May 23, 2022

ADDENDUM 2 OF 2
Invitation to Bid: Akins Blvd. Extension
June 02, 2022 @ 3:00 PM EST
City of Statesboro Central Services Purchasing Office
22 West Grady Street, Statesboro, GA 30458

Addendum 2 of 2

1) The due date has been extended to **June 01, 2022 at 3:00 PM EST**.

2) The City of Statesboro MFBE minimum of 20% stated in Addendum 1 **IS NOT APPLICABLE.**

3) The **GDOT DBE Goal will be 10% for this project per GDOT guidelines/requirements**. The attached City MFBE Grid and Affidavit forms shall be completed and submitted with the bid. Proof shall be provided with each pay request and/or as requested by the City of Statesboro.

4) Addendum 2 of 2 letter:

5) It shall be the sole responsibility of any/all vendors to check the City of Statesboro website for future issued addenda.

This documentation must be included in your submitted sealed bid for the bid to be considered.

Receipt of Addendum 2 of 2 Acknowledged: Signature: _____

MAXWELL-REDDICK
AND ASSOCIATES

May 23, 2022

RE: **Addendum No. 2**
Akins Boulevard Extension
Georgia Southern University, Statesboro, GA

To All Plan Holders:
The following items clarify, add to, delete from and/ or otherwise change and supersede the information previously issued as Bid Documents for the above referenced project, and shall be acknowledged as **Addendum No. 2** in your bid submittal.

GENERAL CLARIFICATIONS:

1. **Low Bidder Determination:** is addressed in Section 8 of the bid documents.
2. **Allotted Time:** is listed in the bid documents.

WRITTEN CONTRACTOR QUESTIONS & ENGINEER'S RESPONSE:

1. **Question:** Can we get a CAD file for this project? There are some scaling issues on the plans sheets. If not CAD files can you provide cross sections to ensure we have accurate take-off data. The grading is being bid LS and we need as complete as possible take off information.

   Response: A CAD file will only be made available to the successful low bidder. Cross-sections will not be provided. Contractors are responsible for determining earthwork quantities.

2. **Question:** GDOT has approved the use of precast culverts on several of our projects. Can we use precast culverts on the double 10 x 5 shown in the plans.

   Response: The City is not opposed to the use of precast double 10x5 box culverts as long as they meet GDOT specifications; however, the Bid Schedule contains line items (33-35) for cast-in-place construction. Bidders shall complete the Bid Schedule as issued and will be allowed to use precast culverts as long as the precast option does not exceed the total cost for summing line items 33-35

in the Bid Schedule. In summary, no additional payment will be made to the Contractor for using precast culverts in lieu of cast-in-place.

3. **Question:** Plans refer to Geotech reports to determine removal of material in the noted wetland areas. Can you please supply this information.

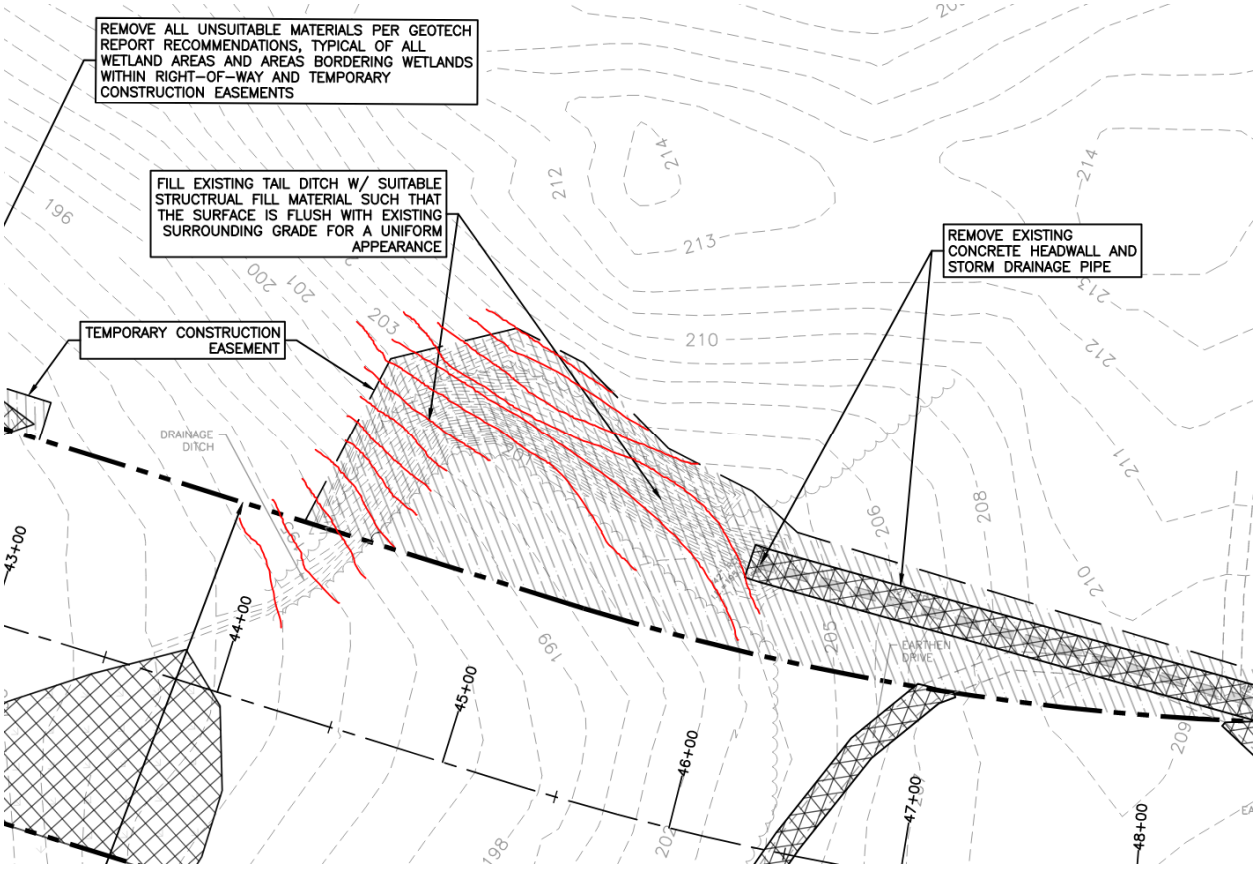
   Response: The Geotech report is included in this addendum.

4. **Question:** Can these *(fees listed in the tables on plan sheet C1.1)* be placed in an allowance item and included in the bid proposal information. This would limit any confusion that could occur.

   Response: All fees listed in the tables on plan sheet C1.1 shall be paid by the Contractor (included in the bid schedule pay item as noted) except for the Excelsior EMC fees which have already been paid by Georgia Southern University. Additionally, monthly electrical and water utility usage fees shall be paid by the Contractor until final acceptance by the Owner. The Contractor will be responsible for setting up accounts with Excelsior EMC and the City of Statesboro. These monthly utility usage fees shall be included in the bid schedule pay item 70 “Landscaping with Irrigation”.

5. **Question:** Can you define the final elevation you are looking for the tailditch on page C2.2 to be filled to?

   Response: As noted on plan sheet C2.2: “Fill existing tail ditch w/ suitable structural fill material such that the surface is flush with existing surrounding grade for a uniform appearance”. The top of the filled tail ditch just needs to conform to the surrounding grade so that a surface depression or hump is not visible; generally connect the existing contours on either side of the tail ditch like the screenshot image below.



6. **Question:** Details on pages C3.0 and C9.0 show GAB stopping at the front of curb and gutter but a detail on page C9.3 shows GAB extending outside the curb and gutter. Please define the limits of GAB.

   Response: Details on plan sheets C3.0 and C9.0 control *(i.e. GAB is not required beneath the curb and gutter)*.

7. **Question:** Can you please check your quantities on Drop Inlets GP 1 and 2 along with your additional depth on sanitary manholes. We are coming up with a much lower quantity on the class 2 depth.

   Response: The quantities listed on the bid schedule have been checked. There are no changes to the quantities.

8. **Question:** Can you check your qty of mulch. It appears to be about 5 times the amount necessary for this project.

   Response: The quantities listed on the bid schedule have been checked. There are no changes to the quantities.

9. **Question:** I've checked the city website all week for addendum 2 and have not seen it. Please extend the question deadline until after the release of addendum 2.

   Response: The question deadline will not be extended.

Bidders shall make sure to acknowledge this addendum and any other addenda on the Bid Proposal Forms. Any errors, ambiguities or omissions of merit should be reported in writing to the attention of the undersigned.

Respectfully Submitted,

Jared Mock, P.E.
Maxwell-Reddick and Associates

Enclosures: -City of Statesboro MFBE Grid & Affidavit
-Geotech Report

City of Statesboro Minority/ Female Business Enterprise Program
MFBE Participation Report

Name of Bidder: _____

Name of Project: _____

MFBE Firm	Type of Work	Contact Person	City, State	%	MBE or FBE

MBE Total _____% FBE Total_____% MFBE Combined_____%

The undersigned should enter into a formal agreement with MFBE Contractor identified herein for work listed in this schedule conditioned upon execution of contract with the City of Statesboro

_____ _____

Signature Print

Minority and Female Business Enterprise Affidavit

City of Statesboro
50 E. Main Street
Statesboro, GA 3058
912-764-5468

Section 1: Business ID

I am a MFBE _____YES _____NO

TAX ID NUMBER _____

DBE /MFBE CERTIFICATION NUMBER _____

Section 2: Business Information

BUSINESS NAME:

DBA /MFBE NAME:

COMPANY TYPE:

COMPANY ETHNICITY:

COMPANY GENDER:

Section 3: Business Contact Information

MAIN COMPANY EMAIL:

MAIN PHONE: MAIN FAX: COMPANY WEBSITE:

COMPANY ADDRESS:

CITY: STATE/PROVINCE: COUNTRY:

Section 4: Company Contact Person

NAME:

TITLE:

EMAIL:

PHONE NUMBER: FAX NUMBER:

*Please sign, date, and return the completed form

Disclaimer and Signature

I certify that my answers are true and complete to the best of my knowledge.

