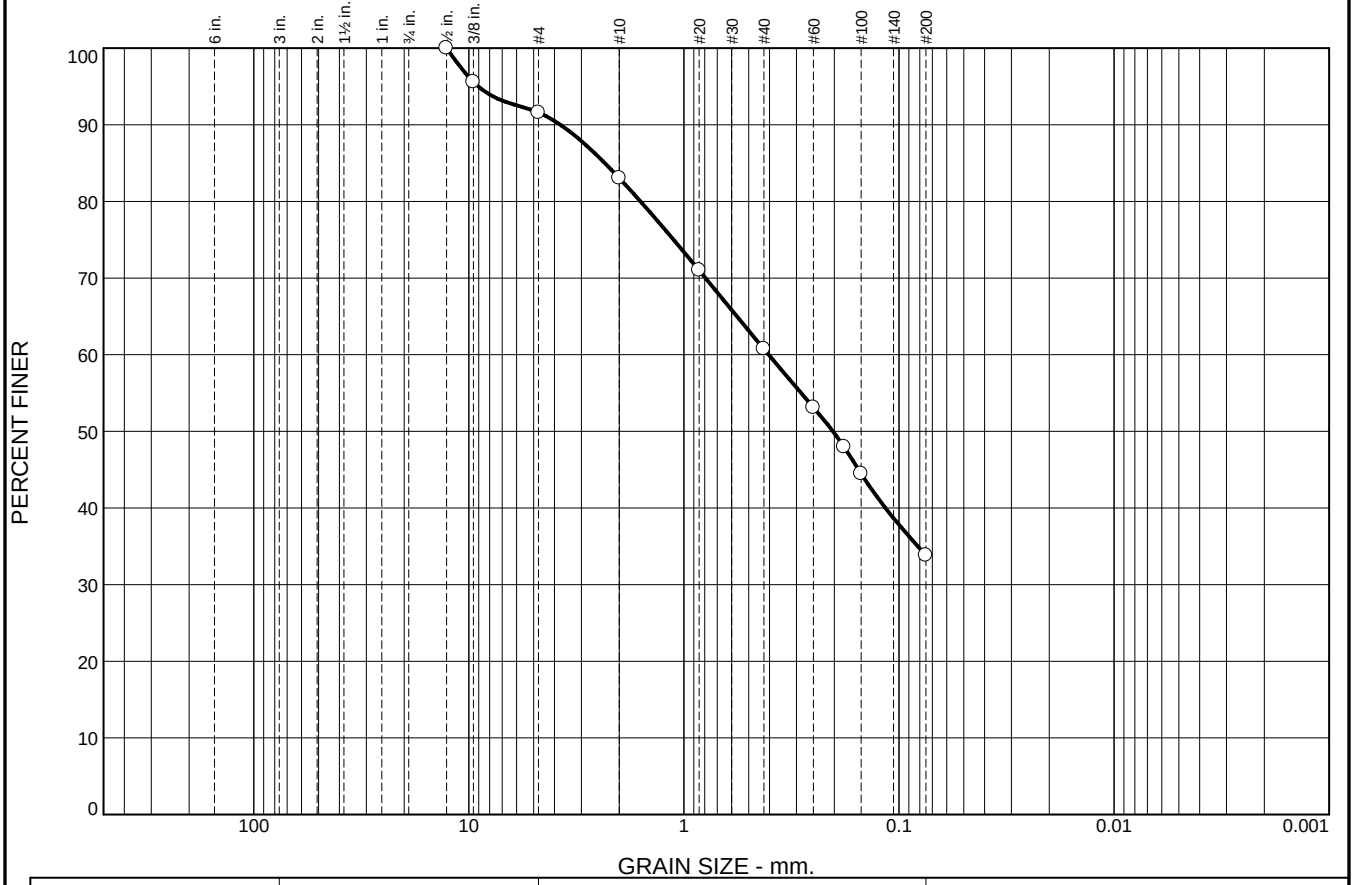
●**Source of Sample:** NB-81 @ 13.5-15 **Depth:** 13.5-15 **Sample Number:** NB-81

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	8.4	8.6	22.2	27.0	33.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	2.3338	0.4036	0.2029					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Yellowish red silty coarse to fine SAND	6/18/19	SM	14.0

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source:** NB-81 @ 13.5-15 **Depth:** 13.5-15 **Sample No.:** NB-81

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: WAM

Table B: Summary of Southbound USCS Index Testing Results

BORING No.	SAMPLE DEPTH (Feet)	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT FINER #40	PERCENT FINER #200	USCS CLASSIFICATION	MOISTURE CONTENT (%)
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SB-16	23.5-25.0	NP	NP	NP	71.9	32.7	SM	23.1
SB-17	3.5-5.0	NP	NP	NP	56.1	19.2	SM	16.4
SB-18	18.0-19.0	NP	NP	NP	75.1	30.7	SM	14.6
SB-19	13.5-15.0	NP	NP	NP	40.8	17.1	SM	20.5
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

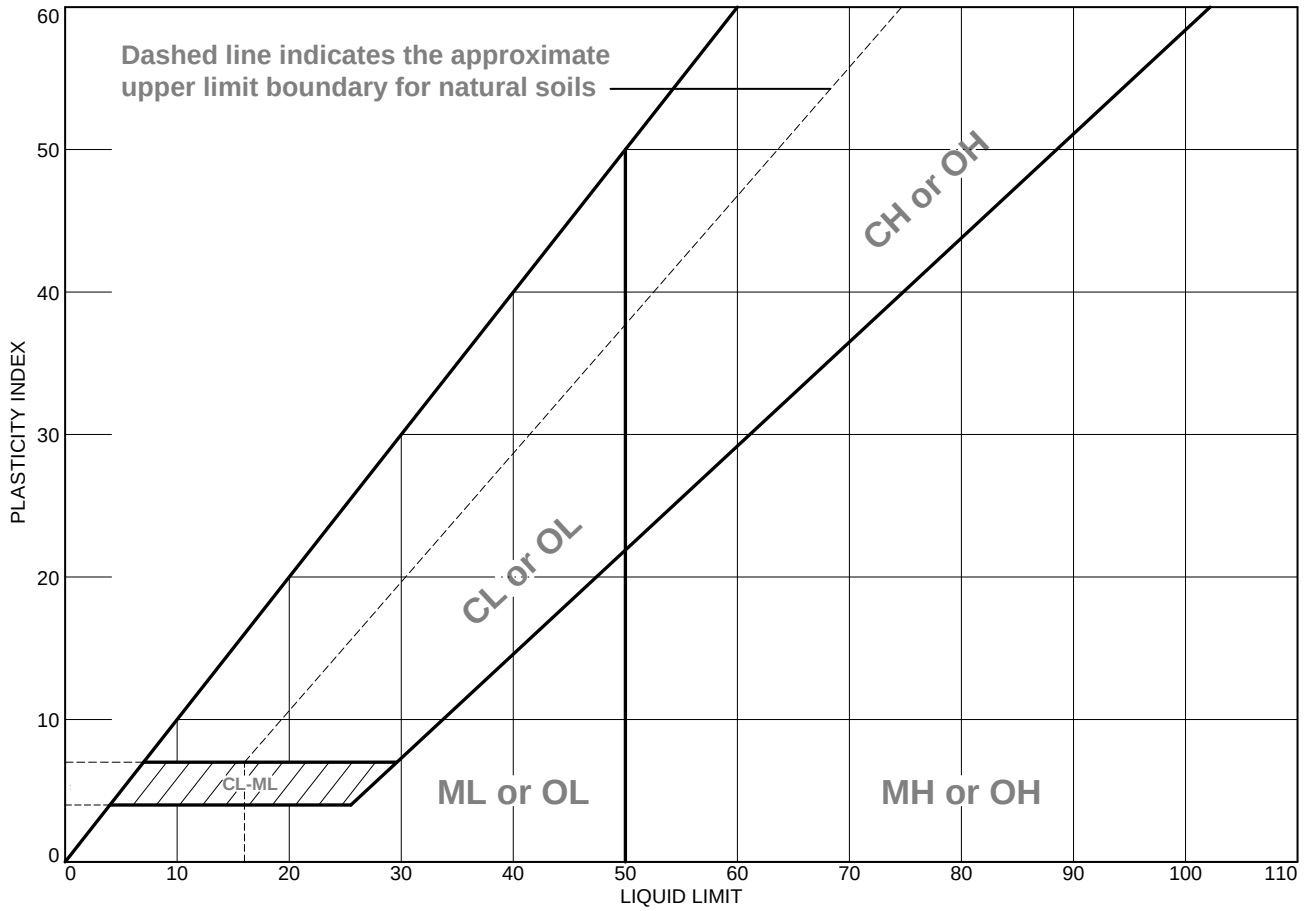
Table B: Summary of Southbound USCS Index Testing Results

BORING No.	SAMPLE DEPTH (Feet)	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT FINER #40	PERCENT FINER #200	USCS CLASSIFICATION	MOISTURE CONTENT (%)
SB-30	12.0-13.0	NP	NP	NP	82.9	19.7	SM	24.3
SB-31	3.5-5.0	NP	NP	NP	50.5	12.6	SM	13.2
SB-32	3.5-5.0	NP	NP	NP	82.0	63.0	ML	38.9
SB-33	3.5-5.0	NP	NP	NP	85.4	36.5	SM	19.4
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table B: Summary of Southbound USCS Index Testing Results

BORING No.	SAMPLE DEPTH (Feet)	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT FINER #40	PERCENT FINER #200	USCS CLASSIFICATION	MOISTURE CONTENT (%)
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SB-84	1.0-2.5	NP	NP	NP	72.7	21.1	SM	28.5
SB-85	7.0-8.0	NP	NP	NP	87.8	45.8	SM	16.9
SB-87	13.5-15.0	NP	NP	NP	83.4	37.7	SM	34.1
SB-88	1.0-2.5	NP	NP	NP	93.7	54.8	ML	34.0
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown micaceous silty medium to fine SAND	NP	NP	NP	71.9	32.7	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

●**Source of Sample:** SB-16 @ 23.5-25 **Depth:** 23.5-25 **Sample Number:** SB-16

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: MLS

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.3	2.4	24.4	39.2	32.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	0.7757	0.2479	0.1652					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Brown micaceous silty medium to fine SAND	8/27/19	SM	23.1

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source:** SB-16 @ 23.5-25 **Depth:** 23.5-25 **Sample No.:** SB-16

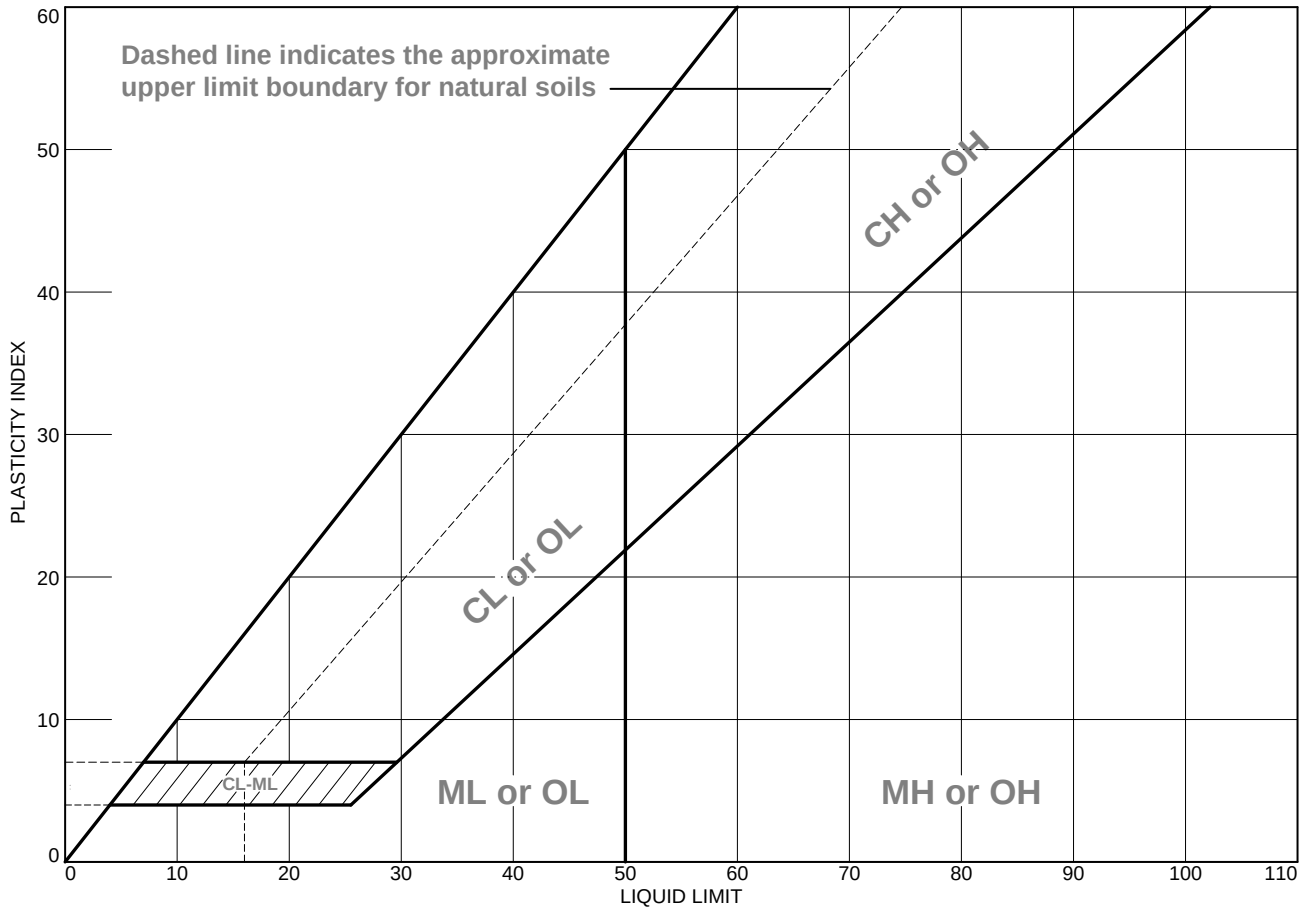
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: JC

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown silty coarse to fine SAND	NP	NP	NP	56.1	19.2	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

●**Source of Sample:** SB-17 @ 3.5-5 **Depth:** 3.5-5 **Sample Number:** SB-17

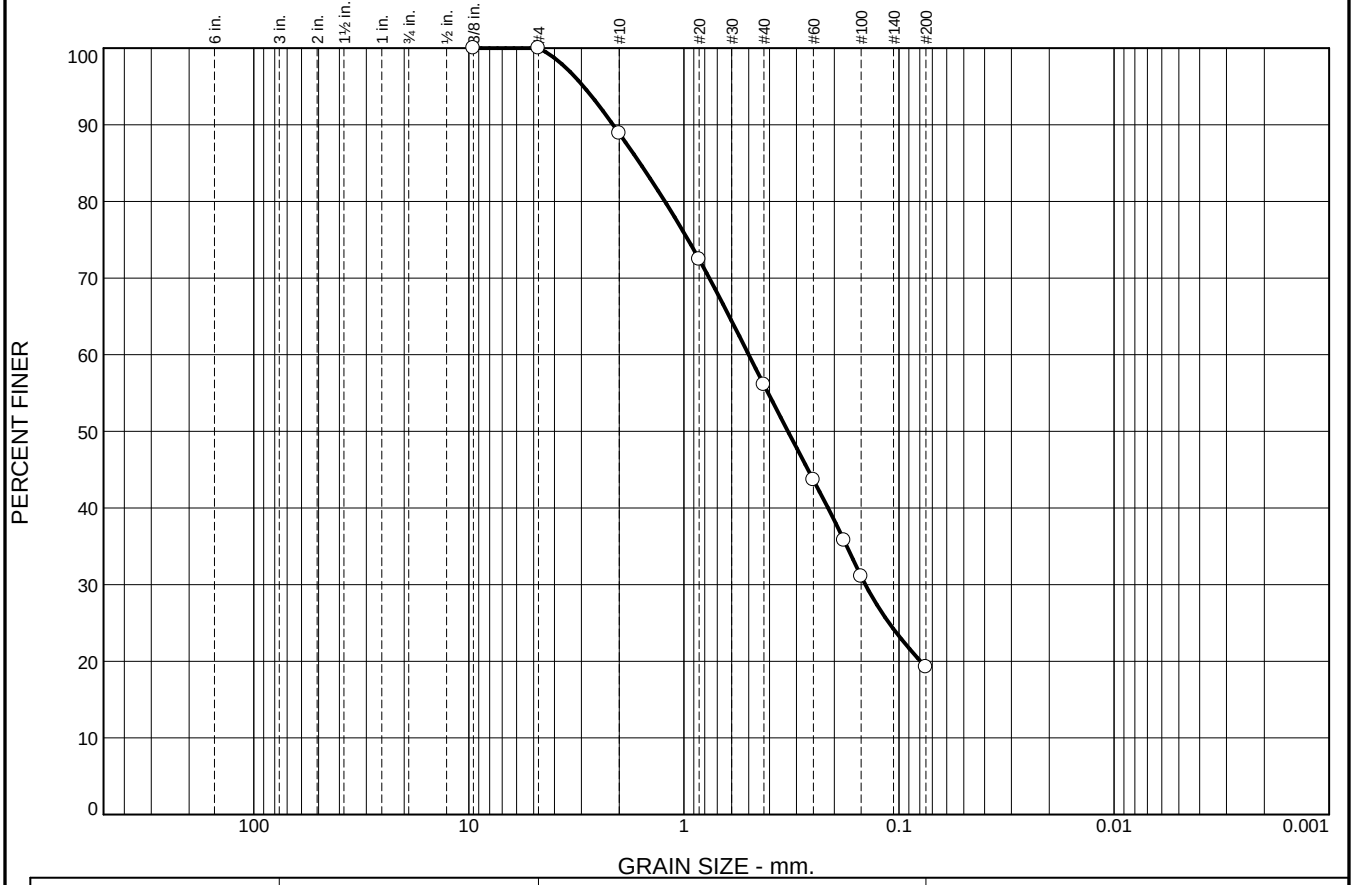
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: HW

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	11.1	32.8	36.9	19.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	1.6030	0.4999	0.3284	0.1433				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Brown silty coarse to fine SAND	6/11/19	SM	16.4

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source of Sample:** SB-17 @ 3.5-5 **Depth:** 3.5-5 **Sample Number:** SB-17

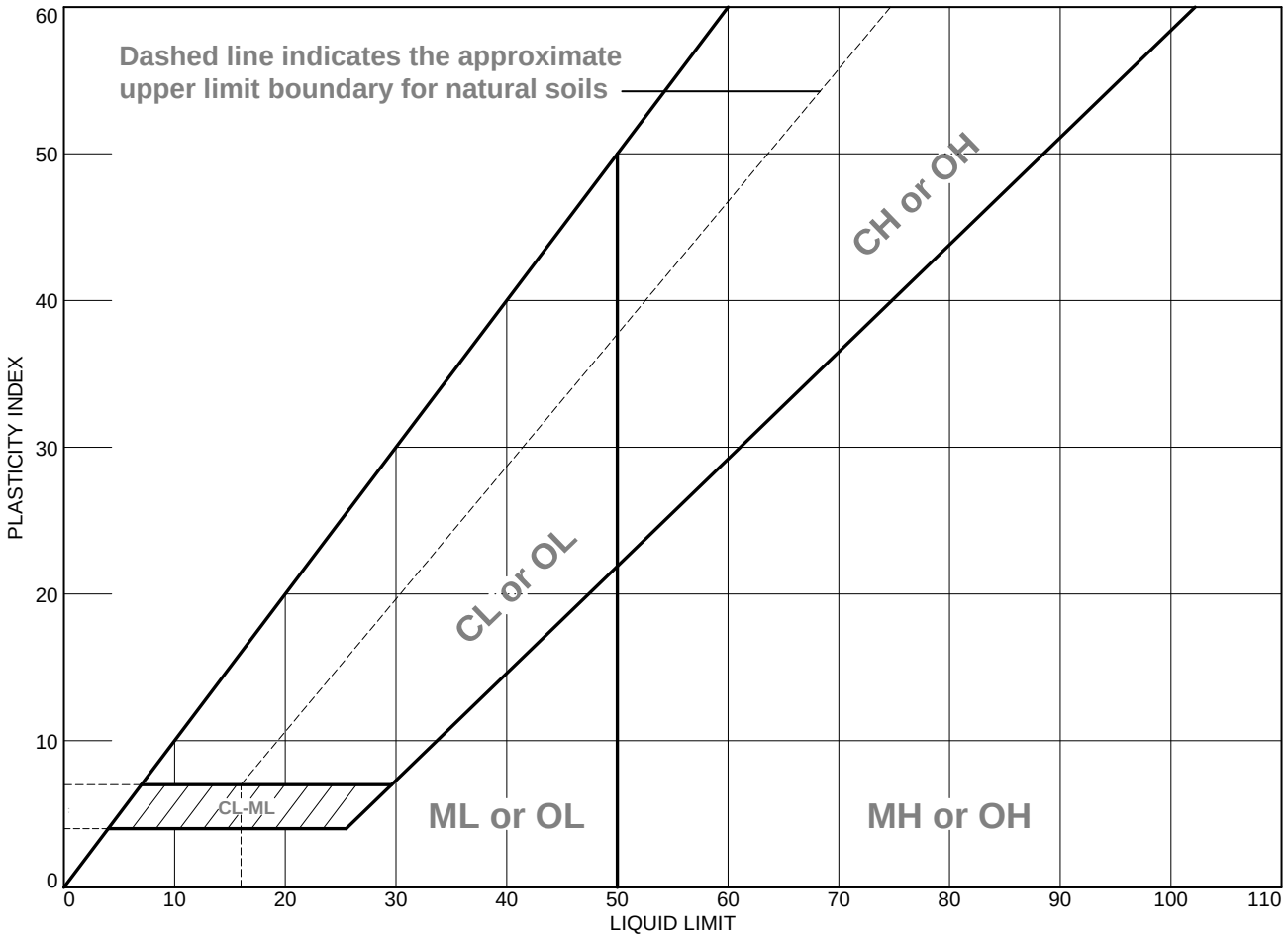
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: WAM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Grayish brown silty medium to fine SAND	NP	NP	NP	75.1	30.7	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