Signature: _____ Date: _____

Geotechnical Engineering Report

GSU South Campus Roadway Extension
Statesboro, Bulloch County, Georgia
March 11, 2021
Terracon Project No. ES205298

Prepared for:
Maxwell-Reddick and Associates
Statesboro, Georgia

Prepared by:
Terracon Consultants, Inc.
Savannah, Georgia

March 11, 2021

Maxwell-Reddick and Associates
40 Joe Kennedy Blvd.
Statesboro, Georgia 30458

Attn: Mr. Jared Mock – P.E.
P: (912) 489 7112
E: jmock@maxred.com

Re: Geotechnical Engineering Report
GSU South Campus Roadway Extension
Statesboro, Bulloch County, Georgia
Terracon Project No. ES205298

Dear Mr. Mock:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PES205298 dated November17, 2020. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning recommended pavement options and design parameters for the proposed project.

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

Sincerely,
Terracon Consultants, Inc.

Daniel Laitano, M.S., E.I.T.
Staff Geotechnical Engineer

Guoming Lin, Ph.D., P.E., D.GE
Senior Consultant

REPORT TOPICS

REPORT COVER PAGE 1
REPORT COVER LETTER TO SIGN 1
REPORT TOPICS 1
REPORT SUMMARY I
INTRODUCTION 1
SITE CONDITIONS 1
PROJECT DESCRIPTION 2
GEOTECHNICAL CHARACTERIZATION 2
RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION 4
EARTHWORK 5
PAVEMENTS 7
GENERAL COMMENTS 11
ATTACHMENTS 13

Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

APPENDIX A – Exploration Plan and Procedures
APPENDIX B – Exploration and testing Results
APPENDIX C – Supporting Information

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

Topic [1]	Overview Statement [2]
Project Description	- Georgia Southern University plans to extend Akins Boulevard approximately 0.28 miles south of its intersection with Veterans Memorial Parkway. The roadway will serve as an addition to the university's bus routes to help students commute between campus and the future commercial development via Tormenta Way (southwest of bypass connection). Moreover, the roadway will extend to the existing roundabout at John Proctor Road.
Geotechnical Characterization	- Approximately 8 inches of topsoil. The thickness of topsoil will vary, depending upon the near-surface soil disturbance during the site preparation. Please refer to the **Geotechnical Characterization** section. - In general, the site's soil stratigraphy is relatively consistent which includes loose to medium dense silty and clayey sands to approximately 5 feet below the existing grade surface (BGS). - **Groundwater** was encountered at approximately **2.5** and **5** feet BGS at the time of our field exploration.
Earthwork	- Install a site drainage system, - Strip/grub topsoil - Level, densify, proofroll subgrade during subgrade preparation. If detected any soft/weak areas, repair subgrade by densification or undercut and backfill. For details, please refer to the **Earthwork** section.
Pavements	Both rigid (concrete) and flexible (asphalt) pavement sections may be considered. **Anticipated traffic is as follows *(please confirm)***: ■ Autos/light trucks = **3,000** vehicles per day ■ Light delivery trucks = **20 – 30** vehicles per day ■ School buses = **50** vehicles per day ■ Trash collection vehicles = **20 – 30** vehicles per day ■ Tractor-trailer trucks **< 3** vehicles per week The pavement design period is **20** years. Based on the traffic information provided, we recommend the following pavements after the subgrade has been prepared as noted in **Earthwork** section. Concrete: ■ 7" PCC over 4" graded aggregate base (GAB) Asphalt: ■ 4" ACC over 8" graded aggregate base (GAB)
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Geotechnical Engineering Report

GSU South Campus Roadway Extension

Statesboro, Bulloch County, Georgia

Terracon Project No. ES205298

March 11, 2021

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed improvements to be located southeast of the intersection of Veterans Memorial Parkway and Old Register Road in Statesboro, Georgia. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of 9 Hand Auger borings to depths ranging from approximately 5 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Appendix A**.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located southeast of Veterans Memorial Parkway and Old Register Road intersection in Statesboro, Bulloch County, Georgia. See **Appendix A.**
Existing Improvements	None.
Current Ground Cover	Grassed and partially-wooded areas.
Existing Topography	Relatively level.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. Our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Georgia Southern University plans to extend Akins Boulevard approximately 0.28 miles south of its intersection with Veterans Memorial Parkway, and will extend to the existing roundabout at John Proctor Road.
Project Description	We understand the site has no previous improvements, however it is noted that the project location is adjacent to an active construction area to the northwest. Underground utility lines are expected near the project's boundaries with existing roads.
Proposed Structure	Boulevard extension.
Finished Pavement Elevation[1,2]	The pavement will start with an approximate elevation of **205 feet** (near HA9) on the northern road segment and will slope downward to **185-187 feet** on the southern side (HA1).
Grading	Based on the provided existing grade and pavement elevations, we understand the site will receive approximately **2 to 7 feet of fill material** to meet the pavement final elevation.
Pavements[1]	Both rigid (concrete) and flexible (asphalt) pavement sections may be considered. **Anticipated traffic is as follows** ***(please confirm)***: ■ Autos/light trucks = **3,000** vehicles per day ■ Light delivery trucks = **20 – 30** vehicles per day ■ School buses = **50** vehicles per day ■ Trash collection vehicles = **20 – 30** vehicles per day ■ Tractor-trailer trucks **< 3** vehicles per week The pavement design period is **20** years.

1. Information provided by the client.
2. Elevation Datum is NAVD 88.

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned construction. The following table provides our geotechnical characterization.

Typical Soil Profile

Soil Profile 1 (based on Hand Auger Borings HA1 to HA9)

Stratum	Approx. Depth to Bottom of Stratum (feet) BGS[1]	Material Characterization
Topsoil[2]	0.5 to 0.8	Topsoil: clayey sands with grass roots.
1	4	Silty sands or clayey sands
2	5	Clayey sands to sandy clays

1. BGS = Below Ground Surface
2. The depth/thickness of topsoil will vary, depending upon the near-surface soil disturbance during the site preparation

Conditions encountered at each exploration location are indicated on the individual logs shown in the **Appendix B** section and are attached to this report. Stratification boundaries on the CPT/boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. The water levels observed in the boreholes can be found on the logs in **Appendix B**, and are summarized below.

Groundwater was observed between **2.5** and **5** feet below ground surface at Hand Auger boring locations HA1 through HA9. Based on the encountered soil stratification, the site is prone to perched water tables due to the poor hydraulic conductivity of the clayey sands and sandy clays. Special attention should be paid to areas near hand auger boring locations HA1, HA2, HA3, HA6, and HA7 during construction since the subsurface conditions may present challenges for access and construction traffic.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Mottling, an indicator of seasonal high groundwater levels, was noted between 1 and 2 feet BGS at hand auger borings HA1, HA3, and HA6 through HA9.

Therefore, groundwater levels during construction or at other times in the life of the pavements may be higher or lower than the levels indicated on the logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

The following evaluation and recommendations are based upon our understanding of the proposed construction and the results from our field exploration. If the above-described project conditions are incorrect or changed after this report, or subsurface conditions encountered during construction are significantly different from those reported, Terracon should be notified, and these recommendations must be re-evaluated to make appropriate revisions.

Geotechnical Considerations

The subsurface conditions in the upper 5 feet BGS are relatively consistent across the site and are considered typical for the area. The generalized soil profile is presented in **Geotechnical Characterization**.

The information regarding the anticipated traffic count is included in **Project Description** of this report. Shallow foundation settlement analyses were performed using estimated soil parameters from the findings at each hand auger boring and the provided estimated fill height of 2 to 7 feet along the road segment as shown in **Exhibit A-2**. Based on the settlement analyses, total settlements from the embankment were estimated to be less than 1 inch in the roadway areas.

In general, the insitu soils are adequate for pavement support as subgrade material after proper densification and proofrolling has been performed. However, based on the soil profile determined by the hand auger borings, it is expected that organics will be present approximately 0.5 to 0.8 feet below ground surface. A more detailed discussion of the site preparation for construction can be found in the **Earthwork** section.

During the site preparation, the clayey soils below the existing ground surface will be exposed and will likely cause an unstable subgrade for support, especially if the subgrade is exposed to rainwater. To achieve a stable subgrade, the contractor should expect undercutting and backfilling of these soft areas or use cement or lime to stabilization to treat the subgrade. It is anticipated that subgrade undercutting and backfilling will be required in that soft area for support and pavement area unless cement stabilization is used. The need and extent of subgrade improvement should also be evaluated in consideration of the fill thickness and site drainage conditions. We recommend undercutting and backing be performed at least 2 feet below the roadway if the proposed final elevation is closer to that of the existing grade elevation.

For pavement areas to receive 2 to 7 feet of fill material, we recommend the site to include material prepared in accordance to sections **Fill Material Types** and **Fill Compaction Requirements.**

We recommend hand auger borings, and dynamic cone penetration (DCP) testing be performed during construction to evaluate and confirm the subgrade conditions under the embankment. It is anticipated that subgrade soil undercutting will be required during subgrade preparation for the foundation.