●**Source of Sample:** SB-18 @ 18-19 **Depth:** 18-19 **Sample Number:** SB-18

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.2	2.2	22.5	44.4	30.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	0.6542	0.2331	0.1630					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Grayish brown silty medium to fine SAND	8/27/19	SM	14.6

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source of Sample:** SB-18 @ 18-19 **Depth:** 18-19 **Sample Number:** SB-18

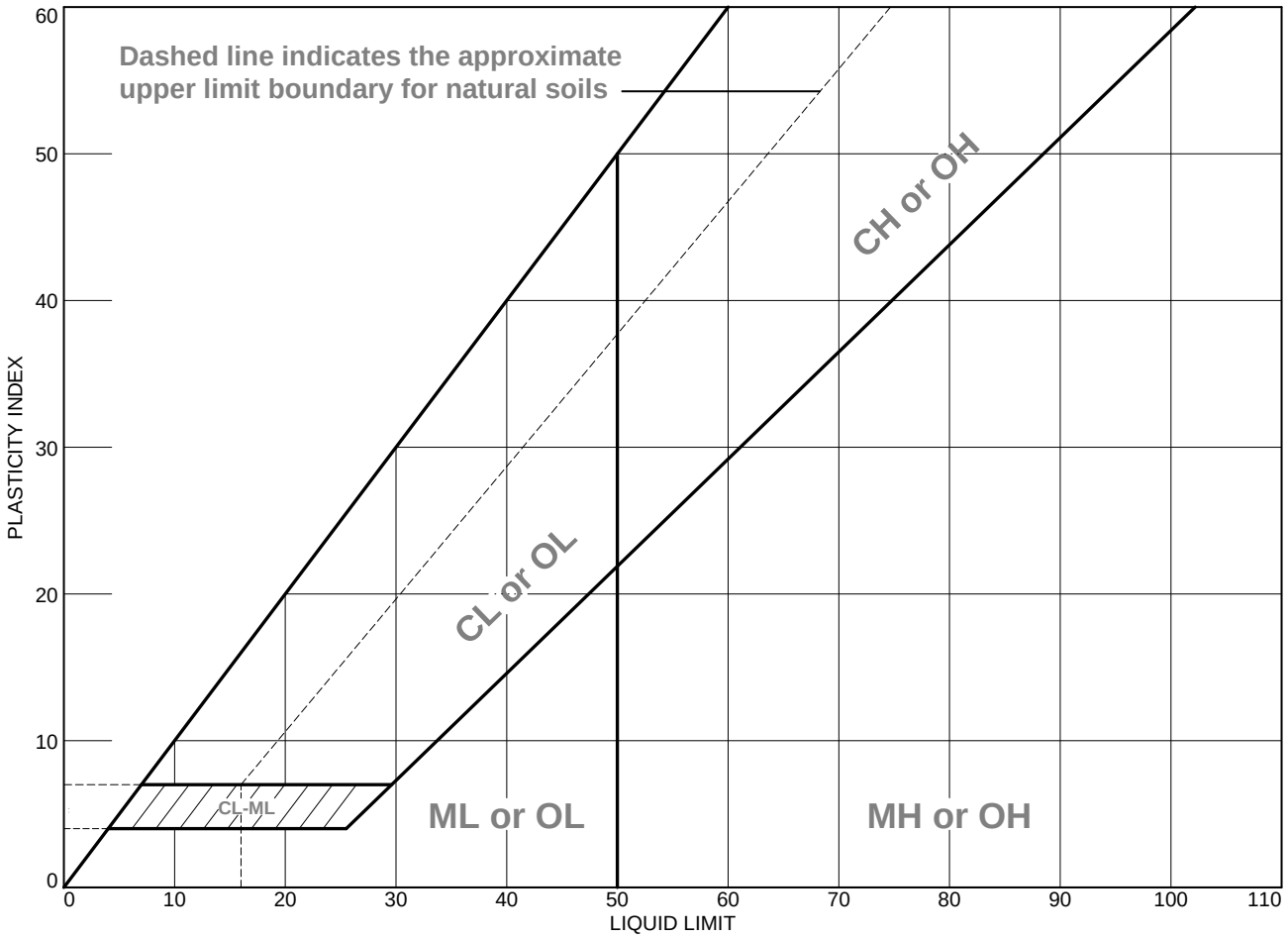
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: JC

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark brown silty coarse to fine SAND	NP	NP	NP	40.8	17.1	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

●**Source of Sample:** SB-19 @ 13.5-15 **Depth:** 13.5-15 **Sample Number:** SB-19

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	7.0	13.7	38.5	23.7	17.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	2.6519	0.9856	0.6644	0.2235				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Dark brown silty coarse to fine SAND	6/12/19	SM	20.5

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source:** SB-19 @ 13.5-15 **Depth:** 13.5-15 **Sample No.:** SB-19

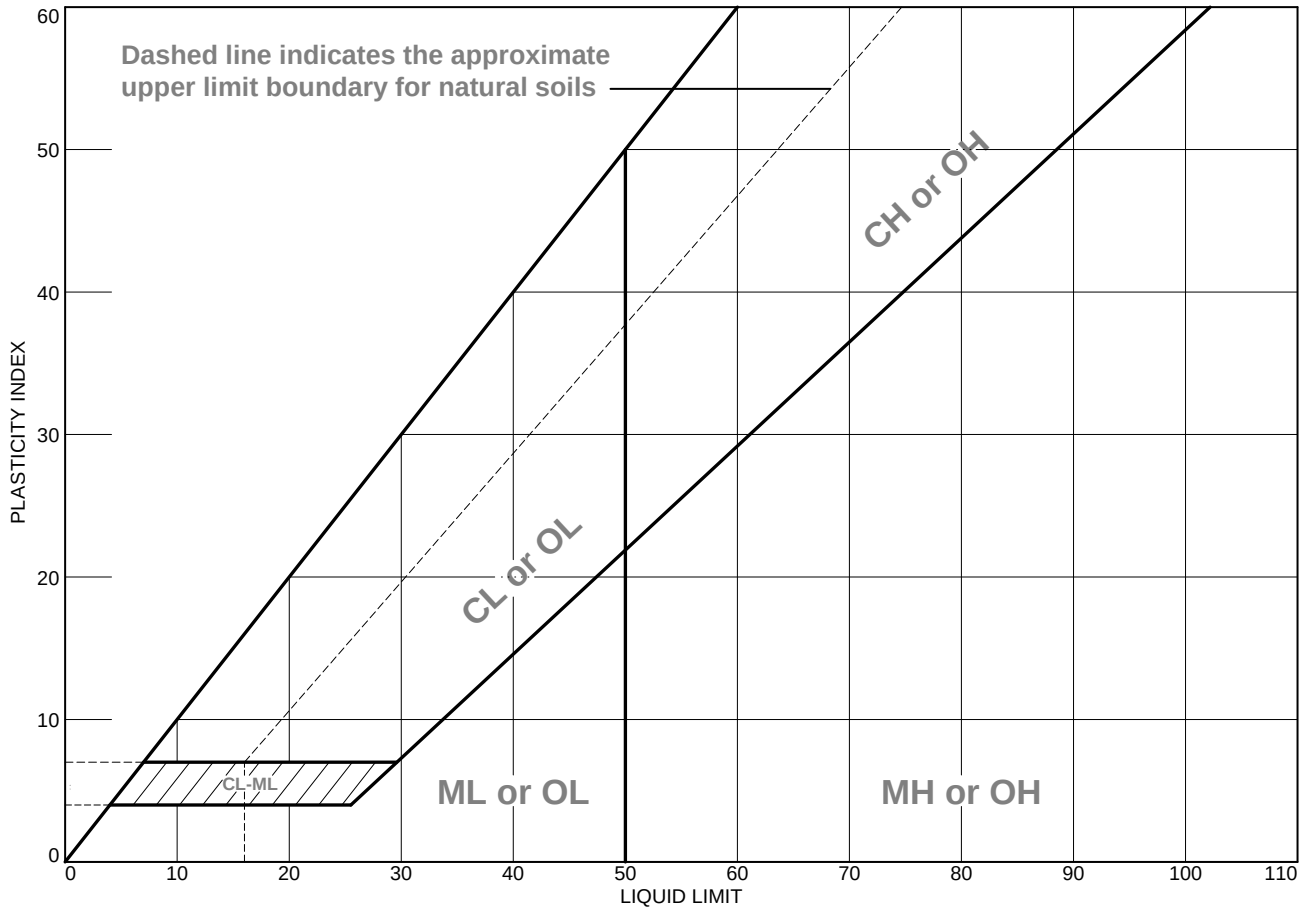
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: AB

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown silty medium to fine SAND	NP	NP	NP	82.9	19.7	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

●**Source of Sample:** SB-30 @ 12-13 **Depth:** 12-13 **Sample Number:** SB-30

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: MLS

Particle Size Distribution Report - ASTM D6913

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.8	16.3	63.2	19.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	0.4643	0.2194	0.1752	0.1079				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Brown silty medium to fine SAND	6/18/19	SM	24.3

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source of Sample:** SB-30 @ 12-13 **Depth:** 12-13 **Sample Number:** SB-30

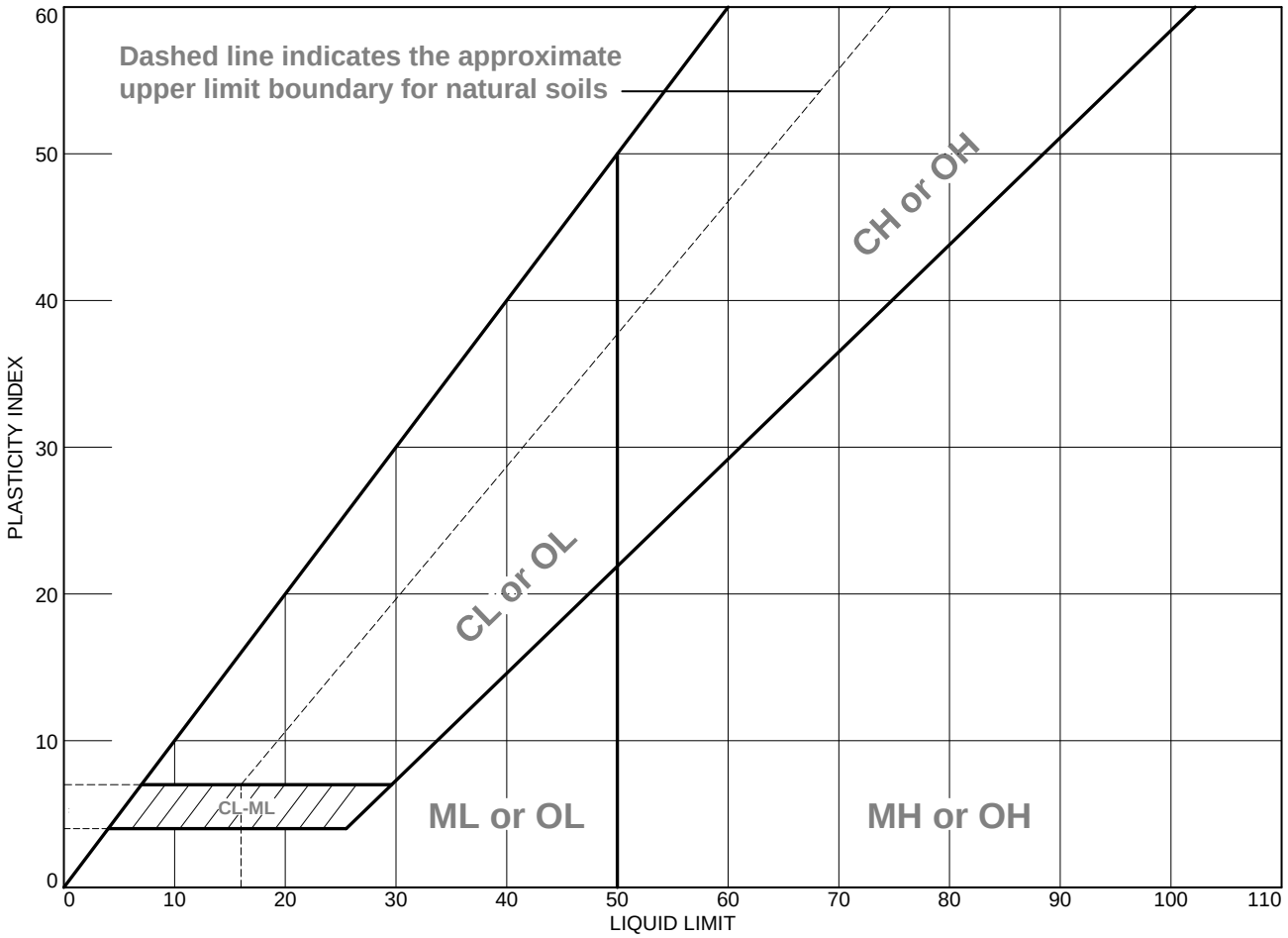
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: WAM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark brown silty coarse to fine SAND with gravel	NP	NP	NP	50.5	12.6	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

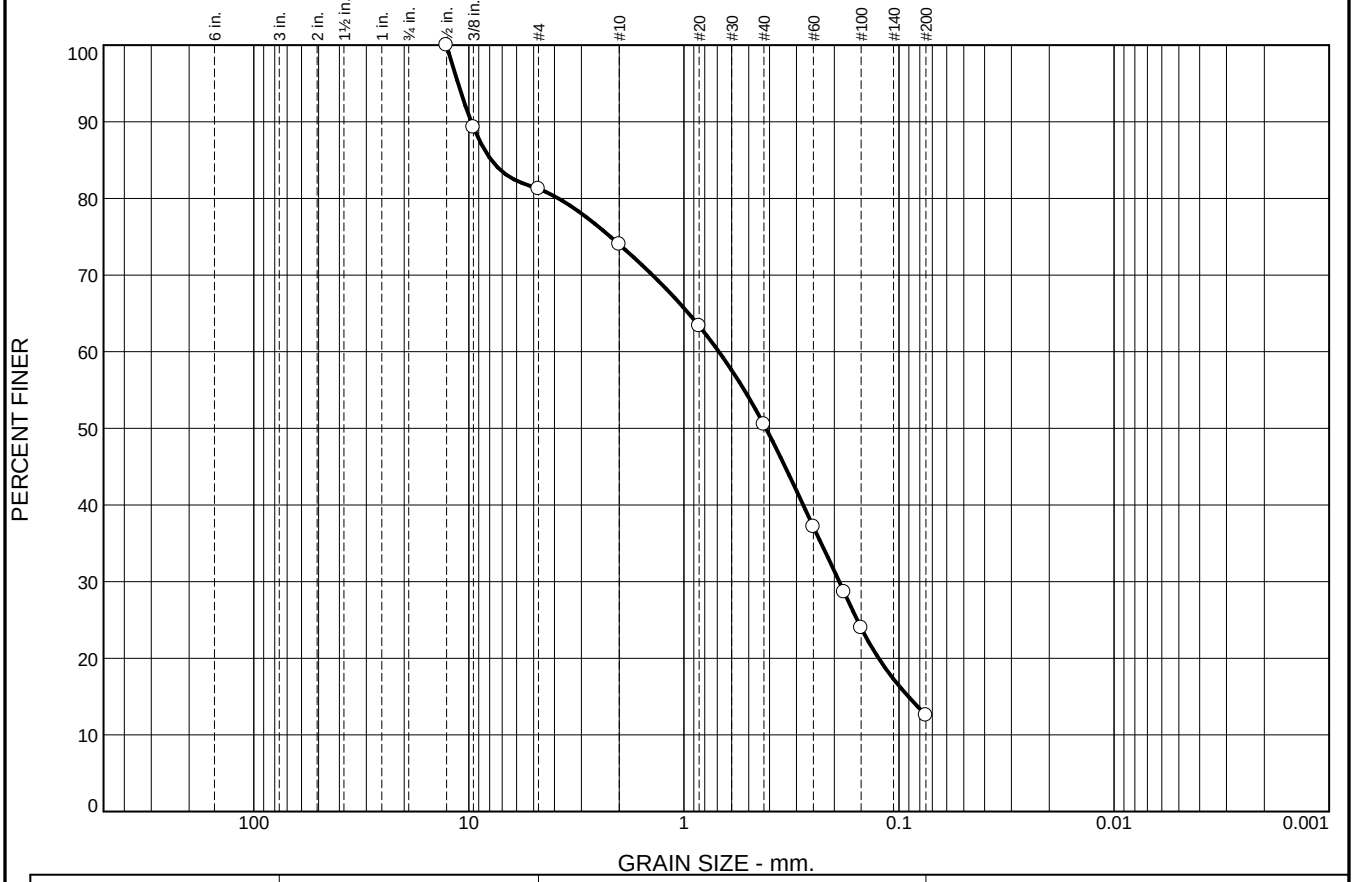
●**Source of Sample:** SB-31 @ 3.5-5 **Depth:** 3.5-5 **Sample Number:** SB-31

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	18.7	7.3	23.5	37.9	12.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	7.8589	0.6882	0.4156	0.1895	0.0904			

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Dark brown silty coarse to fine SAND with gravel	6/13/19	SM	13.2

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source of Sample:** SB-31 @ 3.5-5 **Depth:** 3.5-5 **Sample Number:** SB-31

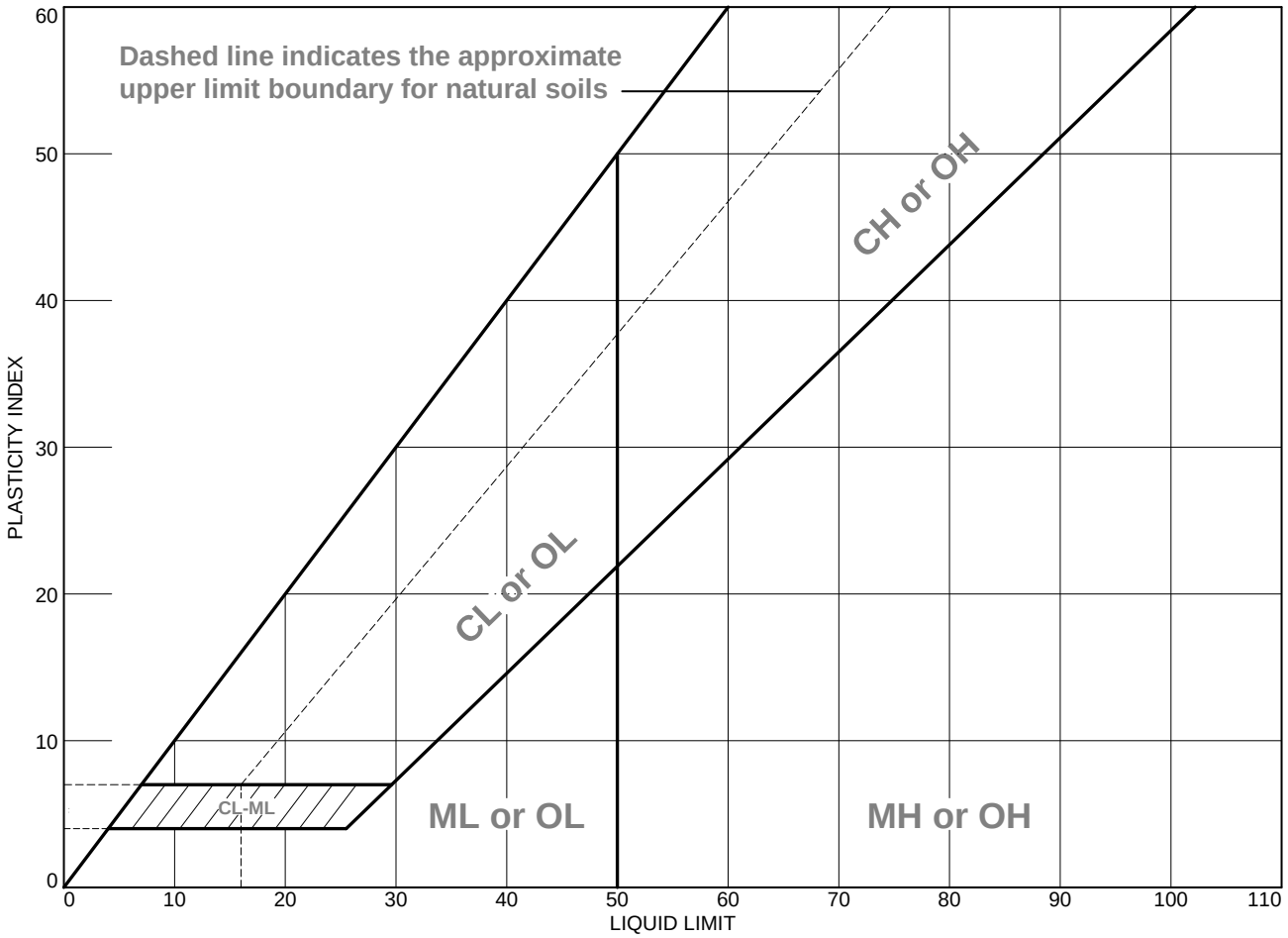
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: AB

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Orange coarse to fine sandy SILT	NP	NP	NP	82.0	63.0	ML

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

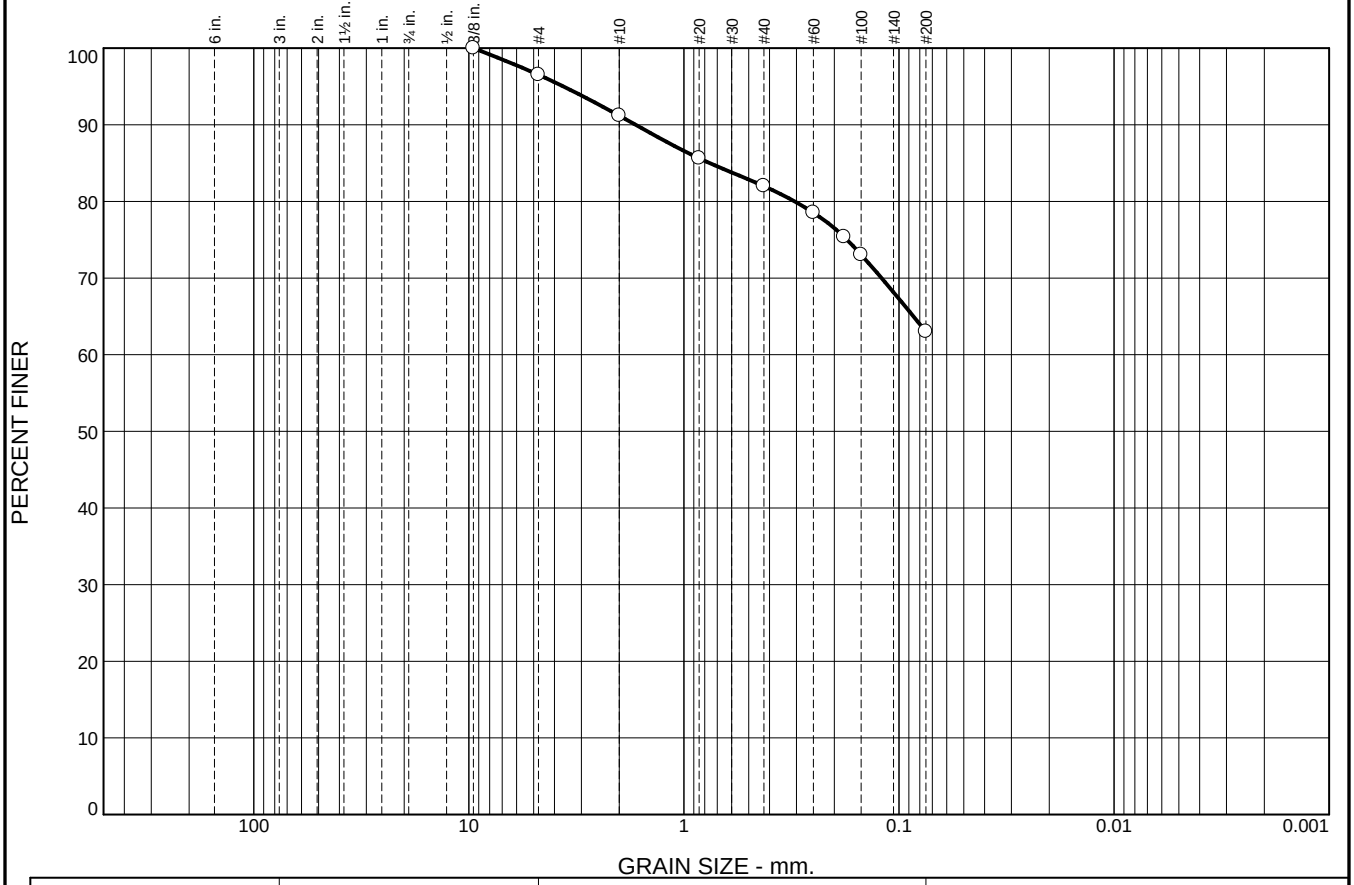
●**Source of Sample:** SB-32 @ 3.5-5 **Depth:** 3.5-5 **Sample Number:** SB-32

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.5	5.3	9.2	19.0	63.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	0.7588							

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Orange coarse to fine sandy SILT	6/14/19	ML	38.9

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source of Sample:** SB-32 @ 3.5-5 **Depth:** 3.5-5 **Sample Number:** SB-32

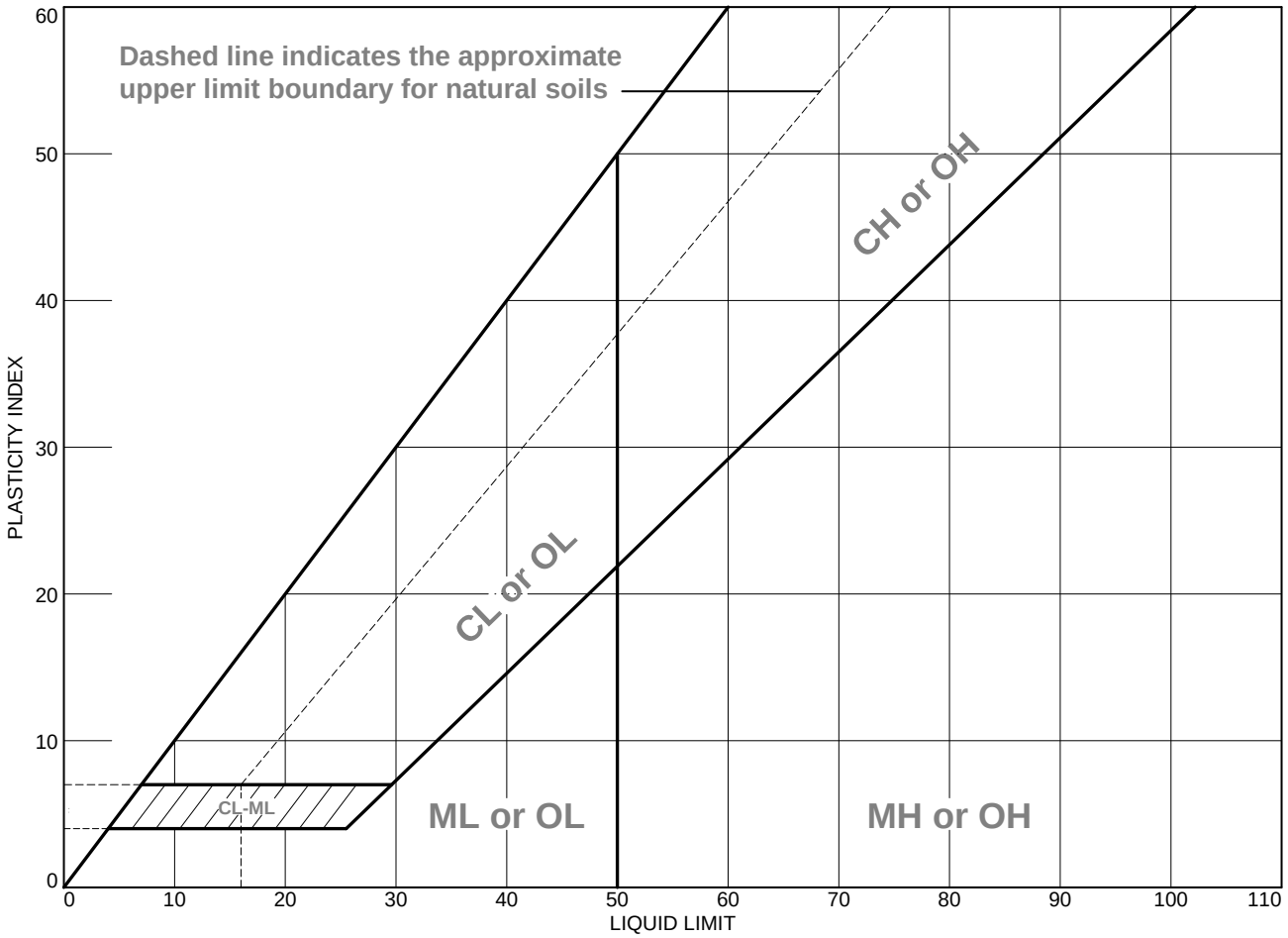
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: WAM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Red silty medium to fine SAND	NP	NP	NP	85.4	36.5	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

●**Source of Sample:** SB-33 @ 3.5-5 **Depth:** 3.5-5 **Sample Number:** SB-33

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	14.4	48.9	36.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	0.4181	0.1770	0.1318					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Red silty medium to fine SAND	6/18/19	SM	19.4

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source of Sample:** SB-33 @ 3.5-5 **Depth:** 3.5-5 **Sample Number:** SB-33

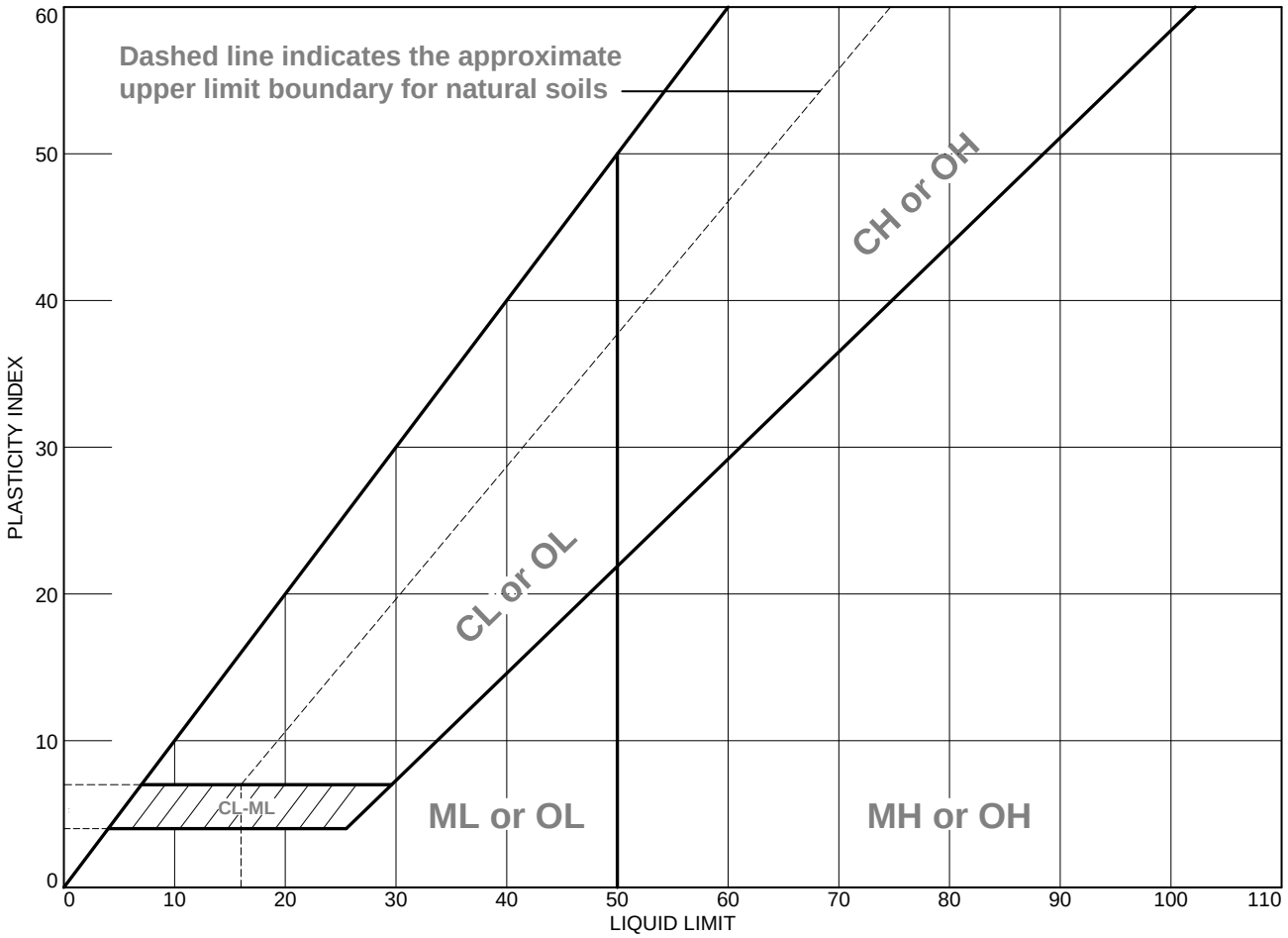
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: WAM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Black and brown silty medium to fine SAND	NP	NP	NP	72.7	21.1	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

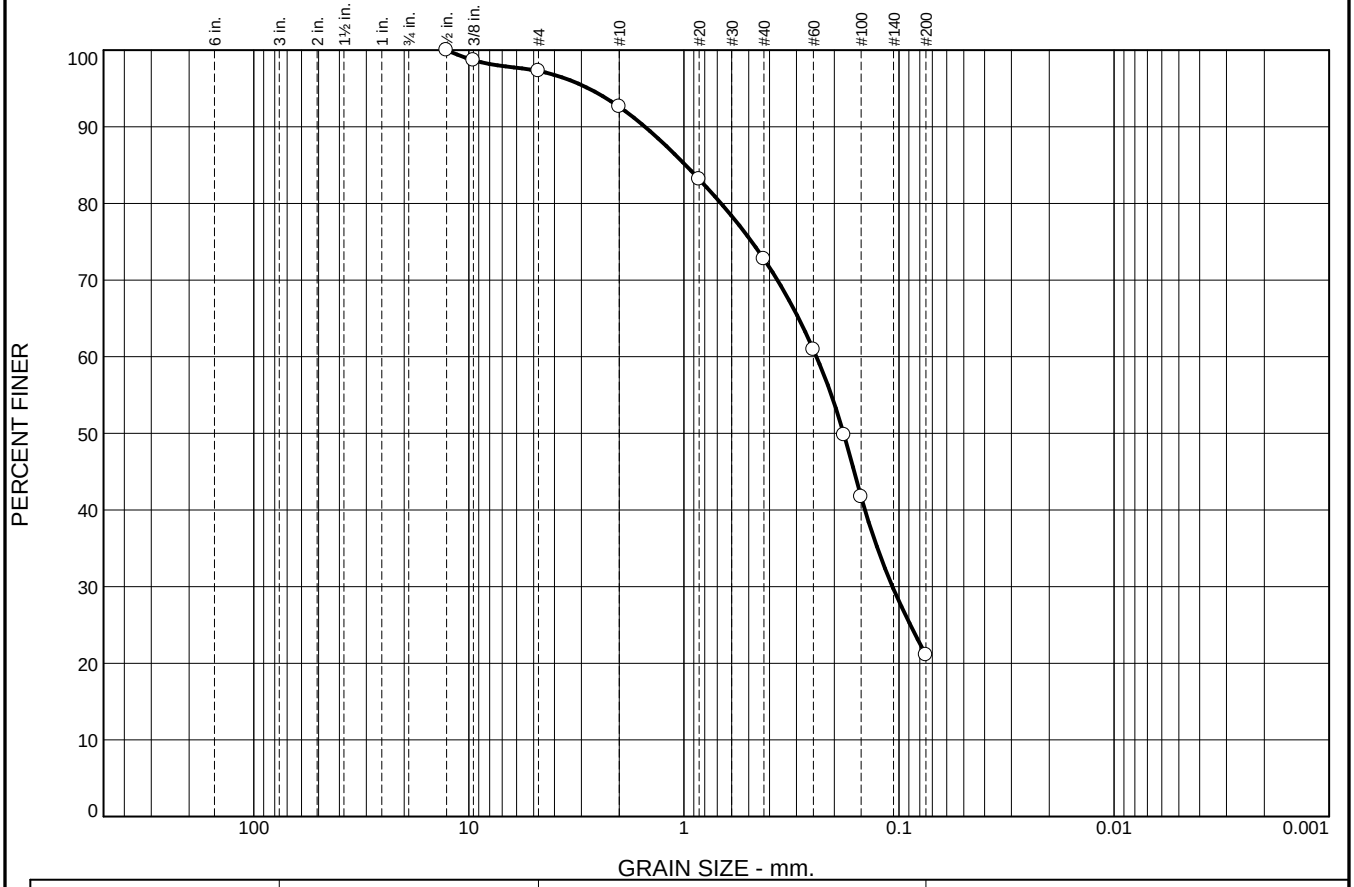
●**Source of Sample:** SB-84 @ 1-2.5 **Depth:** 1-2.5 **Sample Number:** SB-84

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.7	4.7	19.9	51.6	21.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	0.9829	0.2420	0.1809	0.1072				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Black and brown silty medium to fine SAND	6/18/19	SM	28.5

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source of Sample:** SB-84 @ 1-2.5 **Depth:** 1-2.5 **Sample Number:** SB-84