EARTHWORK

Earthwork is anticipated to include clearing and grubbing, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for the proposed pavements. The site work conditions will be largely dependent on the weather conditions and the contractor's means and methods for controlling surface drainage and protecting the subgrade.

Site Preparation

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed paving areas.

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck. The proofrolling should be performed under the direction of the Geotechnical Engineer. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. Excessively wet or dry material should either be removed, or moisture conditioned and recompacted.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill. Earthen materials used for structural should meet the following material property requirements:

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Granular	GW, GP, GM, GC, SW, SP, SM, SC	Less than 35% Passing No. 200 sieve

1. Structural should consist of approved materials free of organic matter and debris. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.

Based on the findings from our hand auger borings, the subject site consists of soils varying from silty sands (SM) to clayey sands (SC) to sandy clays (CL) in the upper 5 feet BGS. The silty sands (SM) are generally considered marginally suitable for structural fill, provided that the soils are free of roots, organics or other foreign materials. Clayey sands (SC) may be considered marginally suitable; and the sandy clays (CL) are deemed unsuitable for structural fill.

We define marginally suitable as the soils that may require extra effort to adjust moisture before they can be compacted. The amount of effort required will be highly dependent on the season and the weather conditions during construction. We recommend Terracon be retained during construction to determine the suitability of the onsite soil as fill material.

Fill Compaction Requirements

Structural should meet the following compaction requirements.

Item	Structural Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Minimum Compaction Requirements [1]	95% of max. below foundations and below finished pavement subgrade
Water Content Range [1]	Granular: -3% to +2% of optimum

1. Maximum density and optimum water content as determined by the modified Proctor test (ASTM D 1557).

Some manipulation of the moisture content (such as wetting, drying) will be required during the filling operations to obtain the required degree of compaction. The manipulation of the moisture content is highly dependent on weather conditions and site drainage conditions. Therefore, the contractor should prepare both dry and wet fill materials to obtain the specified compaction during grading. A sufficient number of density tests should be performed to confirm the required compaction of the fill material.

Site Drainage

An effective drainage system should be installed prior to site preparation and grading activities to intercept surface water and to improve overall shallow drainage. The drainage system may consist of perimeter ditches supplemented with parallel ditches and swales. Pumping equipment should be prepared if the above ditch system cannot effectively drain water away from the site, especially during the rainy season. The site should be graded to shed water and avoid ponding over the subgrade.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling, and mitigation of areas delineated by the proofroll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 5,000 square feet in pavement areas.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

PAVEMENTS

General Pavement Comments

We understand the proposed development will include the extension of Akins Boulevard located south from its intersection with Veterans Memorial Parkway, and the roadway will extend to the existing roundabout at John Proctor Road. This section presents thickness recommendations for asphalt concrete and Portland cement concrete pavements and general considerations for the pavement construction. Pavement thickness design is dependent upon:

- The traffic loads including traffic pattern and the service life of the pavement;
- Subgrade conditions including soil strength and drainage characteristics;
- Paving material characteristics;
- Climatic conditions of the region.

Anticipated traffic is as follows *(please confirm)*:

- Autos/light trucks = **3,000** vehicles per day
- Light delivery trucks = **20 – 30** vehicles per day
- School buses = **50** vehicles per day
- Trash collection vehicles = **20 – 30** vehicles per day
- Tractor-trailer trucks **< 3** vehicles per week

Based on our experience with similar projects in this area, we have provided rigid and flexible pavement sections shown in the following tables.

A detailed pavement evaluation can be performed if traffic load information is made available. As typical for pavement, it should be noted maintenance repairs are typically required after a period of 7 to 10 years to keep the pavement in acceptable condition.

The following tables provide options for AC and PCC Sections. If asphalt pavement is used for the truck parking area, we recommend concrete pads be constructed in areas with truck turning. In general, concrete pavement performs better in areas with frequent turning and concrete pavements are more commonly used for trailer truck parking.

Recommended paving material characteristics, taken from the Georgia Department of Transportation's (GDOT) 2001 edition of Standard Specifications for Construction of Transportation Systems, are included for the asphalt concrete sections.

Asphalt Pavement Design Recommendations

Material	**Minimum Section Thickness** (inch)
Asphalt Surface Course[1]	2
Asphalt Intermediate Course[1]	2
Aggregate Base Course[1]	8
Total Pavement Section	**12**
Select fill[2] / improved subgrade[3]	24

1. Asphalt concrete and base course materials should conform to the following GDOT material specifications.
   - Section 815 for Graded Aggregate
   - Section 828 for Hot Mix Asphalt Concrete Mixture. Surface course may use 12.5 mm Superpave.
2. The select fill should be relatively clean sands with percent fines less than 15%. The fill material should be compacted to a minimum of 95% of the soil's Modified Proctor maximum dry density (ASTM D-1557).
3. If SP or SP-SM or SM soils exist at the proposed subgrade elevation extending to a depth at least 24 inches below the proposed subgrade level, the in-situ soils can replace the select fill, and the subgrade should be improved using densification as discussed in the **Earthwork** section.

Notes:

- Proper surface and subgrade drainage system should be installed to avoid saturation of subgrade soils underneath the asphalt pavements. The site drainage should be designed to maintain the groundwater at least 2 feet below the top of the subgrade.
- Some subgrade soil undercutting and backfilling with suitable structural fill will be required if unstable subgrade soils are encountered during subgrade preparation. The use of geogrid (Tensar BX1100 or equivalent) may be necessary to help reduce the depth of undercut to achieve stability if the unstable subgrade soils extend to greater depths. The need for geogrid and/or the need for undercutting and backfilling should be determined in the field during subgrade preparation.

Concrete Pavement Design Recommendations

Material	**Minimum Section Thickness** (inch)
Concrete[1]	7
Graded aggregate base[2]	4
Select fill[3] / improved subgrade[4]	24

1. The concrete should be air entrained and have a minimum compressive strength of 4,000 psi after 28 days of lab curing per ASTM C-31.
2. Graded aggregate base should conform to the GDOT material specification Section 815.
3. The select fill should be relatively clean sands with percent fines less than 15%. The fill material should be compacted to a minimum of 95% of the soil's Modified Proctor maximum dry density (ASTM D-1557).
4. If SP or SP-SM or SM soils exist at the proposed subgrade elevation extending to a depth at least 24 inches below the proposed subgrade level, the in-situ soils can replace the select fill and the subgrade should be improved using densification as discussed in **Earthwork** section.

Notes:

- Concrete joints should be sealed properly to avoid ingress of surface water into the subgrade soils. We recommend a joint spacing of 12 feet. A jointing plan should be developed to avoid irregular shaped panels to control shrinkage cracking. Proper surface and subgrade drainage system should be installed to avoid saturation of subgrade soils underneath the concrete pavements. The site drainage should be designed to maintain the groundwater at least 2 feet below the top of the subgrade.
- Some subgrade soil undercutting and backfilling with suitable structural fill will be required if unstable subgrade soils are encountered during subgrade preparation. The use of geogrid (Tensar BX1100 or equivalent) may be necessary to help reduce the depth of undercut to achieve stability if the unstable subgrade soils extend to greater depths. The need for geogrid and/or the need for undercutting and backfilling should be determined in the field during subgrade preparation.
- In the areas with truck turning, the pavement should be designed to resist lateral sliding from the truck turning force. Additional measures such as aggregate base course, tied edge panels and key ways along the curbs may be considered to add the lateral resistance against sliding.

For the pavement support, the subgrade conditions can often be the overriding factor in pavement performance. The subgrade conditions will depend on the in-situ soils at the subgrade level, characteristics of fill material for the subgrade, as well as site preparation procedures.

The site grading plan has been provided by the client. We anticipate the finished pavement elevation will be approximately 185 to 205 feet NAVD 88. Based on these elevations, the site is expected to receive approximately 2 to 7 feet of fill material. Beneath the topsoil layer, our hand auger borings encountered soils varying from fine silty to clayey sands to sandy clays. The silty sands should have good drainage characteristics and are deemed suitable for the pavement subgrade support. The clayey sands/sandy clays should not be used for the subgrade support due to poor drainage.

If, during construction, clayey sands or sandy clays are encountered at the subgrade level, the upper (2) feet of the subgrade should be replaced with relatively clean sands with less than 15 percent fines. Based on the in-situ soils at the site and typical imported fills available in this area, a **California Bearing Ratio (CBR) value of 8 has been estimated.**

For the pavements subject to concentrated and repetitive heavy loading conditions such as container parks, truck delivery docks and ingress/egress aprons, we recommend Portland cement concrete pavement with a minimum thickness of 8 inches. The concrete pavement can be poured over compacted granular subgrade (sand) or on at least 4-inches of graded aggregate base (GAB stone).

We emphasize the use of the stone base under the pavement even though the stone base is not part of the pavement structural design. Based on our experience, the stone base can be significantly help improve the constructability during construction especially in rainy seasons. Furthermore, the stone base will help maintain subgrade stability and support when the subgrade is wet due to rise of groundwater or infiltration of surface water through the pavement joints or cracks. The stone base enhances pavement constructability condition during construction and long-term performance.

The above rigid and flexible pavement sections represent the minimum design thicknesses and, as such, periodic maintenance should be anticipated. Prior to the placement of the crushed stones, the pavement subgrade should be thoroughly proofrolled.

Pavement Construction Considerations

Pavement subgrades prepared early in the project should be carefully evaluated as the time for pavement construction approaches. We recommend the pavement areas be rough graded and then thoroughly proofrolled with a loaded tandem-axle dump truck.