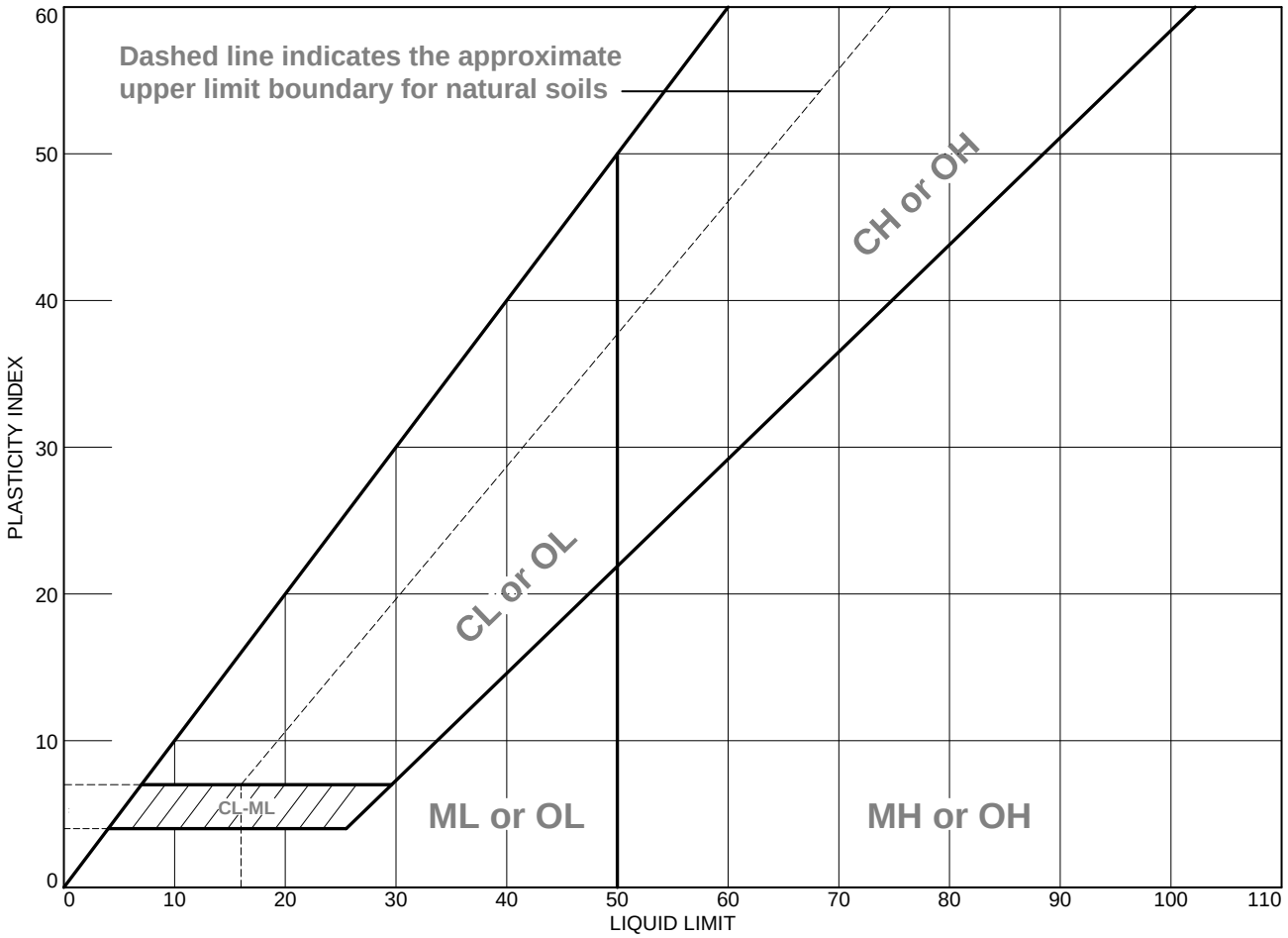
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: WAM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Reddish brown silty medium to fine SAND	NP	NP	NP	87.8	45.8	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

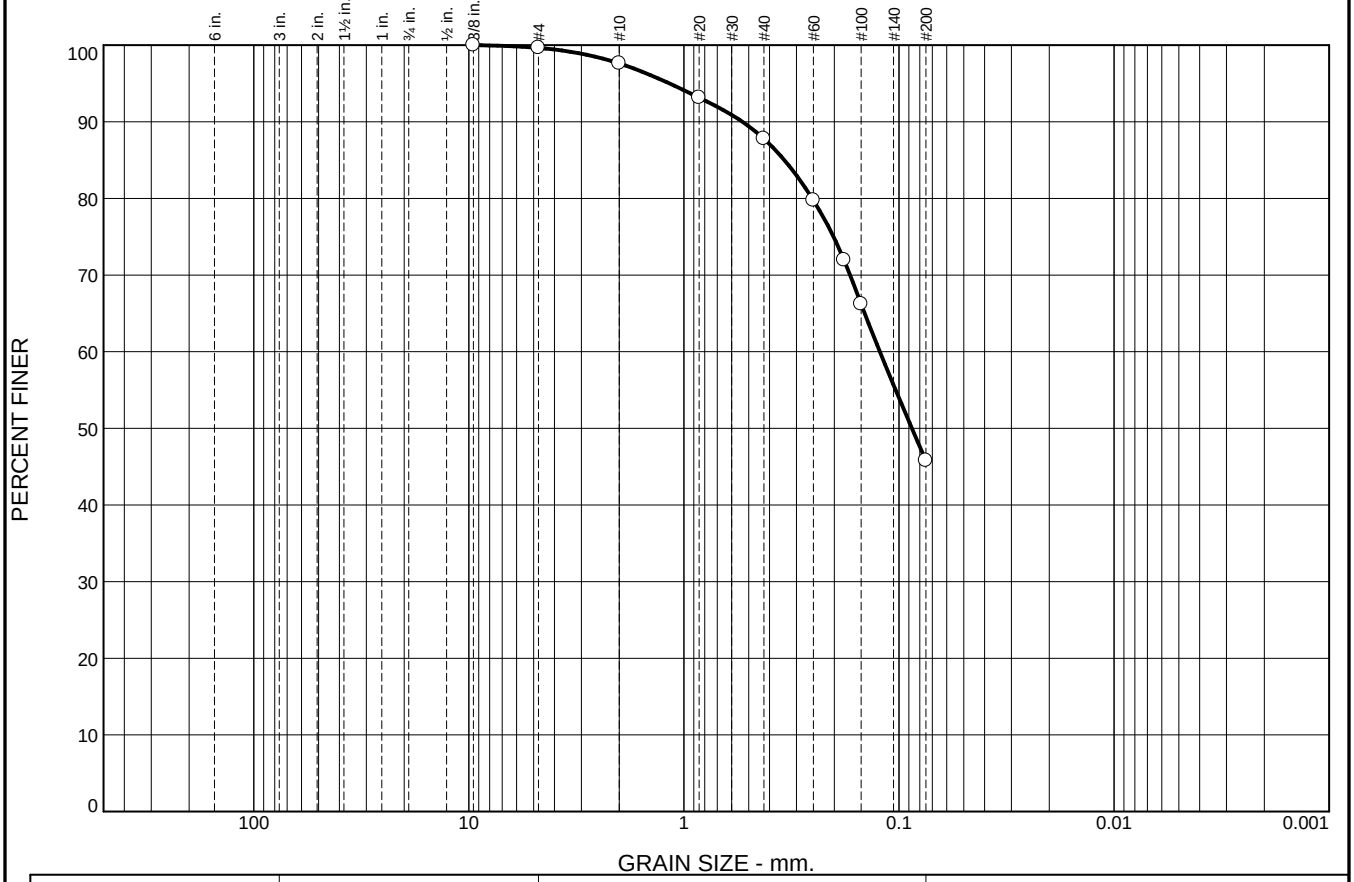
●**Source of Sample:** SB-85 @ 7-8 **Depth:** 7-8 **Sample Number:** SB-85

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.4	2.0	9.8	42.0	45.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	0.3411	0.1228	0.0871					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Reddish brown silty medium to fine SAND	6/17/19	SM	16.9

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source of Sample:** SB-85 @ 7-8 **Depth:** 7-8 **Sample Number:** SB-85

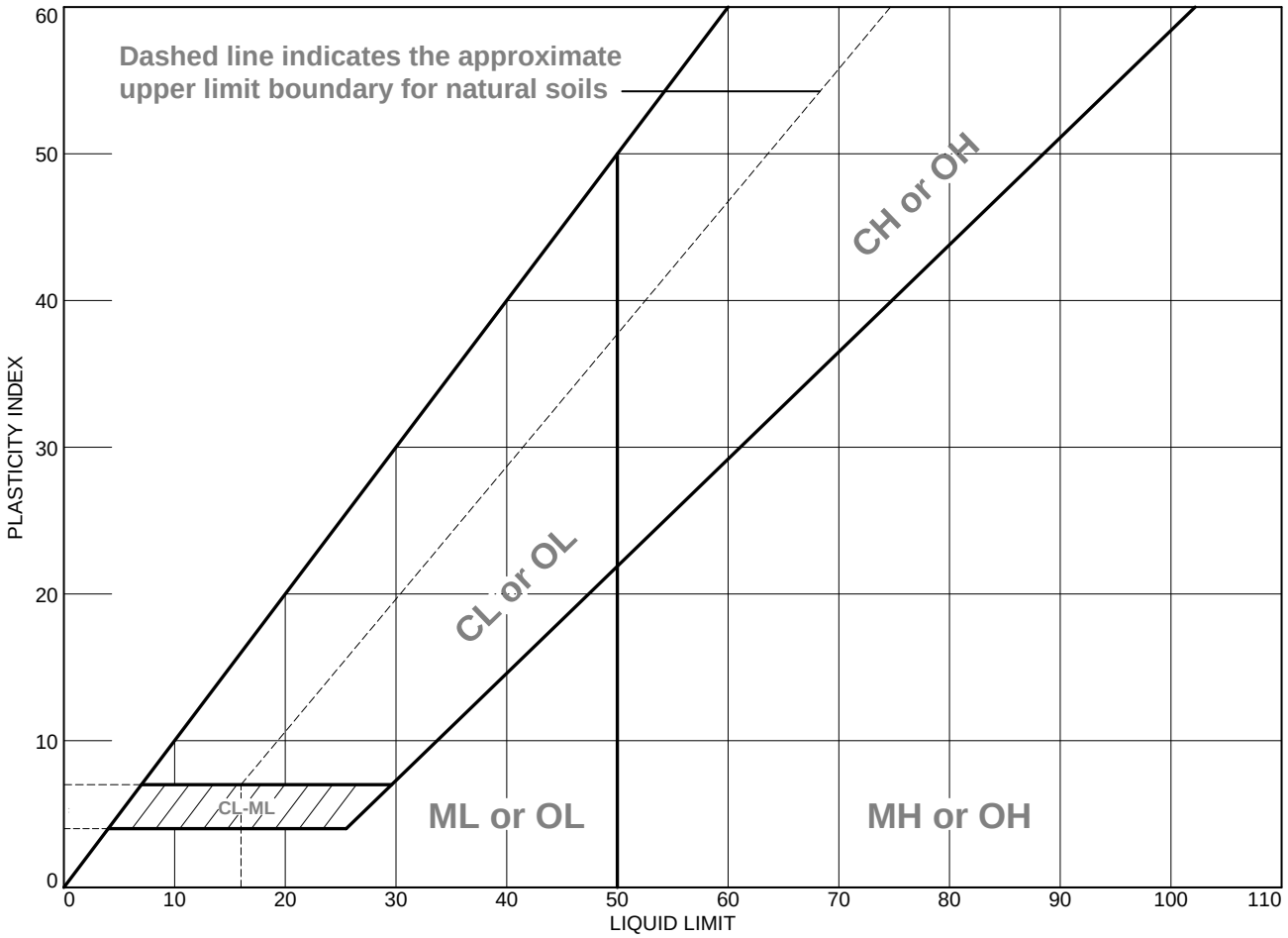
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: AB

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark brown micaceous silty medium to fine SAND	NP	NP	NP	83.4	37.7	SM

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

●**Source of Sample:** SB-87 @ 13.5-15 **Depth:** 13.5-15 **Sample Number:** SB-87

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	1.1	15.5	45.7	37.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	0.4625	0.1763	0.1260					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Dark brown micaceous silty medium to fine SAND	8/27/19	SM	34.1

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source:** SB-87 @ 13.5-15 **Depth:** 13.5-15 **Sample No.:** SB-87

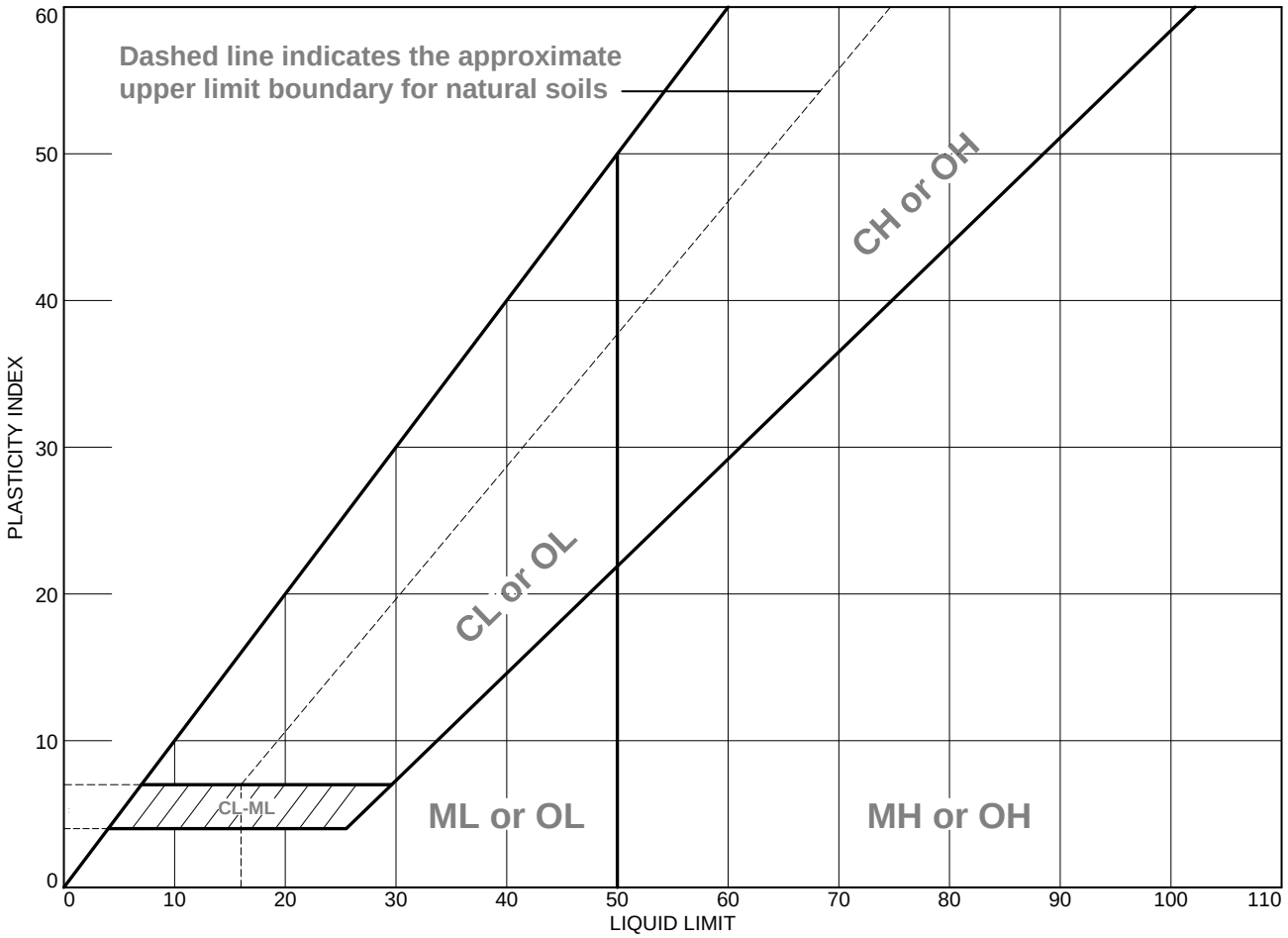
Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: JC

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Reddish brown medium to fine sandy SILT	NP	NP	NP	93.7	54.8	ML

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

●**Source of Sample:** SB-88 @ 1-2.5 **Depth:** 1-2.5 **Sample Number:** SB-88

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.4	5.9	38.9	54.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	0.2168	0.0920						

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Reddish brown medium to fine sandy SILT	6/17/19	ML	34.0

Project No. 2018089 **Client:** AECOM

Project: [redacted] Soil Survey

○ **Source of Sample:** SB-88 @ 1-2.5 **Depth:** 1-2.5 **Sample Number:** SB-88

Remarks:

NOVA ENGINEERING
Kennesaw, Georgia
770-425-0777

Figure

Tested By: AB

GDT 810.2

DOT 420

[redacted]- PI# 0001757

NOVA Project Number 2018089

	MOISTURE DENSITY PROCTOR POINTS					
Boring No.	[redacted]	NB-19	NB-19	NB-19	NB-20	NB-20
Depth		15-20	20-25	25-30	15-20	20-25
Offset						
Dry Weight (Moisture Sample)						
% Natural Moisture		7.2	16.0%	14.2%	19.0%	24.4%
Wt. of Mixture & Mold						
Wt. of Mold						
Wet Wt. of Mixture						
Wet Wt. per Cu. Ft.		116.3	113.2	118.1	114.2	116.3
Dry Wt. per Cu. Ft.						
	SWELL					
A. Height of collar above base plate = .875		0.875	0.875	0.875	0.875	0.875
B. Original dial reading		0.149	0.159	0.148	0.124	0.146
C. Original height of specimen (A + B)						
D. Final dial reading →		0.340	0.303	0.282	0.304	0.251
E. Final height of specimen (A + D)						
F. Change in thickness (E - C)						
G. % Swell; Direct from Table III using C & F		18.7	13.9	13.1	18	10.3
	SHRINKAGE					
H. Height of collar above base plate (short legs) = .250		0.250	0.250	0.250	0.250	0.250
I. Original dial reading on short legs		0.147	0.245	0.146	0.142	0.145
J. Original thickness (H + I)						
K. Original volume in cu. Inches; Table I using J						
L. Height of collar above base plate (long legs) = 3.250		3.250	3.250	3.250	3.250	3.250
M. Average of 4 dial readings for diameter of dry specimen		0.745	0.740	0.728	0.716	0.705
N. Diameter of dry specimen (L + M)						
O. Area of dry specimen; From Table II using N						
P. Final dial reading on short legs →		0.139	0.238	0.144	0.134	0.126
Q. Final thickness (H + P)						
R. Volume of dry specimen (O x Q)						
S. Change in volume (K - R)						
T. % Shrinkage 100 (S ÷ K)		2.3	1.9	1.6	3.7	6.9
	RESULTS OF TESTS ON MINUS 10 MESH MATERIAL					
Maximum Density (pcf)		106.9	102.7	108.0	101.4	106.8
Optimum Moisture (%)		13.9	10.7	13.6	15.8	16.3
Percent Swell (%)		18.7	13.9	13.1	18.0	10.3
Percent Shrinkage (%)		2.3	1.9	1.6	3.7	6.9
Volume Change (%)		21.0	15.8	14.7	21.7	17.2
	RESULTS OF TESTS CALCULATED FOR TOTAL SAMPLE					
Retained on No. 10 (%)		13.5	11.7	13.1	9.6	16.6
Maximum Density (pcf)		112.1	107.1	112.1	104.6	112.2
Volume change (%)		13.0	1.7	13.0	20.0	14.7
Class		IIB4	IA3	IA3	IIB4	IIB3
Tested By		SC	MLS/SC	MLS/SC	MLS/SC	MLS/SC

DOT 420

[redacted] - PI# 0001757

NOVA Project Number 2018089

	MOISTURE DENSITY PROCTOR POINTS	
Boring No.	NB-80	NB-80
Depth	10-15	20-25
Offset		
Dry Weight (Moisture Sample)		
% Natural Moisture	15.2%	10.4%
Wt. of Mixture & Mold		
Wt. of Mold		
Wet Wt. of Mixture		
Wet Wt. per Cu. Ft.	105.7	113.0
Dry Wt. per Cu. Ft.		
	SWELL	
A. Height of collar above base plate = .875	0.875	0.875
B. Original dial reading	0.179	0.148
C. Original height of specimen (A + B)		
D. Final dial reading →	0.365	0.209
E. Final height of specimen (A + D)		
F. Change in thickness (E - C)		
G. % Swell; Direct from Table III using C & F	17.6	6
	SHRINKAGE	
H. Height of collar above base plate (short legs) = .250	0.250	0.250
I. Original dial reading on short legs	0.129	0.137
J. Original thickness (H + I)		
K. Original volume in cu. Inches; Table I using J		
L. Height of collar above base plate (long legs) = 3.250	3.250	3.250
M. Average of 4 dial readings for diameter of dry specimen	0.727	0.724
N. Diameter of dry specimen (L + M)		
O. Area of dry specimen; From Table II using N		
P. Final dial reading on short legs →	0.122	0.136
Q. Final thickness (H + P)		
R. Volume of dry specimen (O x Q)		
S. Change in volume (K - R)		
T. % Shrinkage 100 (S ÷ K)	4.6	1.6
	RESULTS OF TESTS ON MINUS 10 MESH MATERIAL	
Maximum Density (pcf)	99.0	103.7
Optimum Moisture (%)	11.9	10.3
Percent Swell (%)	17.6	6.0
Percent Shrinkage (%)	4.6	1.6
Volume Change (%)	22.2	7.6
	RESULTS OF TESTS CALCULATED FOR TOTAL SAMPLE	
Retained on No. 10 (%)	5.7	8.8
Maximum Density (pcf)	101.3	106.6
Volume change (%)	21.2	7.0
Class	IIB4	IIB3
Tested By	MLS/SC	MLS/SC