Particular attention should be paid to the high traffic areas that were rutted and disturbed, and to the areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fill. After proofrolling and repairing subgrade deficiencies, the entire subgrade should be scarified to a depth of 12 inches, and uniformly compacted to at least 95% of the materials' modified Proctor maximum dry density.

Pavement and Subgrade Drainage

Poor subgrade drainage is the most common cause of pavement failure. Pavement should be sloped to provide rapid drainage of surface water. Water should not be allowed to pond on or adjacent to the pavement, which would saturate the subgrade soils and weaken the subgrade support. We recommend the site drainage be designed to maintain the groundwater at least two (2) feet below the top of the subgrade.

Pavement subgrade drainage should be installed surrounding the areas anticipated for frequent wetting or having poor natural drainage, such as landscaped islands, along curbs and gutters and around drainage structures. All landscaped areas in or adjacent to pavements should be sealed to reduce the moisture migration to subgrade soils. Subgrade drains should be installed with the pipe bottom at least two (2) feet below the top of the select fill. The civil engineer should decide the placement of the subgrade drains to avoid the saturation of pavement subgrade.

Pavement Maintenance

The performance of pavements will require regular maintenance. One key component of the maintenance is to minimize infiltration of water into the pavement base and subgrade. Preventive maintenance should include crack and joint sealing and patching as well as overall surface sealing and overlay. Additional engineering observation and evaluation is recommended prior to any major maintenance.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

EXHIBITS

EXHIBIT A: **Exploration Plan and Procedures**

EXHIBIT B: **Exploration and Testing Results**

EXHIBIT C: **Supporting Information**

EXHIBIT A

EXPLORATION PLAN AND PROCEDURES

- **Exhibit A-1:** Site Location Plan
- **Exhibit A-2:** Exploration Plan
- **Exhibit A-3:** Exploration and Testing Procedures

EXHIBIT A-1 - SITE LOCATION PLAN

GSU South Campus Roadway Extension ■ Statesboro, Georgia
March 11, 2021 ■ Terracon Project No. ES205298

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

MAP PROVIDED BY MICROSOFT BING MAPS

EXHIBIT A-2 - EXPLORATION PLAN

GSU South Campus Roadway Extension ■ Statesboro, Georgia

March 11, 2021 ■ Terracon Project No. ES205298

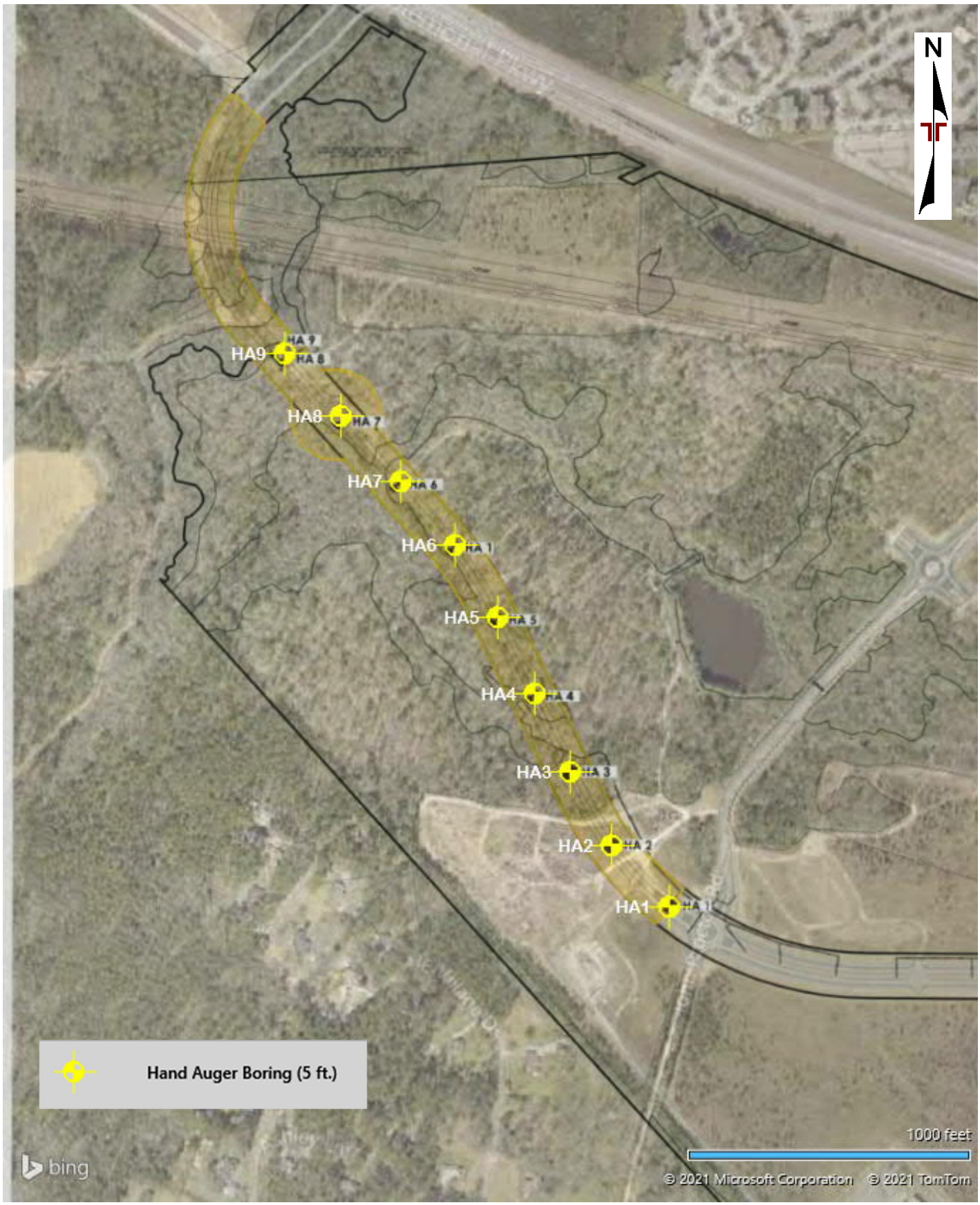


DIAGRAM IS FOR GENERAL LO CATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Field Exploration

No. of Test	Type of Test	Location	Maximum Depth (feet, below ground surface)
9	Hand Auger Boring	Pavement	5

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet). The elevations on the borings were interpreted from the topographic survey plan provided the client and should be considered approximate.

Subsurface Exploration Procedures: Hand auger borings were conducted in general accordance with ASTM D 1452-80 to determine the subsurface conditions at shallow depths. In this test, the hand auger boring is drilled by rotating and advancing a bucket auger to the desired depths while periodically removing the auger from the hole to clear and examine the auger cuttings. The soils will be visually classified by a geotechnical engineer or geologist in accordance with ASTM D-2488.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples.

Laboratory Testing

Laboratory testing procedures were performed on soil samples collected at each hand auger boring location. Bag samples were obtained at multiple depths ranging from the upper 5 feet below existing grade surface and shipped to Terracon's laboratory for the following testing procedures:

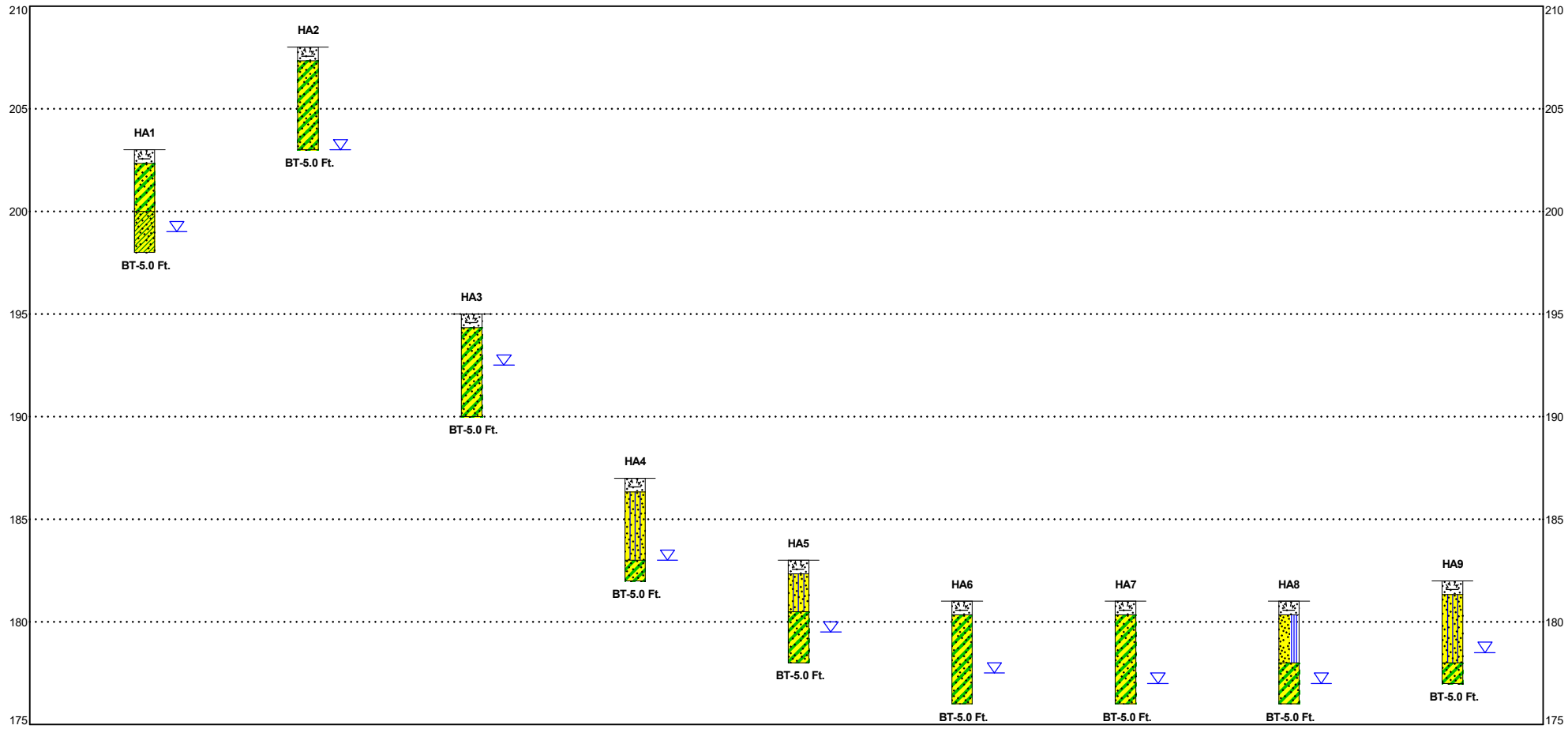
- **Moisture Content:** Standard Test Methods for Laboratory Determination of Water Content of Soil and Rock by Mass (ASTM D2216)
- **Grain Size Analysis:** Standard Test Method for Particle-Size Analysis of Soils (ASTM D422)
- **Atterberg Limits:** Standard Test Method for Liquid Limit, Plastic Limit, and Plastic Index Analysis of Soils (ASTM D4318)