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/23/2020
Project No.:	2018089	**Boring Location No.:**	NB-19
Lab Assignment No.:		**Offset/Depth:**	15'-20'

Soil Description: Gray IIB4

Total Sample Weight = 18225 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	15		99.9
#10	2465		86.5

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 48.86 g			Weight After Elutriation= 42.40 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	13.90			61.9
#60	19.70			51.6
#200	34.20			25.9
Clay (effluent) =			13.2	11.4

Test Performed By: MLS/SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/28/2020
Project No.:	2018089	**Boring Location No.:**	NB-19
Lab Assignment No.:		**Offset/Depth:**	20'-25'

Soil Description: Gray IA3

Total Sample Weight = 17985 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	0		100
#10	2100		88.3

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 48.66 g			Weight After Elutriation= 43.00 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	12.80			65.1
#60	19.20			53.5
#200	35.10			24.6
Clay (effluent) =			11.6	10.3

Test Performed By: MLS/SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/23/2020
Project No.:	2018089	**Boring Location No.:**	NB-19
Lab Assignment No.:		**Offset/Depth:**	25'-30'

Soil Description: Gray IA3

Total Sample Weight = 12715 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	0		100
#10	1665		86.9

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 48.57 g			Weight After Elutriation= 43.00 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	12.60			64.4
#60	19.50			52.0
#200	35.90			22.7
Clay (effluent) =			11.5	10.0

Test Performed By: MLS/SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/23/2020
Project No.:	2018089	**Boring Location No.:**	NB-20
Lab Assignment No.:		**Offset/Depth:**	15'-20'

Soil Description: Red IIB4

Total Sample Weight = 16775 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	10		99.9
#10	1605		90.4

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 47.72 g			Weight After Elutriation= 37.90 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	10.71			70.2
#60	16.50			59.2
#200	32.81			28.3
Clay (effluent) =			20.6	18.6

Test Performed By: MLS/SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/23/2020
Project No.:	2018089	**Boring Location No.:**	NB-20
Lab Assignment No.:		**Offset/Depth:**	20'-25'

Soil Description: Light brown IIB3

Total Sample Weight = 18165 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	15		99.9
#10	3020		83.4

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 46.21 g			Weight After Elutriation= 36.51 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	10.91			63.7
#60	16.11			54.3
#200	28.62			31.8
Clay (effluent) =			21.0	17.5

Test Performed By: MLS/SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/23/2020
Project No.:	2018089	**Boring Location No.:**	NB-80
Lab Assignment No.:		**Offset/Depth:**	10'-15'

Soil Description: Reddish brown IIB4

Total Sample Weight = 14205 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	0		100
#10	815		94.3

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 49.19 g			Weight After Elutriation= 26.33 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	2.33			89.8
#60	4.31			86.0
#200	15.46			64.6
Clay (effluent) =			46.5	43.8

Test Performed By: MLS/SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/23/2020
Project No.:	2018089	**Boring Location No.:**	NB-80
Lab Assignment No.:		**Offset/Depth:**	20'-25'

Soil Description: Red IIB3

Total Sample Weight = 16410 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	0		100
#10	1440		91.2

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 48.48 g			Weight After Elutriation= 27.17 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	2.63			86.3
#60	4.76			82.3
#200	19.75			54.1
Clay (effluent) =			44.0	40.1

Test Performed By: MLS/SC

Gram Scale I.D. 15615026

Oven I.D. O-04

DOT 420

[redacted] PI# 0001757

NOVA Project Number 2018089

	MOISTURE DENSITY PROCTOR POINTS							
Boring No.	[redacted]	SB-18	SB-18	SB-18	[redacted]			
Depth		10-15	15-20	20-25				
Offset								
Dry Weight (Moisture Sample)								
% Natural Moisture		12.8%	11.1%	-				
Wt. of Mixture & Mold								
Wt. of Mold								
Wet Wt. of Mixture								
Wet Wt. per Cu. Ft.		119.1	118.8	123.1				
Dry Wt. per Cu. Ft.								
	SWELL							
A. Height of collar above base plate = .875	[redacted]	0.875	0.875	0.875	[redacted]			
B. Original dial reading		0.198	0.159	0.150				
C. Original height of specimen (A + B)								
D. Final dial reading →		0.375	0.400	0.333				
E. Final height of specimen (A + D)								
F. Change in thickness (E - C)								
G. % Swell; Direct from Table III using C & F		16.5	28.3	17.9				
	SHRINKAGE							
H. Height of collar above base plate (short legs) = .250	[redacted]	0.250	0.250	0.250	[redacted]			
I. Original dial reading on short legs		0.134	0.130	0.12				
J. Original thickness (H + I)								
K. Original volume in cu. Inches; Table I using J								
L. Height of collar above base plate (long legs) = 3.250		3.250	3.250	3.250				
M. Average of 4 dial readings for diameter of dry specimen		0.743	0.755	0.755				
N. Diameter of dry specimen (L + M)								
O. Area of dry specimen; From Table II using N								
P. Final dial reading on short legs →		0.126	0.124	0.117				
Q. Final thickness (H + P)								
R. Volume of dry specimen (O x Q)								
S. Change in volume (K - R)								
T. % Shrinkage 100 (S ÷ K)		2.4	1.3	0.6				
	RESULTS OF TESTS ON MINUS 10 MESH MATERIAL							
Maximum Density (pcf)	[redacted]	102.0	108.5	108.5	[redacted]			
Optimum Moisture (%)		15.6	13.5	13.5				
Percent Swell (%)		16.5	28.3	17.9				
Percent Shrinkage (%)		2.4	1.3	0.6				
Volume Change (%)		18.9	29.6	18.5				
	RESULTS OF TESTS CALCULATED FOR TOTAL SAMPLE							
Retained on No. 10 (%)	[redacted]	7.2	7.3	4.4	[redacted]			
Maximum Density (pcf)		104.4	111.0	109.2				
Volume change (%)		17.9	27.9	17.9				
Class		IIB4	IIIC1	IIB3				
Tested By		SC	SC	SC				

DOT 420

[redacted]- PI# 0001757

NOVA Project Number 2018089

	MOISTURE DENSITY PROCTOR POINTS		
Boring No.	[redacted]	SB-30	SB-30
Depth		10-15	15-20
Offset			
Dry Weight (Moisture Sample)			
% Natural Moisture		14.3%	19.0%
Wt. of Mixture & Mold			
Wt. of Mold			
Wet Wt. of Mixture			
Wet Wt. per Cu. Ft.		113.3	112.9
Dry Wt. per Cu. Ft.			
	SWELL		
A. Height of collar above base plate = .875		0.875	0.875
B. Original dial reading		0.167	0.152
C. Original height of specimen (A + B)			
D. Final dial reading →		0.187	0.222
E. Final height of specimen (A + D)			
F. Change in thickness (E - C)			
G. % Swell; Direct from Table III using C & F		1.9	6.8
	SHRINKAGE		
H. Height of collar above base plate (short legs) = .250		0.250	0.250
I. Original dial reading on short legs		0.127	0.141
J. Original thickness (H + I)			
K. Original volume in cu. Inches; Table I using J			
L. Height of collar above base plate (long legs) = 3.250		3.250	3.250
M. Average of 4 dial readings for diameter of dry specimen		0.683	0.694
N. Diameter of dry specimen (L + M)			
O. Area of dry specimen; From Table II using N			
P. Final dial reading on short legs →		0.121	0.114
Q. Final thickness (H + P)			
R. Volume of dry specimen (O x Q)			
S. Change in volume (K - R)			
T. % Shrinkage 100 (S ÷ K)		4.9	9.5
	RESULTS OF TESTS ON MINUS 10 MESH MATERIAL		
Maximum Density (pcf)		103.2	100.1
Optimum Moisture (%)		10.6	16.2
Percent Swell (%)		1.9	6.8
Percent Shrinkage (%)		4.9	9.5
Volume Change (%)		6.8	16.3
	RESULTS OF TESTS CALCULATED FOR TOTAL SAMPLE		
Retained on No. 10 (%)		13.7	8.7
Maximum Density (pcf)		107.8	103.3
Volume change (%)		6.0	15.2
Class		IIB4	IIB4
Tested By		MLS/SC	MLS/SC

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/28/2020
Project No.:	2018089	**Boring Location No.:**	SB-18
Lab Assignment No.:		**Offset/Depth:**	10'-15'

Soil Description: Light brown IIB4

Total Sample Weight = 16020 g			
Gradation of Plus No. 1SB18 (10-15)0			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	0		100
#10	1155		92.8

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 48.92 g			Weight After Elutriation= 26.19 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	5.25			82.8
#60	10.01			73.8
#200	24.05			47.2
Clay (effluent) =			46.5	43.1

Test Performed By: SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/28/2020
Project No.:	2018089	**Boring Location No.:**	SB-18
Lab Assignment No.:		**Offset/Depth:**	15'-20'

Soil Description: Grayish brown IIIC1

Total Sample Weight = 15475 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	20		99.9
#10	1135		92.7

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 49.15 g			Weight After Elutriation= 31.40 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	9.76			74.3
#60	17.53			59.6
#200	29.60			36.9
Clay (effluent) =			36.1	33.5

Test Performed By: SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/28/2020
Project No.:	2018089	**Boring Location No.:**	SB-18
Lab Assignment No.:		**Offset/Depth:**	20'-25'

Soil Description: Brown IIB3

Total Sample Weight = 15623 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	0		100
#10	687		95.6

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 49.20 g			Weight After Elutriation= 31.83 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	11.06			74.1
#60	17.12			62.3
#200	31.00			36.1
Clay (effluent) =			35.3	33.7

Test Performed By: SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/23/2020
Project No.:	2018089	**Boring Location No.:**	SB-30
Lab Assignment No.:		**Offset/Depth:**	10'-15'

Soil Description: Brown IIB4

Total Sample Weight = 15830 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	70		99.6
#10	2175		86.3

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 47.91 g			Weight After Elutriation= 24.52 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	7.40			72.9
#60	11.36			65.8
#200	20.24			49.8
Clay (effluent) =			48.8	42.1

Test Performed By: MLS/SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/23/2020
Project No.:	2018089	**Boring Location No.:**	SB-30
Lab Assignment No.:		**Offset/Depth:**	15'-20'

Soil Description: Brown IIB4

Total Sample Weight = 16705 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	0		100
#10	1445		91.3

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 46.45 g			Weight After Elutriation= 29.53 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	4.27			83.0
#60	8.14			75.3
#200	26.06			40.1
Clay (effluent) =			36.4	33.2

Test Performed By: MLS/SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/28/2020
Project No.:	2018089	**Boring Location No.:**	SB-85
Lab Assignment No.:		**Offset/Depth:**	10'-15'

Soil Description: Reddish brown IIB3

Total Sample Weight = 17680 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	115		99.3
#10	2740		84.5

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 49.08 g			Weight After Elutriation= 30.61 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	1.69			81.6
#60	4.35			77.0
#200	20.57			49.1
Clay (effluent) =			37.6	31.8

Test Performed By: MLS/SC

Gram Scale I.D. 15615026

Oven I.D. O-04

GDT-4
METHOD OF TEST FOR
DETERMINING GRADATION OF SOILS

Project Name:	[redacted]	**Date:**	01/28/2020
Project No.:	2018089	**Boring Location No.:**	SB-86
Lab Assignment No.:		**Offset/Depth:**	10'-15'

Soil Description: Red IIIC2

Total Sample Weight = 15090 g			
Gradation of Plus No. 10			
Sieve	Accumulative Weight Retained, g	Percent of Total Sample	
		Retained %	Passing %
1 ½"	0		100
¾"	95		99.4
#10	2075		86.2

Gradation of Minus No. 10				
Weight of 50.0-gram sample after drying = 49.49 g			Weight After Elutriation= 29.72 g	(Adjusted for Total Sample Percent Passing)
Sieve	Accumulative Weight Retained, g	Retained %	Passing %	
#40	5.05			77.4
#60	10.71			67.6
#200	22.45			47.1
Clay (effluent) =			39.9	34.4

Test Performed By: MLS/SC

Gram Scale I.D. 15615026

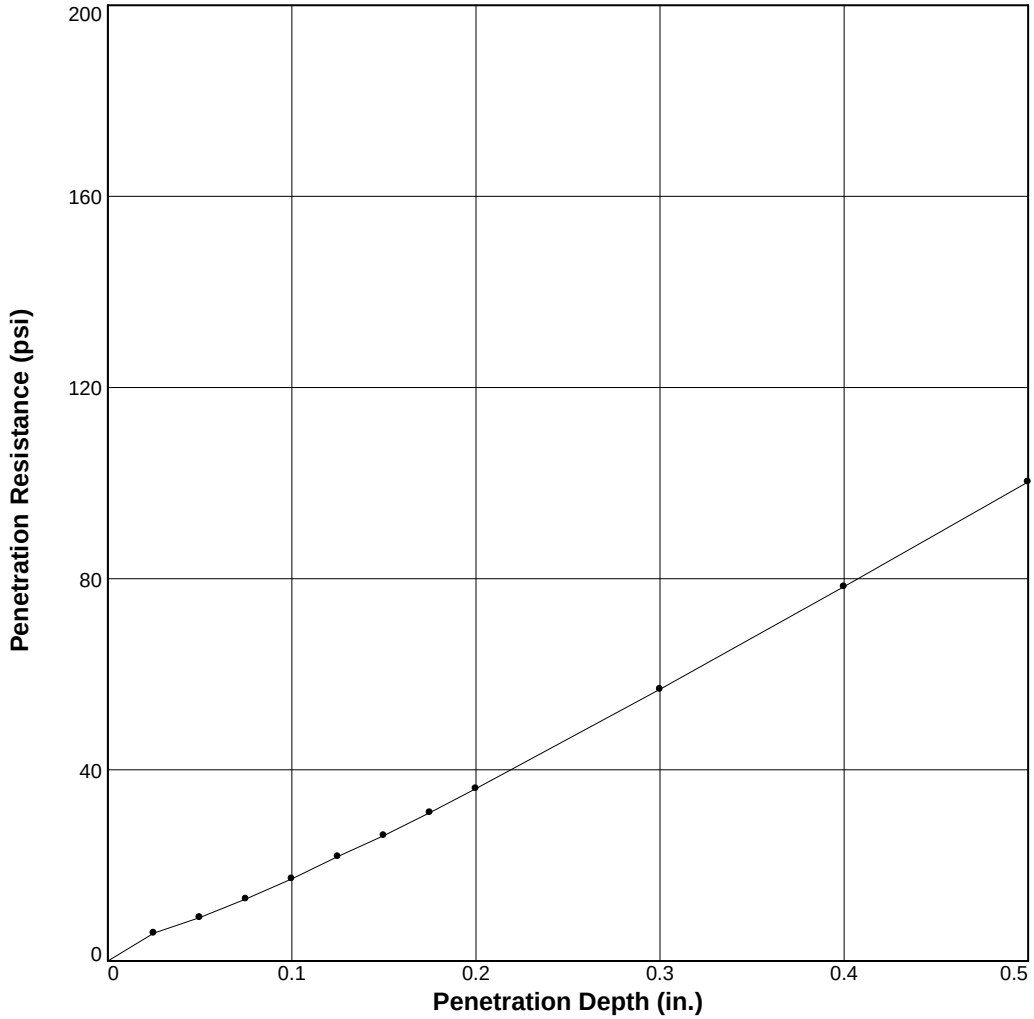
Oven I.D. O-04

California Bearing Ratio

Table C: Summary of Northbound CBR Laboratory Tests Results

BORING No.	SAMPLE DEPTH (ft)	CBR (%)		MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)
		0.10 inches	0.20 inches		
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
NB-19	25-30	1.7	2.4	108.0	13.6
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

BEARING RATIO TEST REPORT
ASTM D1883-16



	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	107.1	99.2	17.8	107.1	99.2	21.0	1.7	2.4	0.000	10	0
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Gray silty fine SAND		108.0	13.6		

Project No: 2018089

Project: [redacted]

Source of Sample: NB-19 @ 25-30 **Depth:** 25-30

Sample Number: NB-19

Date: 7/15/19

BEARING RATIO TEST REPORT
NOVA ENGINEERING
Kennesaw, Georgia

Test Description/Remarks:

Figure _____

SPT HAMMERS ENERGY CALIBRATIONS

TTL - 597 CME 45B (SN 307114)

Alabama Department of Transportation
BUREAU OF MATERIALS & TESTS
3700 Fairground Road Montgomery, Alabama 36110

Record of Standard Penetration Test Energy Calibration

For

TTL
597 – Central Mine Equipment 45B
Serial # 307114

Date of Calibration: August 3, 2018

Documentation:

Alabama Department of Transportation

BUREAU OF MATERIALS & TESTS

3700 Fairground Road Montgomery, Alabama 36110

Tuscaloosa

Tuscaloosa County, Alabama

TTL Office Test

Automatic Hammer Serial Number and Rig Model	Rig Owner	Rig Operator	Boring No. Tested	Date Tested	Drill Rod Size	Average Hammer Operation Rate (BPM)	Drill Rod Length (ft) (LE)	Sample Depth (feet)	SPT Blow Count (blows per six inches) (From Boring Log)	[a]No. of Blows Analyzed (From PDA-S)	[b]Average Measured Energy (Average EFV) (ft-lbs)	[c]Energy Transfer Ratio (%) (Average ETR)	ETR Standard Deviation (From PDA-S)
Serial No . 307114 CME 45B TTL 597	TTL	R.Bell	Test 2	8/3/2018	AW-J	56.8	8.63	3.5 - 5.0	4 - 5 - 6	11	316	90.3%	2.3
						55.6	12.63	7.0 - 8.5	6 - 9	10	317.6	90.7%	1.7
						55.7	14.63	12.0 - 13.5	7 - 9	11	309.5	88.4%	1.5
						55.4	18.63	13.5 - 15.0	7 - 8 - 3	13	302.8	86.5%	4
									[d]Average Measured Energy:		311.0	88.8%	

Overall Average ETR %

[a]Energy results for SPT sampling are averaged and reported for hammer impacts during the final 1 ft of driving, which relates to the observed N-value. In some cases, certain blows produce poor quality data and were not used to calculate the Average Measured Energy. This may result in less blows evalutated for ETR than what is shown on the boring logs.

[b]Measured Energy is based on the EFV method, as outlined in ASTM D4633-10, for each blow recorded by the SPT Analyzer.

[c]Energy Transfer Ratio is the Measured Energy divided by the theoretical SPT energy of 350 foot-pounds (140 pound hammer falling 2.5 feet).

The average EFV and ETR values may differ slightly and insignificantly from those in the PDIPLOT tables due to roundoff.

[d]The overall Average Measured Energy is calculated by taking the weighted average of the number of hammer blows analyzed (last 1 ft) and the Average Measured Energy for each sample depth tested.

[e]ETR COV determined by calculating the overall standard deviation for the average ETR per sample depth (c) and then dividing by the overall average ETR.

The STDEV function from Excel was utilized to determine the standard deviation.

Statistical Analysis - Overall Coefficient of Variation

Calibration Prepared By:	NRM	Date: 8/03/2018		[e]Energy Transfer Ratio (ETR) COV:	2.17	%

DCN: 01

Alabama Department of Transportation
BUREAU OF MATERIALS & TESTS
3700 Fairground Road Montgomery, Alabama 36110

RECORD OF SPT ENERGY MEASUREMENTS

Project Name:	TTL	Rig Make / Model:	CME45B
Location:	TTL office	Rig I.D.:	TTL 597
Date:	8-3-18	Hammer Serial No.:	307114
SPT Inspector:	N. Maxwell	Hammer Type:	Auto
Drilling Company:	TTL	Rod Size:	AWJ

Boring Identification:	Test 2 b2
Geologic Region:	Tuscaloosa
Time Tested:	8:30 AM.
Drill Rig Operator:	R. Bell
SPT Analyzer Serial Number:	4500 TB
Instrumented Rod Type / Area:	1.17 in^2
Accelerometer Serial Number:	A1: K5260 A2: K5259
Accelerometer Calibration Factor:	A1: 314.0 A2: 328.0
Strain Gage Serial Number:	A1: 453AWJ-1 A2: 453AWJ-2
Strain Gage Calibration Factors:	A1: 206.42 A2: 206.54

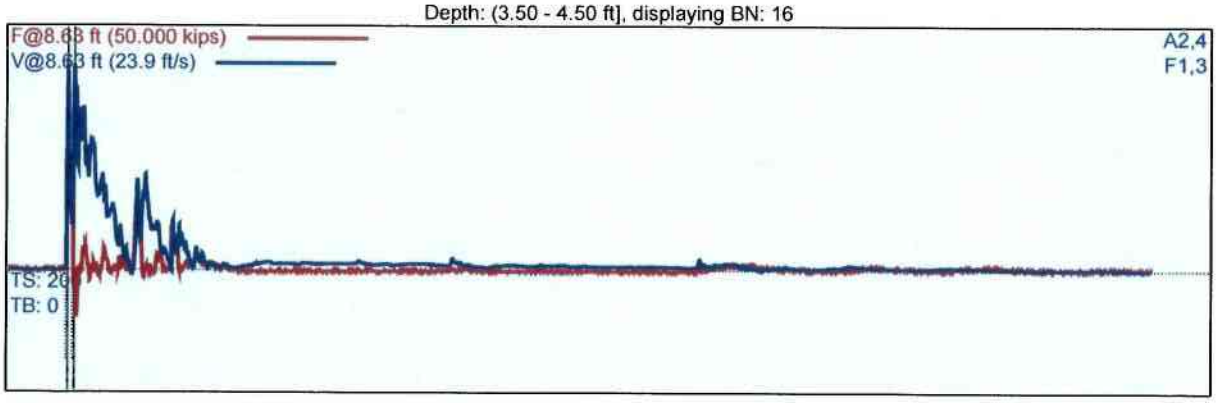
Analyzer File Name (Boring No. plus Sub designation)	Rod Length (FT)	Measured S.U. (FT)	Calculated Start Depth (FT)	Hammer Blow Counts (Provided By Others)	Increment	Misc. Comments
b2_1	2.83+0.8 3.63+5.0 6.63		3.5 (3.5 - 5.0)	4 5 6	6in 12in 18in	
b2_2	3.63+9 12.63		7.0 (7.0 - 8.0)	6 9	6in 12in 18in	To close To gauges
b2_3	3.63+10 13.63		8.5 (8.5 - 10.0)	8 6 11	6in 12in 18in	?
b2_4	3.63+9.0 12.63	14.0	12.0 (12.0 - 13.0)	7 9	6in 12in 18in	To close To gauges
b2_5	3.63+15.0 18.63		13.5 (13.5 - 15.0)	7 8 3	6in 12in 18in	
b2_6	3.63+20 23.63		18.5 (18.5 - 20.0)	Wah 1 2	6in 12in 18in	Omit

*Rod Length: Total From Gages to Tip of Sampler
*Measured S.U.: Measured Drill Rod Stick Up From Ground Surface To Location of Gages
Instrument Subassembly Length: 2ft
DCN:01

TTL45b 597
NM
AR: 1.17 in^2
LE: 8.63 ft
WS: 16807.9 ft/s

b2_1
Test date: 8/3/2018
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (3.50 - 4.50 ft], displaying BN: 16



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 (%)
8	5	25.840	20.1	56.6	310.9	88.8
9	5	25.904	19.5	57.1	321.8	91.9
10	5	25.689	19.9	56.5	312.1	89.2
11	5	25.533	19.7	57.0	310.6	88.8
12	5	26.595	19.9	56.7	336.9	96.3
13	6	25.734	19.8	57.0	312.1	89.2
14	6	26.216	19.8	56.7	322.8	92.2
15	6	25.581	19.7	56.8	318.3	90.9
16	6	25.709	19.9	57.3	310.1	88.6
17	6	25.381	19.5	56.4	310.5	88.7
18	6	25.936	20.2	56.6	309.9	88.5
	Average	25.829	19.8	56.8	316.0	90.3
	Std Dev	0.323	0.2	0.3	8.0	2.3
	Maximum	26.595	20.2	57.3	336.9	96.3
	Minimum	25.381	19.5	56.4	309.9	88.5

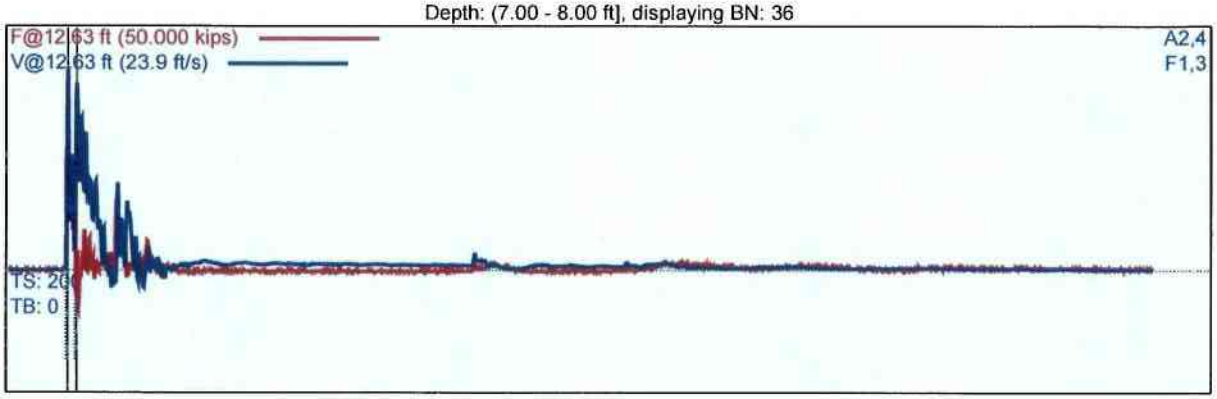
N-value: 11

Sample Interval Time: 10.56 seconds.

TTL45b 597
NM
AR: 1.17 in^2
LE: 12.63 ft
WS: 16807.9 ft/s

b2_1
Test date: 8/3/2018
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (7.00 - 8.00 ft], displaying BN: 36



BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
29	8	25.899	19.8	55.9	327.6	93.6
30	8	25.203	19.4	55.5	321.4	91.8
31	8	25.332	19.4	55.9	322.4	92.1
32	8	25.469	19.4	55.4	316.3	90.4
33	8	25.739	19.6	55.7	309.4	88.4
34	8	25.826	19.5	55.8	311.2	88.9
35	8	25.432	19.2	55.4	316.0	90.3
36	8	25.611	19.6	55.6	320.7	91.6
37	2	25.547	19.3	55.7	321.5	91.8
38	2	25.703	19.4	55.5	309.4	88.4
	Average	25.576	19.5	55.6	317.6	90.7
	Std Dev	0.210	0.2	0.2	5.8	1.7
	Maximum	25.899	19.8	55.9	327.6	93.6
	Minimum	25.203	19.2	55.4	309.4	88.4

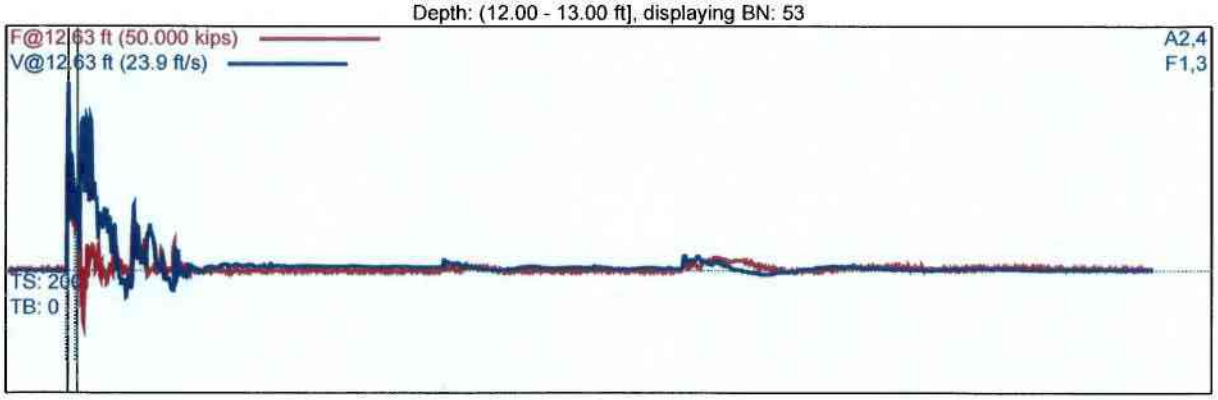
N-value: 10

Sample Interval Time: 9.66 seconds.

TTL45b 597
NM
AR: 1.17 in^2
LE: 12.63 ft
WS: 16807.9 ft/s

b2_1
Test date: 8/3/2018
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (12.00 - 13.00 ft], displaying BN: 53



BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
45	11	24.318	18.6	55.5	305.8	87.4
46	11	25.102	18.6	55.9	306.2	87.5
47	11	24.829	18.8	55.6	307.6	87.9
48	11	25.177	18.0	55.8	308.4	88.1
49	11	24.966	18.7	55.6	312.5	89.3
50	11	25.597	18.2	55.8	310.4	88.7
51	11	25.538	18.4	55.8	310.7	88.8
52	11	25.062	17.9	55.5	319.2	91.2
53	11	24.929	18.4	55.9	316.9	90.6
54	11	25.104	18.7	55.7	308.6	88.2
55	11	25.005	18.5	55.7	298.5	85.3
	Average	25.057	18.4	55.7	309.5	88.4
	Std Dev	0.326	0.3	0.1	5.3	1.5
	Maximum	25.597	18.8	55.9	319.2	91.2
	Minimum	24.318	17.9	55.5	298.5	85.3

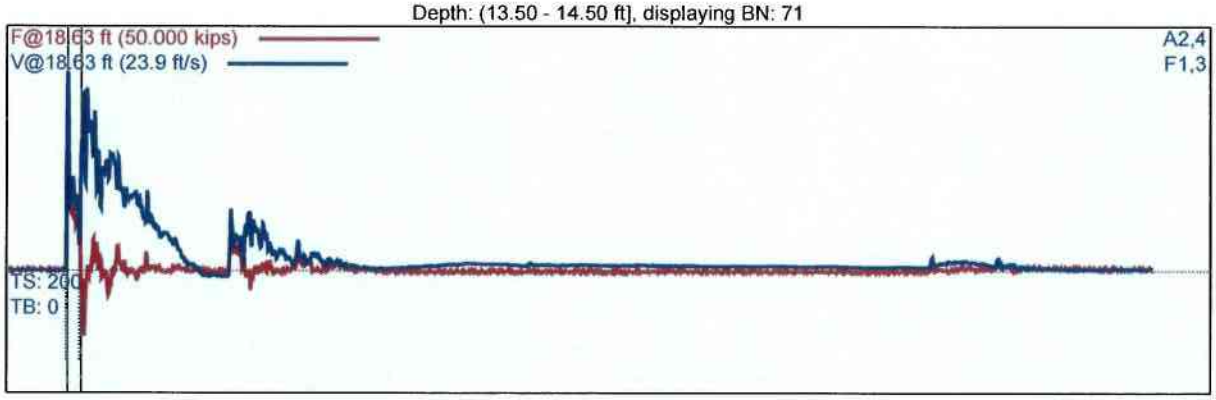
N-value: 11

Sample Interval Time: 10.76 seconds.

TTL45b 597
NM
AR: 1.17 in^2
LE: 18.63 ft
WS: 16807.9 ft/s

b2_1
Test date: 8/3/2018
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (13.50 - 14.50 ft], displaying BN: 71



BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
61	10	25.160	18.9	55.6	308.5	88.1
62	10	24.931	19.1	55.6	304.7	87.0
63	10	25.136	19.0	55.2	310.7	88.8
64	10	24.941	18.8	55.5	296.5	84.7
65	10	25.326	19.1	55.3	314.2	89.8
66	10	25.301	19.0	55.2	318.8	91.1
67	10	25.259	19.2	55.7	314.1	89.7
68	10	24.984	18.7	55.4	301.1	86.0
69	10	24.750	19.0	55.3	312.3	89.2
70	10	25.087	19.3	55.7	305.5	87.3
71	3	25.401	19.4	55.2	302.7	86.5
72	3	25.215	18.6	55.6	278.0	79.4
73	3	24.676	18.7	55.4	269.3	76.9
	Average	25.090	19.0	55.4	302.8	86.5
	Std Dev	0.214	0.2	0.2	13.8	4.0
	Maximum	25.401	19.4	55.7	318.8	91.1
	Minimum	24.676	18.6	55.2	269.3	76.9

N-value: 13

Sample Interval Time: 13.03 seconds.

Summary of SPT Test Results

Project: TTL45b 597, Test Date: 8/3/2018

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

Instr. Length ft	Blows Applied /6"	N Value	N60 Value	Average FMX kips	Average VMX ft/s	Average BPM bpm	Average EFV ft-lb	Average ETR (%)
8.63	**5-6**	**6**	**8**	25.829	19.8	56.8	316.0	90.3
12.63	**8-2**	**2**	**2**	25.576	19.5	55.6	317.6	90.7
12.63	**11-0**	**0**	**0**	25.057	18.4	55.7	309.5	88.4
18.63	**10-3**	**3**	**4**	25.090	19.0	55.4	302.8	86.5
		Overall Average Values:		25.371	19.2	55.9	311.0	88.8
		Standard Deviation:		0.427	0.6	0.6	11.0	3.1
		Overall Maximum Value:		26.595	20.2	57.3	336.9	96.3
		Overall Minimum Value:		24.318	17.9	55.2	269.3	76.9

TTL – 619 CME 45B (SN 317534)

Alabama Department of Transportation
BUREAU OF MATERIALS & TESTS
3700 Fairground Road Montgomery, Alabama 36110

Record of Standard Penetration Test Energy Calibration

For

TTL
619 – Central Mine Equipment 45B
Serial # 317534

Date of Calibration: August 3, 2018

Documentation:

Alabama Department of Transportation

BUREAU OF MATERIALS & TESTS
3700 Fairground Road Montgomery, Alabama 36110

Tuscaloosa
Tuscaloosa County, Alabama
TTL Office Test

Automatic Hammer Serial Number and Rig Model	Rig Owner	Rig Operator	Boring No. Tested	Date Tested	Drill Rod Size	Average Hammer Operation Rate (BPM)	Drill Rod Length (ft) (LE)	Sample Depth (feet)	SPT Blow Count (blows per six inches) (From Boring Log)	[a]No. of Blows Analyzed (From PDA-S)	[b]Average Measured Energy (Average EFV) (ft-lbs)	[c]Energy Transfer Ratio (%) (Average ETR)	ETR Standard Deviation (From PDA-S)
Serial No. 317534 CME 45B TTL 619	TTL	R.Bell	Test 3	8/3/2018	AW-J	50.5	8.63	3.5 - 5.0	4 - 8 - 15	22	296.4	84.7%	1.9
						47.2	13.63	7.0 - 8.5	7 - 9 - 10	17	284.1	81.2%	1.2
						50.7	13.63	8.5 - 10.0	8 - 4 - 5	8	288.6	82.5%	2.2
						47.3	18.63	12.0 - 13.5	11 - 10 - 6	20	295.1	84.3%	2.1
						50.8	18.63	13.5 - 15.0	12 - 14 - 9	23	293.5	83.9%	2
									[d]Average Measured Energy:		292.4	83.5%	

Overall Average ETR %

[a]Energy results for SPT sampling are averaged and reported for hammer impacts during the final 1 ft of driving, which relates to the observed N-value. In some cases, certain blows produce poor quality data and were not used to calculate the Average Measured Energy. This may result in less blows evalutated for ETR than what is shown on the boring logs.

[b]Measured Energy is based on the EFV method, as outlined in ASTM D4633-10, for each blow recorded by the SPT Analyzer.

[c]Energy Transfer Ratio is the Measured Energy divided by the theoretical SPT energy of 350 foot-pounds (140 pound hammer falling 2.5 feet).

The average EFV and ETR values may differ slightly and insignificantly from those in the PDIPLOT tables due to roundoff.

[d]The overall Average Measured Energy is calculated by taking the weighted average of the number of hammer blows analyzed (last 1 ft) and the Average Measured Energy for each sample depth tested.

[e]ETR COV determined by calculating the overall standard deviation for the average ETR per sample depth (c) and then dividing by the overall average ETR.

The STDEV function from Excel was utilized to determine the standard deviation.

Statistical Analysis - Overall Coefficient of Variation

Calibration Prepared By:	NRM	Date: 8/03/2018		[e]Energy Transfer Ratio (ETR) COV:	1.75	%

DCN: 01

Alabama Department of Transportation
BUREAU OF MATERIALS & TESTS
3700 Fairground Road Montgomery, Alabama 36110

RECORD OF SPT ENERGY MEASUREMENTS

Project Name:	TTL	Rig Make / Model:	CME 45B
Location:	TTL office	Rig I.D.:	TTL619
Date:	8-3-18	Hammer Serial No.:	317534
SPT Inspector:	N. Maxwell	Hammer Type:	AUTO
Drilling Company:	TTL	Rod Size:	AWJ

Boring Identification:	Test 3 b3	
Geologic Region:	Tuscaloosa	
Time Tested:	9:30	
Drill Rig Operator:	R. Bell	
SPT Analyzer Serial Number:	4500 TB	
Instrumented Rod Type / Area:	1.17 in^2	
Accelerometer Serial Number:	A1: K5260	A2: K5259
Accelerometer Calibration Factor:	A1: 314.0	A2: 328.0
Strain Gage Serial Number:	A1: 453AWJ-1	A2: 453AWJ-2
Strain Gage Calibration Factors:	A1: 206.42	A2: 206.54

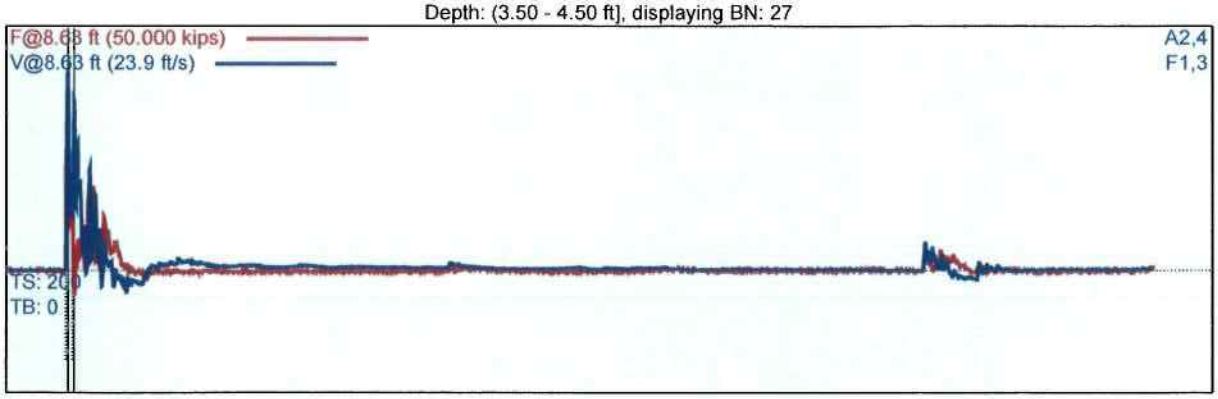
Analyzer File Name (Boring No. plus Sub designation)	Rod Length (FT)	Measured S.U. (FT)	Calculated Start Depth (FT)	Hammer Blow Counts (Provided By Others)	Increment	Misc. Comments
b3-1	2.83+0.8 3.63+5 8.63		3.5 (3.5-5.0)	4 8 15	6in 12in 18in	
b3-2	3.63+10.0 13.63		7.0 (7.0-8.5)	7 9 10	6in 12in 18in	
b3-3	3.63+10.0 13.63		8.5 (8.5-10.0)	8 4 5	6in 12in 18in	
b4-4	3.63+15.0 18.63		12.0 (12.0-13.5)	11 10 6	6in 12in 18in	
b5-5	3.63+15.0 18.63		13.5 (13.5-15.0)	12 14 9	6in 12in 18in	
			( )		6in 12in 18in	

*Rod Length: Total From Gages to Tip of Sampler
*Measured S.U.: Measured Drill Rod Stick Up From Ground Surface To Location of Gages
DCN:01

Instrument Subassembly Length: 2ft

TTL45b 619 — b 3_1
NM — Test date: 8/3/2018
AR: 1.17 in^2 — SP: 0.492 k/ft3
LE: 8.63 ft — EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (3.50 - 4.50 ft], displaying BN: 27



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 (%)
8	8	26.102	19.4	50.7	290.3	82.9
9	8	25.983	19.3	50.5	290.0	82.9
10	8	26.354	19.5	50.5	293.9	84.0
11	8	25.576	19.5	50.6	289.9	82.8
12	8	25.889	19.7	50.7	292.7	83.6
13	8	26.013	19.5	50.5	291.9	83.4
14	8	25.969	19.7	50.4	298.8	85.4
15	8	25.536	19.6	50.5	312.9	89.4
16	14	26.009	19.7	50.7	282.7	80.8
17	14	25.521	19.7	50.5	292.8	83.7
18	14	25.574	19.6	50.5	293.2	83.8
19	14	25.254	19.5	50.8	291.0	83.1
20	14	25.377	19.4	50.4	293.5	83.9
21	14	25.803	19.7	50.4	297.4	85.0
22	14	25.448	19.4	50.6	298.8	85.4
23	14	25.546	19.4	50.3	298.1	85.2
24	14	25.322	19.4	50.4	300.2	85.8
25	14	25.164	19.3	50.4	298.1	85.2
26	14	25.656	19.4	50.5	303.9	86.8
27	14	25.279	19.3	50.5	300.9	86.0
28	14	25.551	19.1	50.4	305.7	87.3
29	14	25.844	19.3	50.5	304.7	87.1
	Average	25.671	19.5	50.5	296.4	84.7
	Std Dev	0.309	0.2	0.1	6.5	1.9
	Maximum	26.354	19.7	50.8	312.9	89.4
	Minimum	25.164	19.1	50.3	282.7	80.8

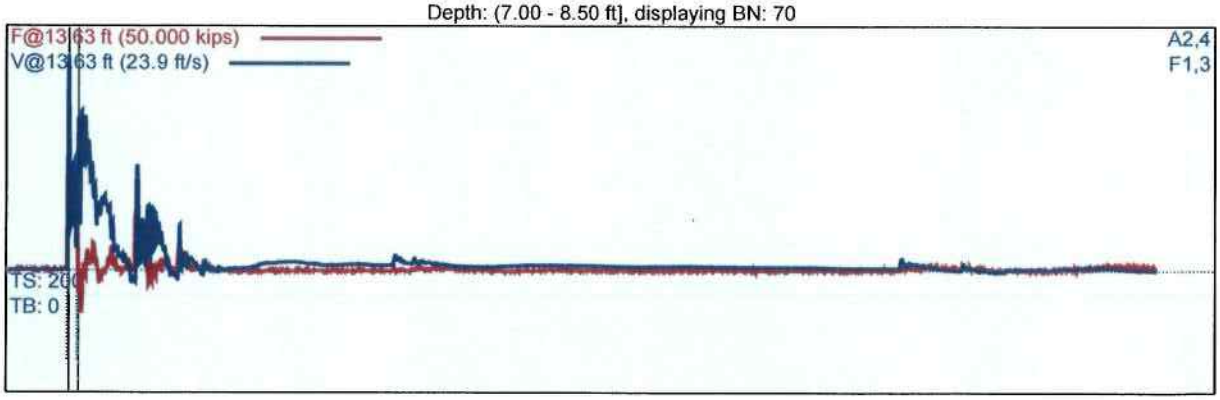
N-value: 22

Sample Interval Time: 24.91 seconds.