Our laboratory testing results are represented in individual graphs and tables in detail in **Exhibits B-3**, **B-4** and **B-5**.

EXHIBIT B

EXPLORATION AND TESTING RESULTS

- **Exhibit B-1:** Subsurface Profile
- **Exhibit B-2:** Hand Auger Boring Logs
- **Exhibit B-3:** Summary of Soil Laboratory Test
- **Exhibit B-4:** Grain Size Distribution
- **Exhibit B-5:** Atterberg Limits



Topsoil | Clayey Sand | Sandy Lean Clay | Silty Sand | Poorly-graded Sand with Silt

Explanation

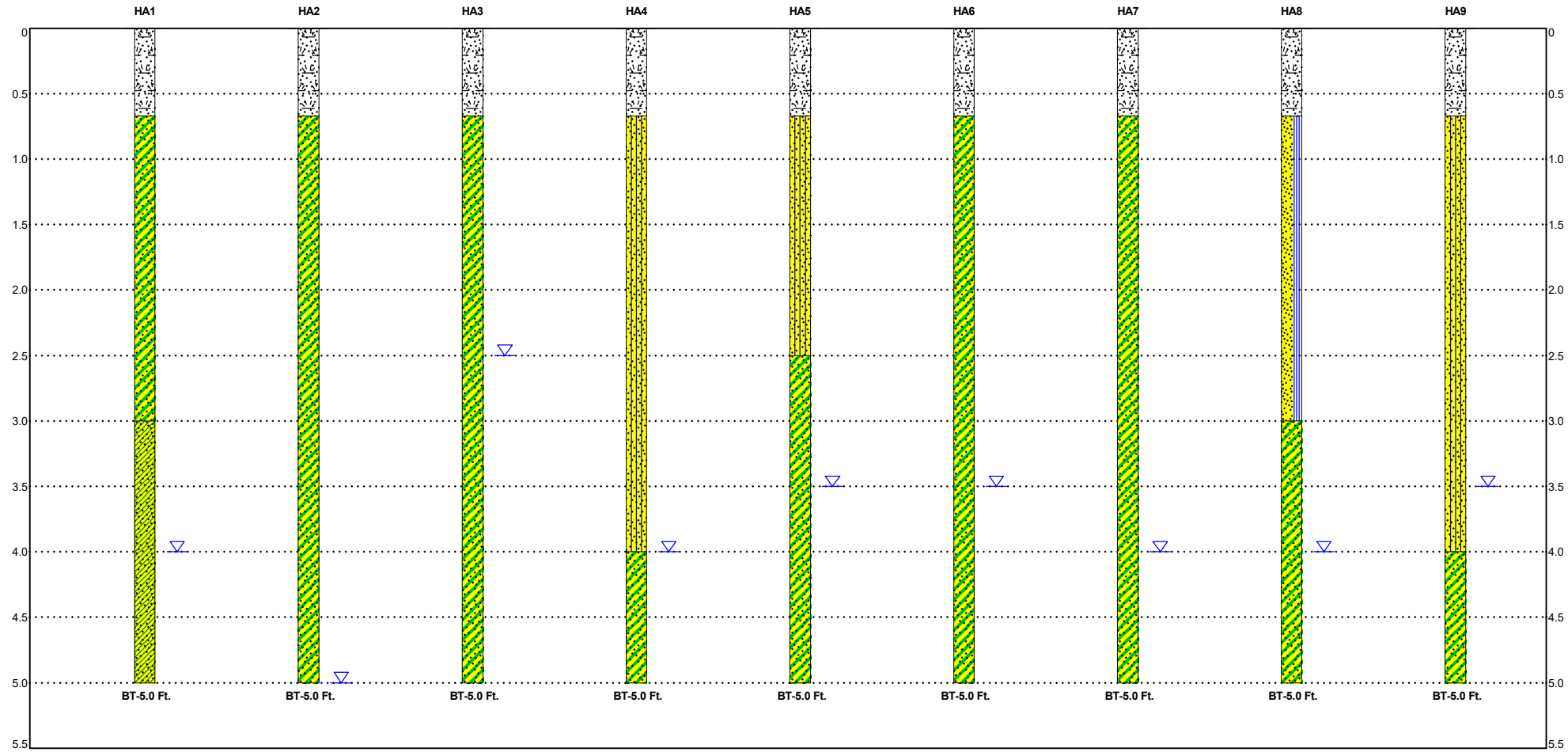
HA1 — Borehole Number
Moisture Content — %w
LL PL — Liquid and Plastic Limits
Sampling (See General Notes)
Borehole Lithology
AR
BT
Borehole Termination Type
Water Level Reading at time of drilling.
Water Level Reading after drilling.

NOTES:

See Exploration Plan for orientation of soil profile.
See General Notes in Supporting Information for symbols and soil classifications.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project No.: ES205298	Terracon 2201 Rowland Ave Savannah, GA	**SUBSURFACE PROFILE**
Date: 3/5/2021		GSU SOUTH CAMPUS ROADWAY EXTENSION LANIER DR STATESBORO, GA
Scale: N.T.S.		

Exhibit B-1-1



Explanation

HA1 — Borehole Number
Moisture Content — %w
LL PL — Liquid and Plastic Limits
Sampling (See General Notes)
Borehole Lithology
AR
BT
Borehole Termination Type
Water Level Reading at time of drilling.
Water Level Reading after drilling.

NOTES:

See Exploration Plan for orientation of soil profile.
See General Notes in Supporting Information for symbols and soil classifications.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project No.: ES205298	Terracon 2201 Rowland Ave Savannah, GA	**SUBSURFACE PROFILE**
Date: 3/5/2021		GSU SOUTH CAMPUS ROADWAY EXTENSION LANIER DR STATESBORO, GA
Scale: N.T.S.		

Exhibit B-1-2

BORING LOG NO. HA1

PROJECT: GSU South Campus Roadway Extension

CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

SITE: Lanier Dr
Statesboro, GA

LOCATION See Exploration Plan

Latitude: 32.4012° Longitude: -81.7869°

Surface Elev.: 203 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	TOPSOIL, grass roots							
	0.7	202.5						
	CLAYEY SAND (SC), fine grained, light brown		1					
			2			18.1	23-14-9	34
	3.0	200	3					
	SANDY LEAN CLAY (CL), light brown and orange							
			4	▽				
	5.0	198	5					
	Boring Terminated at 5 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Mottling noted at 2 feet BGS.

Advancement Method:

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
2201 Rowland Ave
Savannah, GA

Boring Started: 02-18-2021 | Boring Completed: 02-18-2021

Drill Rig: Hand Auger | Driller: CS

Project No.: ES205298 | **Exhibit B-2-1**

BORING LOG NO. HA2

PROJECT: GSU South Campus Roadway Extension

CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

SITE: Lanier Dr
Statesboro, GA

LOCATION See Exploration Plan

Latitude: 32.4018° Longitude: -81.7869°

Surface Elev.: 208 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		TOPSOIL, grass roots						
	0.7	207.5						
		CLAYEY SAND (SC), fine grained, red and brown	1					
			2					
			3			14.4	22-12-10	19
			4					
	5.0	203	5	▽				
		Boring Terminated at 5 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.
No mottling noted.

Advancement Method:

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
2201 Rowland Ave
Savannah, GA

Boring Started: 02-18-2021 | Boring Completed: 02-18-2021

Drill Rig: Hand Auger | Driller: CS

Project No.: ES205298 | **Exhibit B-2-2**

BORING LOG NO. HA3

PROJECT: GSU South Campus Roadway Extension

CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

SITE: Lanier Dr
Statesboro, GA

LOCATION See Exploration Plan

Latitude: 32.4026° Longitude: -81.7874°

Surface Elev.: 195 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		TOPSOIL, grass roots						
	0.7	194.5						
		CLAYEY SAND (SC), fine grained, light brown	1					
			2	▽				
			3					
						23.6	26-15-11	25
			4					
	5.0	190	5					
		Boring Terminated at 5 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.
Mottling noted at 1 feet BGS.