TTL45b 619
NM
AR: 1.17 in^2
LE: 13.63 ft
WS: 16807.9 ft/s

b 3_1
Test date: 8/3/2018
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (7.00 - 8.50 ft], displaying BN: 70



BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
42	11	24.613	19.8	50.4	287.6	82.2
43	11	24.891	19.1	50.4	286.4	81.8
44	11	24.882	19.3	50.7	279.8	80.0
45	11	24.789	19.6	50.5	280.8	80.2
46	11	24.907	19.5	50.4	280.3	80.1
47	11	25.736	19.7	50.6	290.8	83.1
48	11	24.997	19.0	50.5	281.5	80.4
49	11	24.966	19.5	50.4	278.6	79.6
50	11	25.908	19.3	50.5	291.3	83.2
51	11	24.658	19.3	50.4	276.8	79.1
52	11	24.308	17.8	50.6	287.3	82.1
53	8	25.566	19.6	50.4	289.0	82.6
54	8	24.431	18.5	50.4	287.1	82.0
55	8	24.914	19.0	50.4	287.2	82.1
56	8	25.197	19.4	50.5	281.4	80.4
57	8	24.247	17.9	50.5	288.6	82.5
58	8	24.722	19.2	50.6	283.2	80.9
59	8	24.757	18.4	50.4	283.4	81.0
60	8	24.885	18.7	50.4	282.1	80.6
61	9	24.772	18.8	50.5	280.6	80.2
65	9	20.581	22.2	41.1	277.6	79.3
66	9	23.006	21.2	4.0	287.0	82.0
67	9	23.268	21.3	50.5	290.8	83.1
68	9	22.990	21.0	50.8	277.2	79.2
69	9	23.001	21.0	50.6	284.6	81.3
70	9	23.476	20.9	50.5	287.5	82.1
71	9	23.376	20.8	50.8	285.4	81.5
72	9	23.421	21.1	50.7	276.9	79.1
	Average	23.918	19.9	47.2	284.1	81.2
	Std Dev	1.177	1.3	11.0	4.2	1.2
	Maximum	25.566	22.2	50.8	290.8	83.1
	Minimum	20.581	17.9	4.0	276.9	79.1

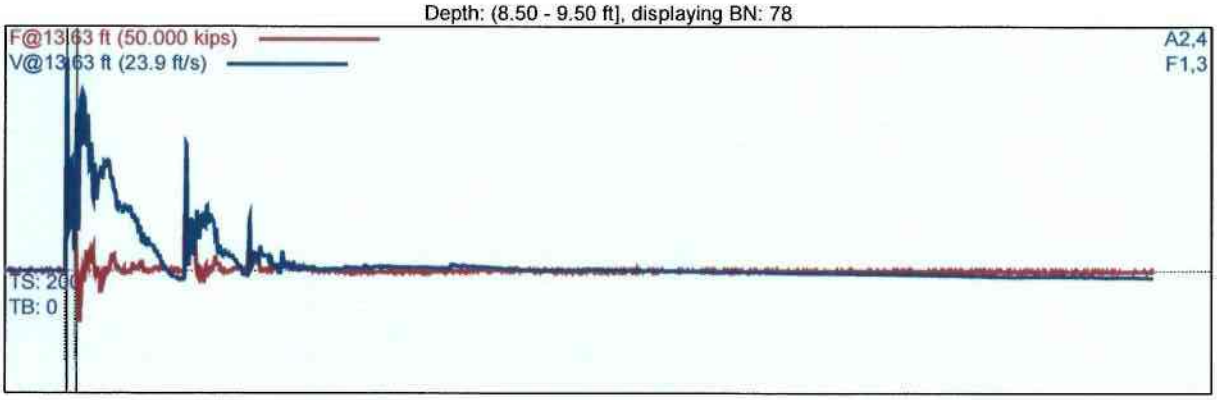
N-value: 17

Sample Interval Time: 279.16 seconds.

TTL45b 619
NM
AR: 1.17 in^2
LE: 13.63 ft
WS: 16807.9 ft/s

b 3_1
Test date: 8/3/2018
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (8.50 - 9.50 ft], displaying BN: 78



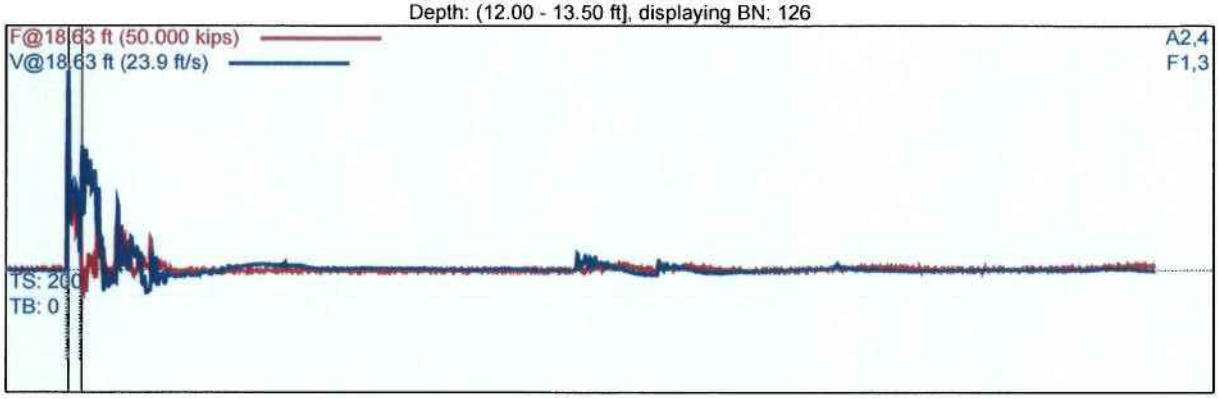
BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
73	5	23.428	20.9	50.7	295.2	84.3
74	5	23.641	20.9	50.7	290.9	83.1
75	5	23.406	20.9	50.6	288.6	82.5
76	5	23.335	20.7	50.6	295.4	84.4
77	5	23.544	21.1	50.9	280.3	80.1
78	3	23.540	20.8	50.4	281.2	80.3
79	3	23.480	20.8	51.1	277.9	79.4
80	3	23.356	21.0	50.5	299.7	85.6
	Average	23.466	20.9	50.7	288.6	82.5
	Std Dev	0.098	0.1	0.2	7.6	2.2
	Maximum	23.641	21.1	51.1	299.7	85.6
	Minimum	23.335	20.7	50.4	277.9	79.4

N-value: 8

Sample Interval Time: 8.28 seconds.

TTL45b 619 | b 3_1
NM | Test date: 8/3/2018
AR: 1.17 in^2 | SP: 0.492 k/ft3
LE: 18.63 ft | EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (12.00 - 13.50 ft], displaying BN: 126



BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
96	10	25.323	19.2	50.7	300.3	85.8
97	10	25.382	19.2	50.8	298.5	85.3
98	10	25.275	19.3	50.7	295.5	84.4
99	10	25.449	18.9	51.0	301.4	86.1
100	10	24.700	19.3	50.7	299.3	85.5
101	10	24.903	19.3	50.8	298.7	85.4
102	10	25.340	19.0	50.8	309.1	88.3
103	10	24.661	19.4	50.9	307.4	87.8
104	10	25.422	19.0	50.7	297.6	85.0
105	10	25.124	19.2	50.9	299.8	85.7
106	6	25.009	19.3	50.8	290.2	82.9
107	6	25.192	19.4	50.8	284.3	81.2
108	6	24.675	18.3	51.0	310.9	88.8
109	6	23.192	17.4	50.9	282.5	80.7
110	6	22.468	17.1	50.8	295.5	84.4
111	6	23.269	17.1	50.7	295.8	84.5
112	14	22.983	17.2	50.7	304.1	86.9
113	14	22.944	17.0	51.0	302.9	86.5
117	14	26.457	19.4	27.6	279.9	80.0
118	14	26.485	19.3	2.9	297.3	84.9
119	14	26.679	19.6	50.6	299.5	85.6
120	14	25.962	18.9	50.8	285.1	81.5
121	14	26.141	19.5	50.8	294.7	84.2
122	14	26.132	19.7	50.9	296.9	84.8
123	14	26.380	19.4	50.7	299.6	85.6
124	14	26.540	19.5	50.7	298.1	85.2
125	14	26.230	19.4	50.9	299.7	85.6
126	14	26.361	19.3	50.8	292.7	83.6
127	14	26.347	19.5	50.8	297.7	85.1
128	14	26.250	19.5	50.8	294.5	84.2
	Average	25.285	18.8	47.3	295.1	84.3
	Std Dev	1.435	1.0	11.4	7.5	2.1
	Maximum	26.679	19.7	51.0	310.9	88.8
	Minimum	22.468	17.0	2.9	279.9	80.0

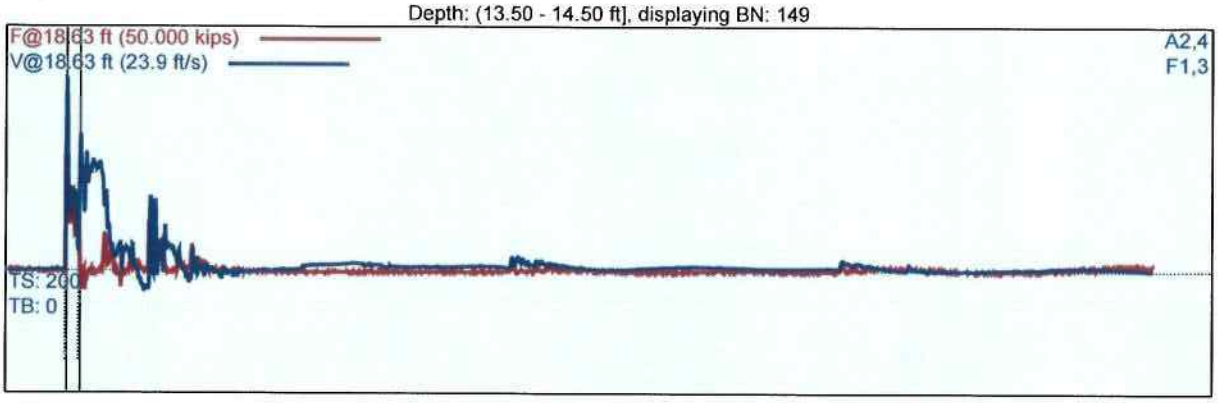
N-value: 20

Sample Interval Time: 255.19 seconds.

TTL45b 619
NM
AR: 1.17 in^2
LE: 18.63 ft
WS: 16807.9 ft/s

b 3_1
Test date: 8/3/2018
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (13.50 - 14.50 ft], displaying BN: 149



BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
129	14	26.306	19.6	50.7	293.3	83.8
130	14	26.326	19.3	50.7	297.3	85.0
131	14	26.028	17.6	50.8	305.9	87.4
132	14	26.243	18.0	50.9	308.2	88.0
133	14	26.241	19.0	50.7	297.5	85.0
134	14	26.265	17.9	50.9	301.1	86.0
135	14	26.016	19.2	50.7	295.1	84.3
136	14	26.120	17.6	50.9	303.4	86.7
137	14	26.086	19.2	50.7	297.6	85.0
138	14	25.911	18.9	50.9	286.2	81.8
139	14	25.764	18.6	50.9	286.1	81.7
140	14	26.048	19.0	50.6	288.2	82.3
141	14	25.713	18.4	50.8	282.7	80.8
142	14	25.680	18.9	50.7	279.2	79.8
143	9	25.859	18.8	50.8	288.4	82.4
144	9	25.728	18.5	50.7	291.6	83.3
145	9	25.860	18.4	50.7	289.4	82.7
146	9	25.779	18.3	50.8	288.7	82.5
147	9	25.956	18.5	50.5	292.5	83.6
148	9	26.031	18.6	51.1	297.3	84.9
149	9	26.078	18.8	50.4	298.9	85.4
150	9	25.960	18.8	51.1	290.9	83.1
151	9	26.047	18.7	50.6	292.1	83.5
	Average	26.002	18.6	50.8	293.5	83.9
	Std Dev	0.191	0.5	0.2	7.1	2.0
	Maximum	26.326	19.6	51.1	308.2	88.0
	Minimum	25.680	17.6	50.4	279.2	79.8

N-value: 23

Sample Interval Time: 25.99 seconds.

Summary of SPT Test Results

Project: TTL45b 619, Test Date: 8/3/2018

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

Instr. Length ft	Blows Applied /6"	N Value	N60 Value	Average FMX kips	Average VMX ft/s	Average BPM bpm	Average EFV ft-lb	Average ETR (%)
8.63	**8-14**	**14**	**19**	25.671	19.5	50.5	296.4	84.7
13.63	**11-8-9**	**17**	**23**	23.918	19.9	47.2	284.1	81.2
13.63	**5-3**	**3**	**4**	23.466	20.9	50.7	288.6	82.5
18.63	**10-6-14**	**20**	**27**	25.285	18.8	47.3	295.1	84.3
18.63	**14-9**	**9**	**12**	26.002	18.6	50.8	293.5	83.9
		Overall Average Values:		25.143	19.3	49.3	292.4	83.5
		Standard Deviation:		1.244	1.0	7.4	8.0	2.3
		Overall Maximum Value:		26.679	22.2	51.1	312.9	89.4
		Overall Minimum Value:		20.581	17.0	2.9	276.9	79.1

TTL- CME 550X (SN 371903)

Alabama Department of Transportation
BUREAU OF MATERIALS & TESTS
3700 Fairground Road Montgomery, Alabama 36110

Record of Standard Penetration Test Energy Calibration

For

TTL
Central Mine Equipment 550X
Serial # 371903

Date of Calibration: August 3, 2018

Documentation:

Alabama Department of Transportation

BUREAU OF MATERIALS & TESTS
3700 Fairground Road Montgomery, Alabama 36110

Tuscaloosa
Tuscaloosa County, Alabama
TTL Office Test

Automatic Hammer Serial Number and Rig Model	Rig Owner	Rig Operator	Boring No. Tested	Date Tested	Drill Rod Size	Average Hammer Operation Rate (BPM)	Drill Rod Length (ft) (LE)	Sample Depth (feet)	SPT Blow Count (blows per six inches) (From Boring Log)	[a]No. of Blows Analyzed (From PDA-S)	[b]Average Measured Energy (Average EFV) (ft-lbs)	[c]Energy Transfer Ratio (%) (Average ETR)	ETR Standard Deviation (From PDA-S)
Serial No. 371903 CME 550X	TTL	R.Bell	Test 1	8/3/2018	AW-J	55.9	8.63	3.5 - 5.0	7 - 5 - 5	11	307.7	87.9%	5.1
						55.6	13.63	8.5 - 10.0	8 - 12 - 13	25	327.3	93.5%	2.4
						55.5	18.63	13.5 - 15.0	6 - 7 - 7	15	331.3	94.7%	3.6
						55.4	23.63	18.5 - 20.0	3 - 1 - 2	3	296.1	84.6%	4.3
						55	28.63	23.5 - 25.0	1 - 2 - 2	3	311.5	89.0%	0.6
						55.1	30.63	28.5 - 30.0	2 - 3 - 4	7	322.9	92.3%	4.4
									[d]Average Measured Energy:		322.2	92.1%	

Overall Average ETR %

[a]Energy results for SPT sampling are averaged and reported for hammer impacts during the final 1 ft of driving, which relates to the observed N-value. In some cases, certain blows produce poor quality data and were not used to calculate the Average Measured Energy. This may result in less blows evalutated for ETR than what is shown on the boring logs.

[b]Measured Energy is based on the EFV method, as outlined in ASTM D4633-10, for each blow recorded by the SPT Analyzer.

[c]Energy Transfer Ratio is the Measured Energy divided by the theoretical SPT energy of 350 foot-pounds (140 pound hammer falling 2.5 feet).

The average EFV and ETR values may differ slightly and insignificantly from those in the PDIPLOT tables due to roundoff.

[d]The overall Average Measured Energy is calculated by taking the weighted average of the number of hammer blows analyzed (last 1 ft) and the Average Measured Energy for each sample depth tested.

[e]ETR COV determined by calculating the overall standard deviation for the average ETR per sample depth (c) and then dividing by the overall average ETR.

The STDEV function from Excel was utilized to determine the standard deviation.