Advancement Method:

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
2201 Rowland Ave
Savannah, GA

Boring Started: 02-18-2021 | Boring Completed: 02-18-2021

Drill Rig: Hand Auger | Driller: CS

Project No.: ES205298 | **Exhibit B-2-3**

BORING LOG NO. HA4

PROJECT: GSU South Campus Roadway Extension

CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

SITE: Lanier Dr
Statesboro, GA

LOCATION See Exploration Plan

Latitude: 32.4033° Longitude: -81.7878°

Surface Elev.: 187 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		TOPSOIL, grass roots						
	0.7	186.5						
		SILTY SAND (SM), fine grained, dark brown	1					
			2					
			3					
	4.0	183	4	▽				
		CLAYEY SAND (SC), fine grained, dark brown						
						20.3	22-13-9	22
	5.0	182	5					
		Boring Terminated at 5 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.
No mottling noted.

Advancement Method:

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
2201 Rowland Ave
Savannah, GA

Boring Started: 02-18-2021 | Boring Completed: 02-18-2021

Drill Rig: Hand Auger | Driller: CS

Project No.: ES205298 | **Exhibit B-2-4**

BORING LOG NO. HA5

PROJECT: GSU South Campus Roadway Extension

CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

SITE: Lanier Dr
Statesboro, GA

LOCATION See Exploration Plan

Latitude: 32.4041° Longitude: -81.7882°

Surface Elev.: 183 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0.7	182.5						
			1					
	2.5	180.5						
			2			14.7		27
			3					
	5.0	178						
			4					
			5					

TOPSOIL, grass roots

SILTY SAND (SM), fine grained, dark brown

CLAYEY SAND (SC), fine grained, dark brown

Boring Terminated at 5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.
No mottling noted.

Advancement Method:

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
2201 Rowland Ave
Savannah, GA

Boring Started: 02-18-2021 | Boring Completed: 02-18-2021

Drill Rig: Hand Auger | Driller: CS

Project No.: ES205298 | **Exhibit B-2-5**

BORING LOG NO. HA6

PROJECT: GSU South Campus Roadway Extension

CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

SITE: Lanier Dr
Statesboro, GA

LOCATION See Exploration Plan

Latitude: 32.4048° Longitude: -81.7887°

Surface Elev.: 181 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		TOPSOIL, grass roots						
	0.7	180.5						
		CLAYEY SAND (SC), fine grained, light brown and orange	1					
			2					
						21.0	24-13-11	26
			3	▽				
			4					
	5.0	176	5					
		Boring Terminated at 5 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.
Mottling noted at 1 feet BGS.

Advancement Method:

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
2201 Rowland Ave
Savannah, GA

Boring Started: 02-18-2021 | Boring Completed: 02-18-2021

Drill Rig: Hand Auger | Driller: CS

Project No.: ES205298 | **Exhibit B-2-6**

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL ES205298 - GSU SOUTH CAMPUS ROADWAY EXTENSION-REV.GPJ TERRACON_DATATEMPLATE.GDT 3/5/21

BORING LOG NO. HA7

PROJECT: GSU South Campus Roadway Extension

CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

SITE: Lanier Dr
Statesboro, GA

LOCATION See Exploration Plan

Latitude: 32.4054° Longitude: -81.7893°

Surface Elev.: 181 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	TOPSOIL, grass roots							
	0.7	180.5						
	CLAYEY SAND (SC), fine grained, light brown and orange		1					
			2					
			3					
			4	▽		16.9	22-12-10	21
	5.0	176	5					
	Boring Terminated at 5 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Mottling noted at 1 feet BGS.

Advancement Method:

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
2201 Rowland Ave
Savannah, GA

Boring Started: 02-18-2021 | Boring Completed: 02-18-2021

Drill Rig: Hand Auger | Driller: CS

Project No.: ES205298 | **Exhibit B-2-7**

BORING LOG NO. HA8

PROJECT: GSU South Campus Roadway Extension

CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

SITE: Lanier Dr
Statesboro, GA

LOCATION See Exploration Plan

Latitude: 32.4060° Longitude: -81.7900°

Surface Elev.: 181 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	TOPSOIL, grass roots							
	0.7	180.5						
	POORLY GRADED SAND WITH SILT (SP-SM), fine grained, dark brown		1					
			2			9.2		12
	3.0	178	3					
	CLAYEY SAND (SC), fine grained, dark brown							
			4	▽				
	5.0	176	5					
	Boring Terminated at 5 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Mottling noted at 2 feet BGS.

Advancement Method:

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
2201 Rowland Ave
Savannah, GA

Boring Started: 02-18-2021 | Boring Completed: 02-18-2021

Drill Rig: Hand Auger | Driller: CS

Project No.: ES205298 | **Exhibit B-2-8**

BORING LOG NO. HA9

PROJECT: GSU South Campus Roadway Extension

CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

SITE: Lanier Dr
Statesboro, GA

LOCATION See Exploration Plan

Latitude: 32.4066° Longitude: -81.7907°

Surface Elev.: 182 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	TOPSOIL, grass roots							
	0.7	181.5						
	SILTY SAND (SM), fine grained, dark brown		1					
			2					
			3	▽		8.8		18
	4.0	178	4					
	CLAYEY SAND (SC), fine grained, dark brown							
	5.0	177	5					
	Boring Terminated at 5 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Mottling noted at 2 feet BGS.

Advancement Method:

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
2201 Rowland Ave
Savannah, GA

Boring Started: 02-18-2021 | Boring Completed: 02-18-2021

Drill Rig: Hand Auger | Driller: CS

Project No.: ES205298 | **Exhibit B-2-9**

SUMMARY OF LABORATORY RESULTS

BORING ID	Depth (Ft.)	Soil Classification USCS	% Gravel	% Sand	% Fines	Water Content (%)	Plasticity Index	Liquid Limit	Liquid Limit
HA1	1.5 - 3	CLAYEY SAND	0.2	65.7	34.1	18.1	9	23	23
HA2	2 - 4	CLAYEY SAND	0.9	79.6	19.4	14.4	10	22	22
HA3	3 - 4.5	CLAYEY SAND	2.8	71.7	25.5	23.6	11	26	26
HA4	4 - 5	CLAYEY SAND	0.1	77.8	22.1	20.3	9	22	22
HA5	1 - 2.5	SILTY SAND	0.2	72.4	27.3	14.7			
HA6	2 - 3.5	CLAYEY SAND	0.7	73.2	26.0	21	11	24	24
HA7	3 - 5	CLAYEY SAND	0.2	79.0	20.7	16.9	10	22	22
HA8	1 - 3	POORLY GRADED SAND WITH SILT	3.0	85.1	11.9	9.2			
HA9	2 - 4	SILTY SAND	0.0	81.8	18.2	8.8			

PROJECT: GSU South Campus Roadway Extension

SITE: Lanier Dr
Statesboro, GA

Terracon
2201 Rowland Ave
Savannah, GA
PH. 912-629-4000 FAX. 912-629-4001

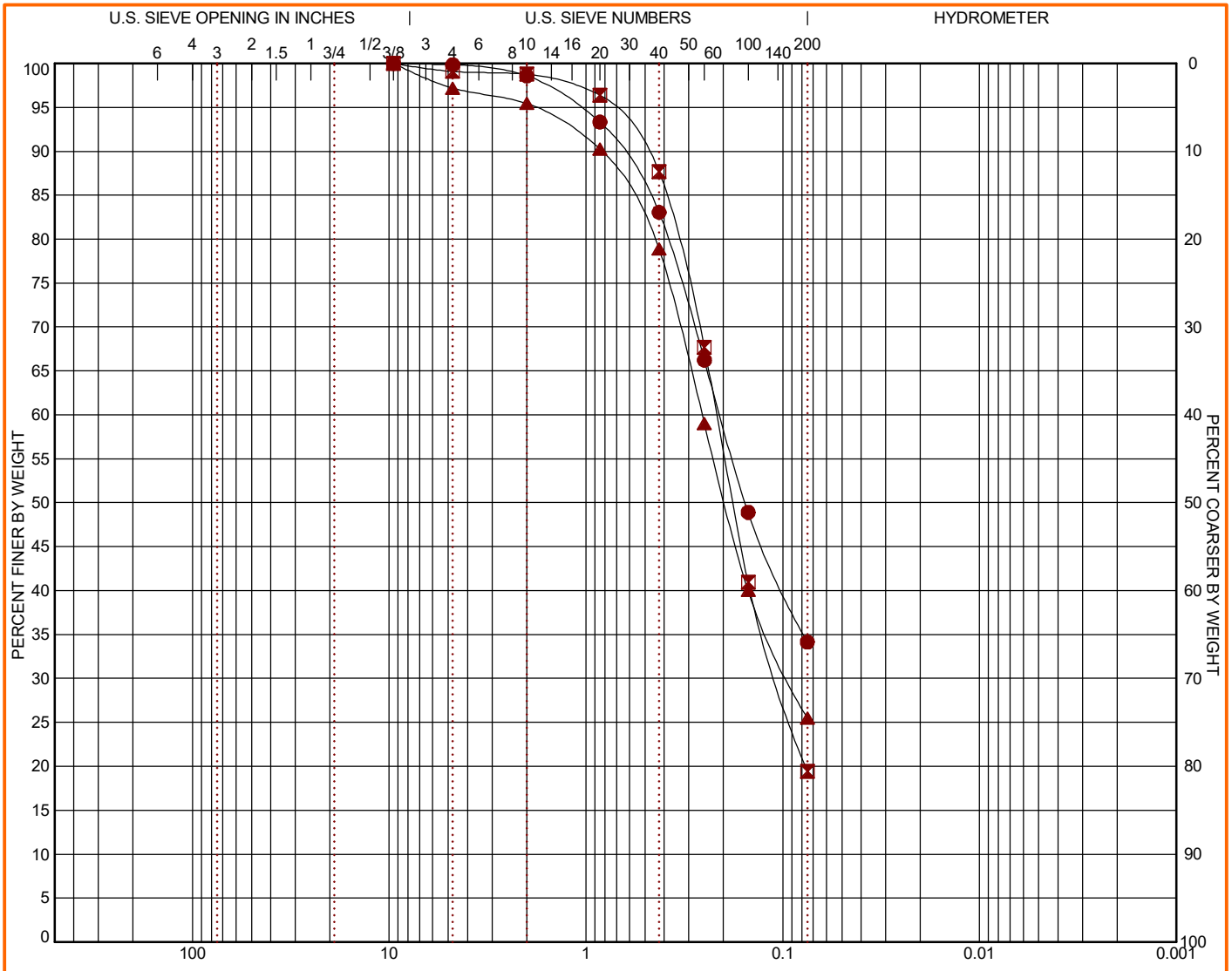
PROJECT NUMBER: ES205298

CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

Exhibit B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	HA1	1.5 - 3	0.0	0.2	65.7		34.1		SC
⊠	HA2	2 - 4	0.0	0.9	79.6		19.4		SC
▲	HA3	3 - 4.5	0.0	2.8	71.7		25.5		SC