Statistical Analysis - Overall Coefficient of Variation

Calibration Prepared By:	NRM	Date: 8/03/2018		[e]Energy Transfer Ratio (ETR) COV:	4.15	%

DCN: 01

Alabama Department of Transportation
BUREAU OF MATERIALS & TESTS
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RECORD OF SPT ENERGY MEASUREMENTS

Project Name:	TTL	Rig Make / Model:	CME550X
Location:	TTL office	Rig I.D.:	
Date:	8-3-18	Hammer Serial No.:	371903
SPT Inspector:	N. Maxwell	Hammer Type:	Auto
Drilling Company:	TTL	Rod Size:	AWJ

Boring Identification:	Test 1 b1
Geologic Region:	Tuscaloosa
Time Tested:	7:30 AM.
Drill Rig Operator:	R. Bell
SPT Analyzer Serial Number:	4500 TB
Instrumented Rod Type / Area:	1.17 in²
Accelerometer Serial Number:	A1: K5260 A2: K5259
Accelerometer Calibration Factor:	A1: 314.0 A2: 328.0
Strain Gage Serial Number:	A1: 453AWJ-1 A2: 453AWJ-2
Strain Gage Calibration Factors:	A1: 206.42 A2: 206.54

Analyzer File Name (Boring No. plus Sub designation)	Rod Length (FT) 34"	Measured S.U. (FT)	Calculated Start Depth (FT)	Hammer Blow Counts (Provided By Others)	Increment	Misc. Comments
b1_1	2.83+0.8 3.63+2 5.63		0.0' (0.0'-1.5')	3 1 2	6in 12in 18in	? omit
b1_2	3.63+5 8.63		3.5 (3.5-5.0)	7 5 5	6in 12in 18in	
b1_3	3.63+10 13.63		8.5 (8.5-10.0)	8 12 13	6in 12in 18in	
b1_4	3.63+15 18.63	14.5	13.5 (13.5-15.0)	6 7 7	6in 12in 18in	
b1_5	20.0+3.63 23.63	19.5	18.5 (18.5-20.0)	3 1 2	6in 12in 18in	
b1_6	25.0+3.63 28.63		23.5 (23.5-25.0)	1 2 2	6in 12in 18in	

*Rod Length: Total From Gages to Tip of Sampler
*Measured S.U.: Measured Drill Rod Stick Up From Ground Surface To Location of Gages

Instrument Subassembly Length: 2ft

DCN:01

Alabama Department of Transportation
BUREAU OF MATERIALS & TESTS
3700 Fairground Road Montgomery, Alabama 36110

RECORD OF SPT ENERGY MEASUREMENTS

Project Name:	TTL	Rig Make / Model:	CME550x
Location:	TTL office	Rig I.D.:	
Date:	8-3-18	Hammer Serial No.:	371903
SPT Inspector:	N. Maxwell	Hammer Type:	Auto
Drilling Company:	TTL	Rod Size:	AWJ

Boring Identification:	Test 1	b1
Geologic Region:	Tuscaloosa	
Time Tested:	R. Bell	
Drill Rig Operator:		
SPT Analyzer Serial Number:	4500 TB	
Instrumented Rod Type / Area:	1.17	
Accelerometer Serial Number:	A1: K5260	A2: K5259
Accelerometer Calibration Factor:	A1: 314.0	A2: 328.0
Strain Gage Serial Number:	A1: 453AWJ-1	A2: 453AWJ-2
Strain Gage Calibration Factors:	A1: 206.42	A2: 206.54

Analyzer File Name (Boring No. plus Sub designation)	Rod Length (FT)	Measured S.U. (FT)	Calculated Start Depth (FT)	Hammer Blow Counts (Provided By Others)	Increment	Misc. Comments
b1-X-8	3.63+30.0		28.5	2	6in	-Z do 64
	33.63-3 30.63		(28.5-39.0)	3	12in	
				4	18in	
					6in	
					12in	
			( )		18in	
					6in	
					12in	
			( )		18in	
					6in	
					12in	
			( )		18in	
					6in	
					12in	
			( )		18in	
					6in	
					12in	
			( )		18in	

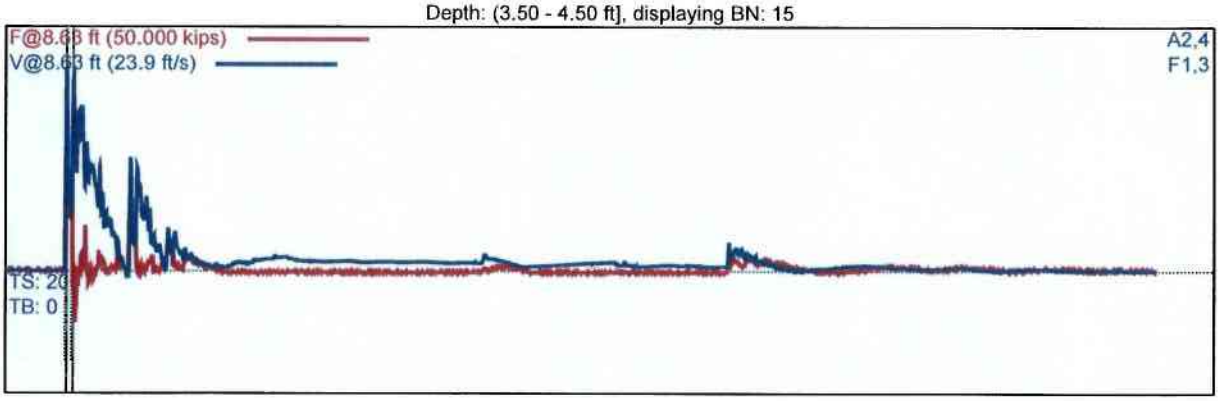
*Rod Length: Total From Gages to Tip of Sampler
*Measured S.U.: Measured Drill Rod Stick Up From Ground Surface To Location of Gages

Instrument Subassembly Length: ___2ft___

DCN:01

ttlcme550 b1_2
NM Test date: 8/3/2018
AR: 1.17 in^2 SP: 0.492 k/ft3
LE: 8.63 ft EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (3.50 - 4.50 ft], displaying BN: 15



FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute

EFV: Maximum Energy
ETR: Energy Transfer Ratio - Rated

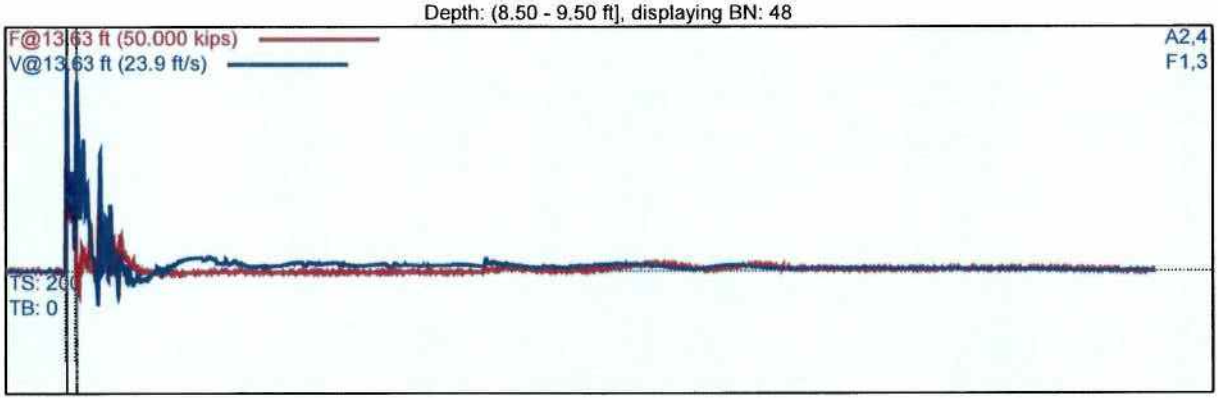
BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
7	5	23.023	19.4	56.5	283.8	81.1
8	5	23.660	19.4	55.7	314.3	89.8
9	5	23.341	19.6	55.9	292.5	83.6
10	5	23.361	19.5	55.6	294.1	84.0
11	5	23.629	19.9	55.8	339.8	97.1
12	6	23.271	19.8	55.9	295.3	84.4
13	6	23.612	20.0	55.7	299.3	85.5
14	6	22.950	19.3	55.5	295.4	84.4
15	6	24.121	19.9	56.8	310.2	88.6
16	6	24.752	20.4	55.0	325.8	93.1
17	6	24.159	20.0	56.1	334.2	95.5
	Average	23.625	19.7	55.9	307.7	87.9
	Std Dev	0.513	0.3	0.5	17.8	5.1
	Maximum	24.752	20.4	56.8	339.8	97.1
	Minimum	22.950	19.3	55.0	283.8	81.1

N-value: 11

Sample Interval Time: 10.81 seconds.

ttlcme550 b1_2
NM Test date: 8/3/2018
AR: 1.17 in^2 SP: 0.492 k/ft3
LE: 13.63 ft EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (8.50 - 9.50 ft], displaying BN: 48



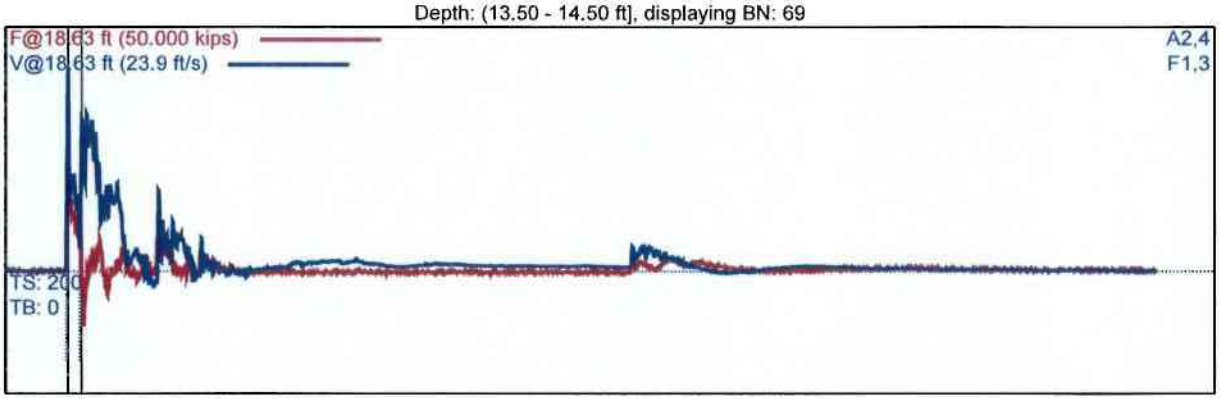
BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
26	12	24.722	19.4	56.4	336.6	96.2
27	12	25.638	20.4	55.6	319.9	91.4
28	12	24.899	20.1	56.1	328.2	93.8
29	12	25.470	20.1	55.1	328.6	93.9
30	12	25.457	20.3	55.8	340.9	97.4
31	12	25.024	20.1	55.6	333.4	95.3
32	12	24.366	19.6	55.7	320.7	91.6
33	12	25.468	20.1	55.9	325.0	92.9
34	12	26.229	20.5	55.8	335.3	95.8
35	12	25.125	20.2	55.6	325.6	93.0
36	12	25.180	19.9	54.9	331.0	94.6
37	12	24.456	19.9	55.9	316.7	90.5
38	13	25.055	20.3	55.8	337.8	96.5
39	13	24.979	20.0	55.4	346.1	98.9
40	13	24.337	19.6	55.4	315.9	90.3
41	13	24.950	20.0	55.1	326.1	93.2
42	13	24.609	19.9	55.0	329.0	94.0
43	13	25.185	20.3	55.6	327.8	93.7
44	13	24.678	19.8	55.7	324.8	92.8
45	13	24.743	19.5	55.7	320.9	91.7
46	13	24.835	19.8	56.2	337.1	96.3
47	13	24.511	19.8	55.1	325.6	93.0
48	13	24.289	19.7	55.4	316.9	90.6
49	13	24.473	20.0	55.5	323.4	92.4
50	13	23.809	19.2	55.0	309.5	88.4
	Average	24.899	19.9	55.6	327.3	93.5
	Std Dev	0.507	0.3	0.4	8.5	2.4
	Maximum	26.229	20.5	56.4	346.1	98.9
	Minimum	23.809	19.2	54.9	309.5	88.4

N-value: 25

Sample Interval Time: 25.94 seconds.

ttlcme550 b1_2
NM Test date: 8/3/2018
AR: 1.17 in^2 SP: 0.492 k/ft3
LE: 18.63 ft EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (13.50 - 14.50 ft], displaying BN: 69



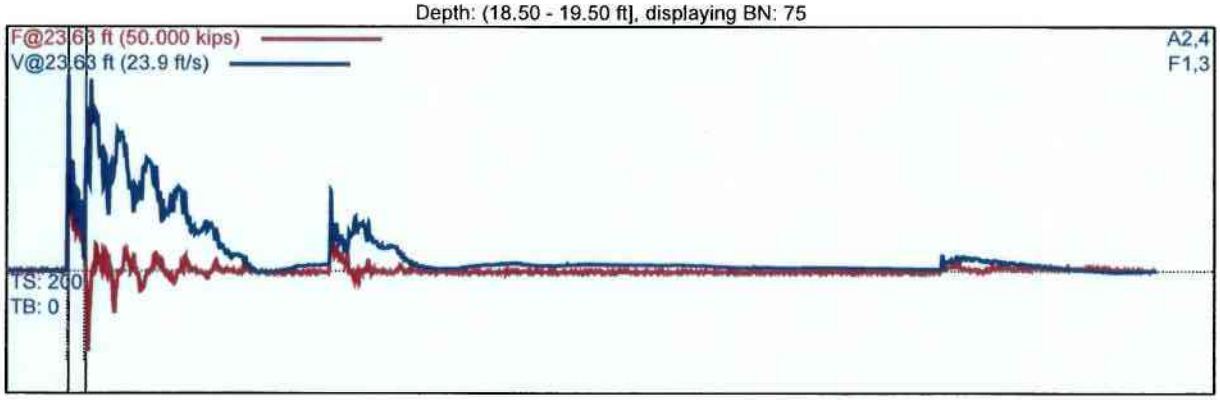
BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
57	7	23.944	19.2	56.8	312.1	89.2
58	7	23.941	19.4	54.7	320.9	91.7
59	7	24.964	19.9	56.2	336.6	96.2
60	7	25.144	20.1	54.9	340.8	97.4
61	7	23.913	18.9	55.5	312.8	89.4
62	7	24.604	19.3	55.7	328.5	93.9
63	7	24.140	19.5	55.2	325.3	92.9
64	8	23.990	19.2	55.5	319.8	91.4
65	8	24.050	19.0	55.2	317.1	90.6
66	8	24.341	19.6	55.5	332.0	94.9
67	8	24.290	19.5	55.1	337.7	96.5
68	8	24.529	19.8	55.2	349.2	99.8
69	8	25.081	19.9	55.7	349.7	99.9
70	8	24.676	19.8	54.8	338.6	96.7
71	8	24.793	19.8	56.4	348.5	99.6
	Average	24.427	19.5	55.5	331.3	94.7
	Std Dev	0.420	0.4	0.6	12.6	3.6
	Maximum	25.144	20.1	56.8	349.7	99.9
	Minimum	23.913	18.9	54.7	312.1	89.2

N-value: 15

Sample Interval Time: 15.16 seconds.

ttlcme550 b1_2
NM Test date: 8/3/2018
AR: 1.17 in^2 SP: 0.492 k/ft3
LE: 23.63 ft EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (18.50 - 19.50 ft], displaying BN: 75



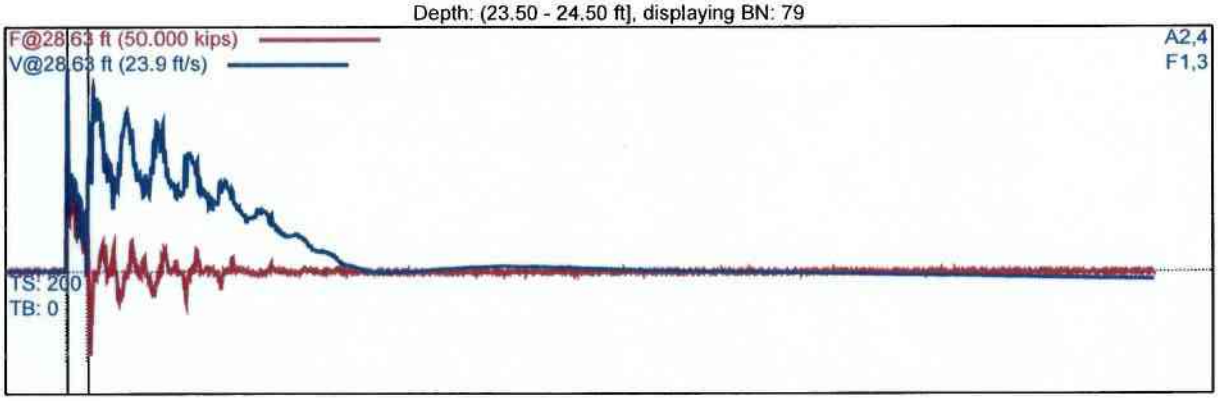
BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
75	2	23.623	19.2	55.5	285.1	81.4
76	2	24.580	19.9	54.6	317.2	90.6
77	1	23.335	19.5	56.0	286.0	81.7
	Average	23.846	19.5	55.4	296.1	84.6
	Std Dev	0.532	0.3	0.6	14.9	4.3
	Maximum	24.580	19.9	56.0	317.2	90.6
	Minimum	23.335	19.2	54.6	285.1	81.4

N-value: 3

Sample Interval Time: 2.17 seconds.

ttlcme550 b1_2
NM Test date: 8/3/2018
AR: 1.17 in^2 SP: 0.492 k/ft3
LE: 28.63 ft EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (23.50 - 24.50 ft], displaying BN: 79



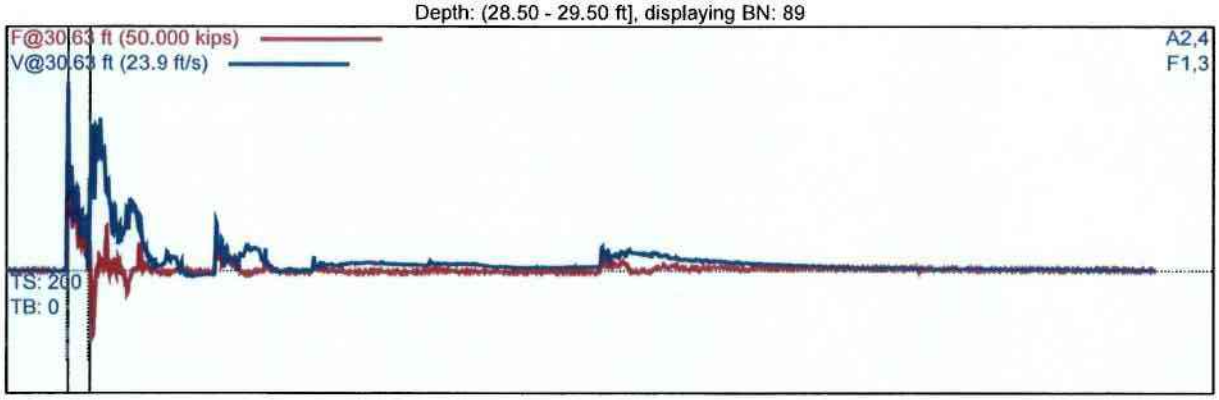
BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
79	3	25.413	19.9	54.4	312.2	89.2
80	3	25.273	19.8	55.0	308.5	88.1
81	3	25.345	20.2	55.6	313.7	89.6
	Average	25.344	20.0	55.0	311.5	89.0
	Std Dev	0.057	0.2	0.5	2.2	0.6
	Maximum	25.413	20.2	55.6	313.7	89.6
	Minimum	25.273	19.8	54.4	308.5	88.1

N-value: 3

Sample Interval Time: 2.18 seconds.

ttlcme550 b1_2
NM Test date: 8/3/2018
AR: 1.17 in^2 SP: 0.492 k/ft3
LE: 30.63 ft EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (28.50 - 29.50 ft], displaying BN: 89



BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)
85	1	26.671	17.9	55.2	301.6	86.2
86	6	26.563	18.1	55.1	304.3	86.9
87	6	26.257	17.8	55.0	310.5	88.7
88	6	27.009	18.3	55.3	341.1	97.5
89	6	26.490	18.5	54.7	337.5	96.4
90	6	26.482	18.3	55.5	331.5	94.7
91	6	26.666	18.7	55.0	333.6	95.3
	Average	26.591	18.2	55.1	322.9	92.3
	Std Dev	0.214	0.3	0.2	15.5	4.4
	Maximum	27.009	18.7	55.5	341.1	97.5
	Minimum	26.257	17.8	54.7	301.6	86.2

N-value: 7

Sample Interval Time: 6.52 seconds.

Summary of SPT Test Results

Project: ttlcme550, Test Date: 8/3/2018

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

Instr. Length ft	Blows Applied /6"	N Value	N60 Value	Average FMX kips	Average VMX ft/s	Average BPM bpm	Average EFV ft-lb	Average ETR (%)
8.63	**5-6**	**6**	**9**	23.625	19.7	55.9	307.7	87.9
13.63	**12-13**	**13**	**19**	24.899	19.9	55.6	327.3	93.5
18.63	**7-8**	**8**	**12**	24.427	19.5	55.5	331.3	94.7
23.63	**2-1**	**1**	**1**	23.846	19.5	55.4	296.1	84.6
28.63	**0-3**	**3**	**4**	25.344	20.0	55.0	311.5	89.0
30.63	**1-6**	**6**	**9**	26.591	18.2	55.1	322.9	92.3
		Overall Average Values:		24.726	19.6	55.5	322.2	92.1
		Standard Deviation:		0.939	0.6	0.5	16.1	4.6
		Overall Maximum Value:		27.009	20.5	56.8	349.7	99.9
		Overall Minimum Value:		22.950	17.8	54.4	283.8	81.1

IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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