GRAIN SIZE	●	⊠	▲
D_{60}	0.208	0.216	0.257
D_{30}		0.105	0.093
D_{10}			

COEFFICIENTS	●	⊠	▲
C_C			
C_U			

●		⊠		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/8"	100.0	3/8"	100.0	3/8"	100.0
#4	99.84	#4	99.08	#4	97.19
#10	98.59	#10	98.76	#10	95.45
#20	93.32	#20	96.38	#20	90.27
#40	83.05	#40	87.69	#40	78.91
#60	66.22	#60	67.71	#60	59.02
#100	48.9	#100	40.94	#100	40.01
#200	34.13	#200	19.44	#200	25.5

SOIL DESCRIPTION	
●	CLAYEY SAND (SC)
⊠	CLAYEY SAND (SC)
▲	CLAYEY SAND (SC)

REMARKS	
●	
⊠	
▲	

PROJECT: GSU South Campus Roadway Extension

SITE: Lanier Dr
Statesboro, GA

Terracon
2201 Rowland Ave
Savannah, GA

PROJECT NUMBER: ES205298

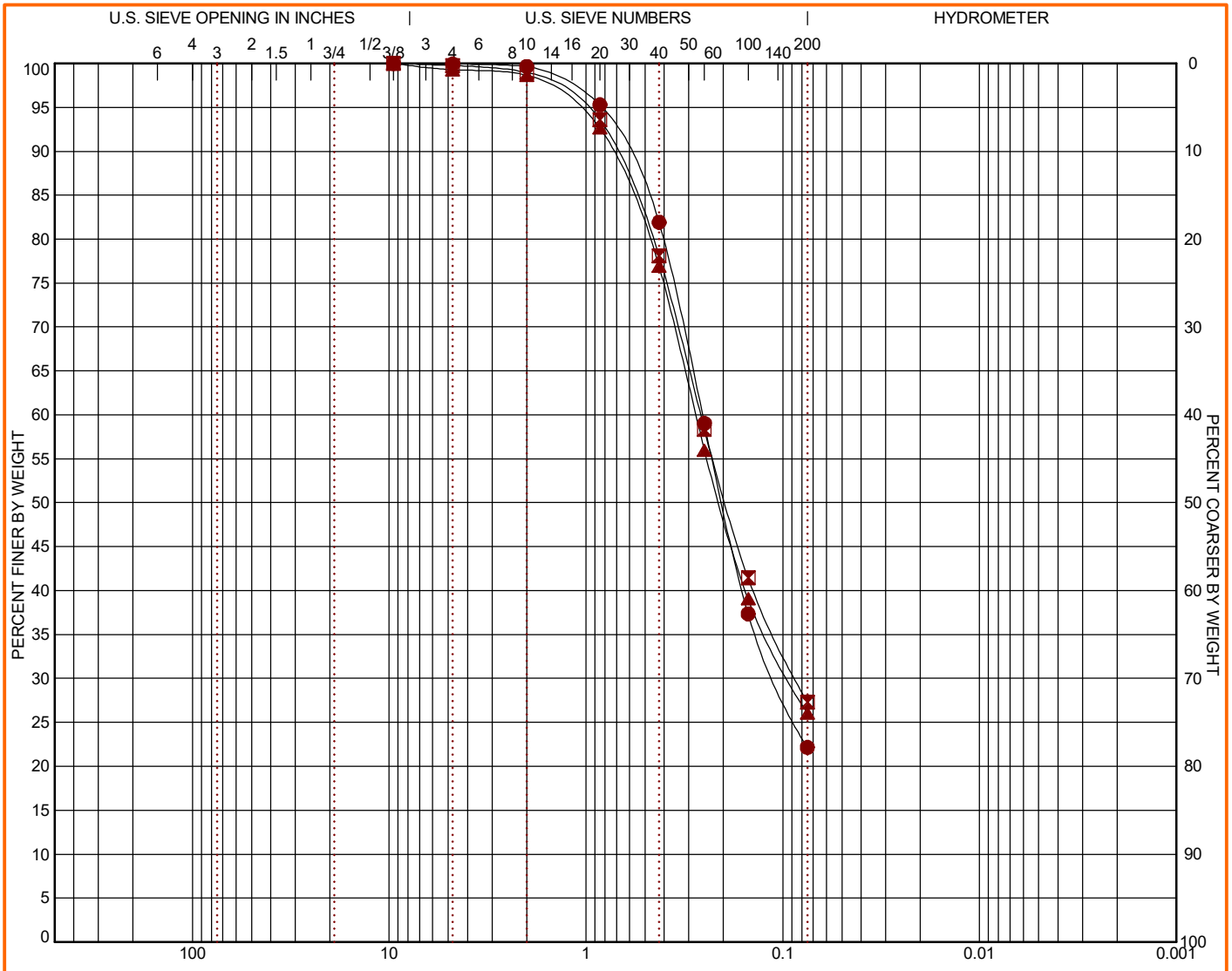
CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

Exhibit B-4-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 ES205298 - GSU SOUTH CAMPUS ROADWAY EXTENSION-REV.GPJ TERRACON_DATATEMPLATE.GDT 3/5/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	HA4	4 - 5	0.0	0.1	77.8		22.1		SC
⊠	HA5	1 - 2.5	0.0	0.2	72.4		27.3		SM
▲	HA6	2 - 3.5	0.0	0.7	73.2		26.0		SC

GRAIN SIZE	●	⊠	▲
D_{60}	0.256	0.261	0.277
D_{30}	0.107	0.086	0.093
D_{10}			

COEFFICIENTS	●	⊠	▲
C_C			
C_U			

●		⊠		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/8"	100.0	3/8"	100.0	3/8"	100.0
#4	99.93	#4	99.75	#4	99.27
#10	99.64	#10	98.97	#10	98.65
#20	95.28	#20	93.61	#20	92.64
#40	81.92	#40	78.11	#40	76.93
#60	59.03	#60	58.36	#60	55.99
#100	37.35	#100	41.43	#100	39.05
#200	22.15	#200	27.33	#200	26.03

SOIL DESCRIPTION	
●	CLAYEY SAND (SC)
⊠	SILTY SAND (SM)
▲	CLAYEY SAND (SC)

REMARKS	
●	
⊠	
▲	

PROJECT: GSU South Campus Roadway Extension

SITE: Lanier Dr
Statesboro, GA

Terracon
2201 Rowland Ave
Savannah, GA

PROJECT NUMBER: ES205298

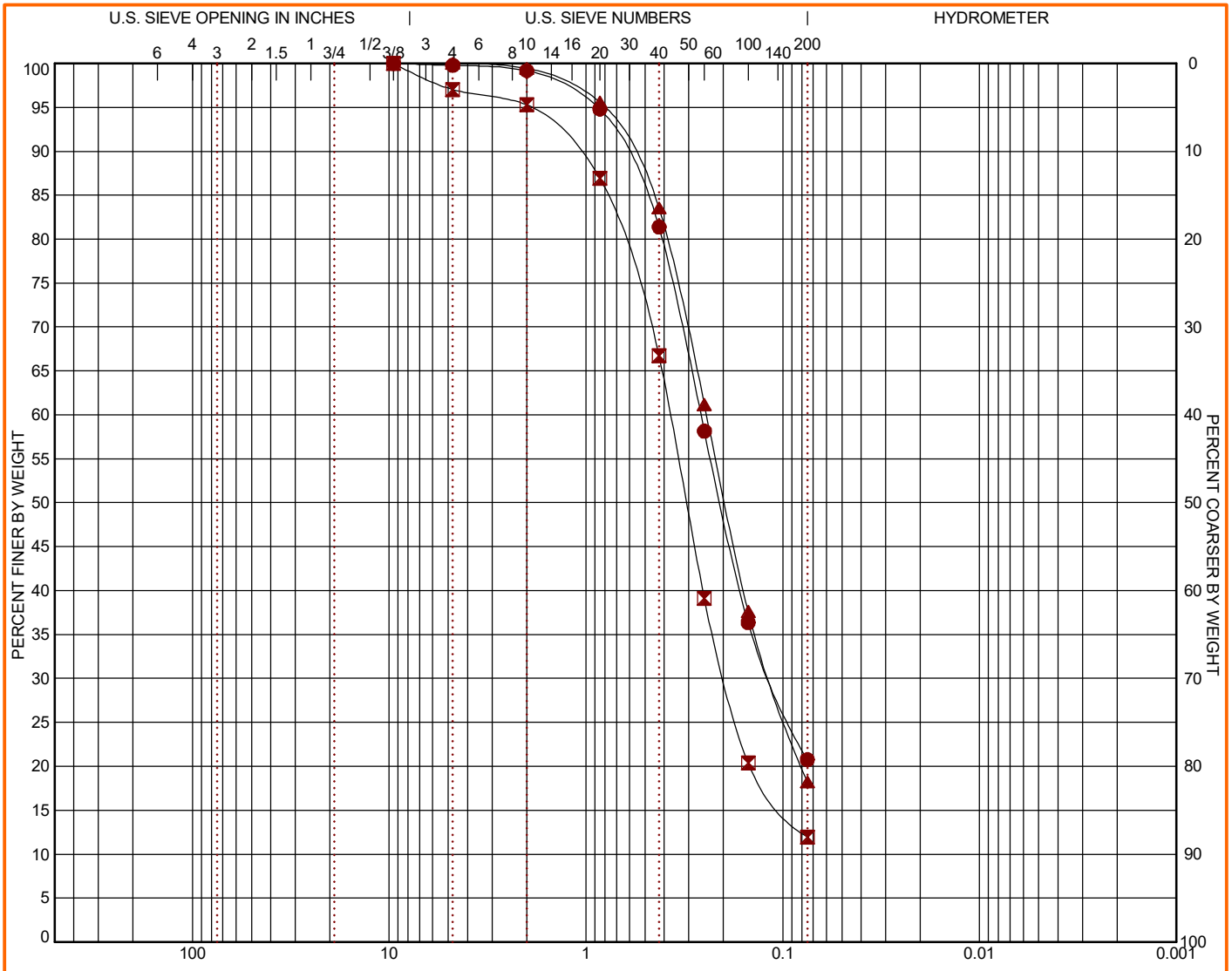
CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

Exhibit B-4-2

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 ES205298 - GSU SOUTH CAMPUS ROADWAY EXTENSION-REV.GPJ TERRACON_DATATEMPLATE.GDT 3/5/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	HA7	3 - 5	0.0	0.2	79.0		20.7		SC
⊠	HA8	1 - 3	0.0	3.0	85.1		11.9		SP-SM
▲	HA9	2 - 4	0.0	0.0	81.8		18.2		SM

GRAIN SIZE	●	⊠	▲
D_{60}	0.261	0.374	0.244
D_{30}	0.113	0.195	0.114
D_{10}			

COEFFICIENTS	●	⊠	▲
C_C		1.59	
C_U		5.84	

●		⊠		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/8"	100.0	3/8"	100.0	#4	100.0
#4	99.78	#4	97.03	#10	99.43
#10	99.17	#10	95.28	#20	95.58
#20	94.8	#20	86.94	#40	83.55
#40	81.38	#40	66.72	#60	61.19
#60	58.14	#60	39.09	#100	37.64
#100	36.35	#100	20.4	#200	18.23
#200	20.75	#200	11.94		

SOIL DESCRIPTION	
●	CLAYEY SAND (SC)
⊠	POORLY GRADED SAND WITH SILT (SP-SM)
▲	SILTY SAND (SM)

REMARKS	
●	
⊠	
▲	

PROJECT: GSU South Campus Roadway Extension

SITE: Lanier Dr
Statesboro, GA

Terracon
2201 Rowland Ave
Savannah, GA

PROJECT NUMBER: ES205298

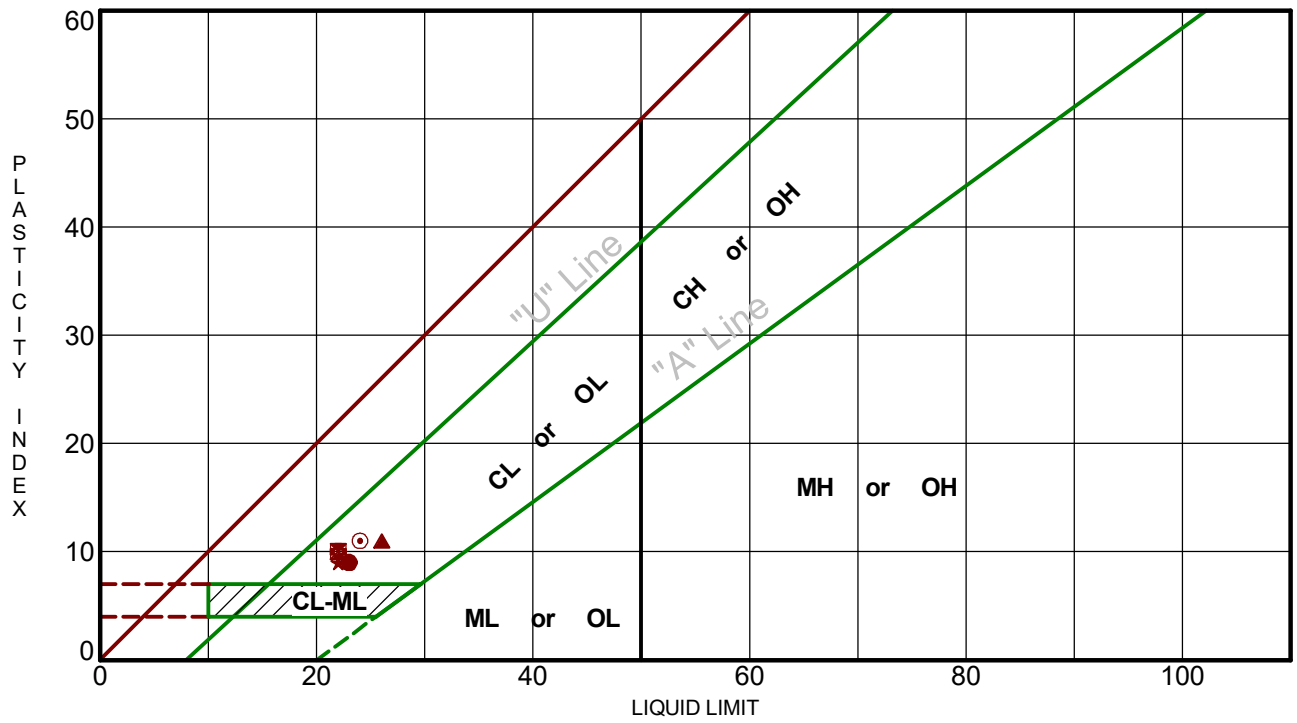
CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

Exhibit B-4-3

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 ES205298 - GSU SOUTH CAMPUS ROADWAY EXTENSION-REV.GPJ TERRACON_DATATEMPLATE.GDT 3/5/21

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth	LL	PL	PI	Fines	USCS	Description
●	HA1	1.5 - 3	23	14	9	34.1	SC	CLAYEY SAND
⊠	HA2	2 - 4	22	12	10	19.4	SC	CLAYEY SAND
▲	HA3	3 - 4.5	26	15	11	25.5	SC	CLAYEY SAND
★	HA4	4 - 5	22	13	9	22.1	SC	CLAYEY SAND
⊙	HA6	2 - 3.5	24	13	11	26.0	SC	CLAYEY SAND
✿	HA7	3 - 5	22	12	10	20.7	SC	CLAYEY SAND

PROJECT: GSU South Campus Roadway Extension

SITE: Lanier Dr
Statesboro, GA

Terracon
2201 Rowland Ave
Savannah, GA

PROJECT NUMBER: ES205298

CLIENT: Maxwell-Reddick and Associates, Inc.
Statesboro, GA

Exhibit B-5

EXHIBIT C

SUPPORTING INFORMATION

- **Exhibit C-1:** General Notes
- **Exhibit C-2:** Unified Soil Classification System

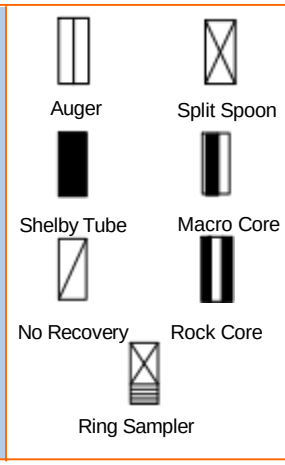
GENERAL NOTES

GSU South Campus Roadway Extension ■ Statesboro, Georgia

March 11, 2021 ■ Terracon Project No. ES205298

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING



GROUNDWATER

- Groundwater Initially Encountered
- Groundwater Level After a Specified Period of Time
- Static Groundwater Level After a Specified Period of Time
- No Groundwater Observed

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	Std. Penetration Resistance (blows per foot)	Descriptive Term (Consistency)	Undrained Shear Strength (kips per square foot)	Std. Penetration Resistance (blows per foot)
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium-Stiff	0.50 to 1.00	5 - 7
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 14
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	above 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Descriptive Term(s) of other constituents	Percent of Dry Weight
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

GSU South Campus Roadway Extension ■ Statesboro, Georgia

March 11, 2021 ■ Terracon Project No. ES205298

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ³ 4 and 1 £ Cc £ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or 1 > Cc > 3 [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ³ 6 and 1 £ Cc £ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or 1 > Cc > 3 [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above “A”		CL	Lean clay [K,L,M]
			PI < 4 or plots below “A” line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K,L,M,N] / Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above “A” line		CH	Fat clay [K,L,M]
			PI plots below “A” line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K,L,M,P] / Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ³ 15% sand, add “with sand” to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add “with organic fines” to group name.

[I] If soil contains ³ 15% gravel, add “with gravel” to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add “with sand” or “with gravel,” whichever is predominant.

[L] If soil contains ³ 30% plus No. 200 predominantly sand, add “sandy” to group name.

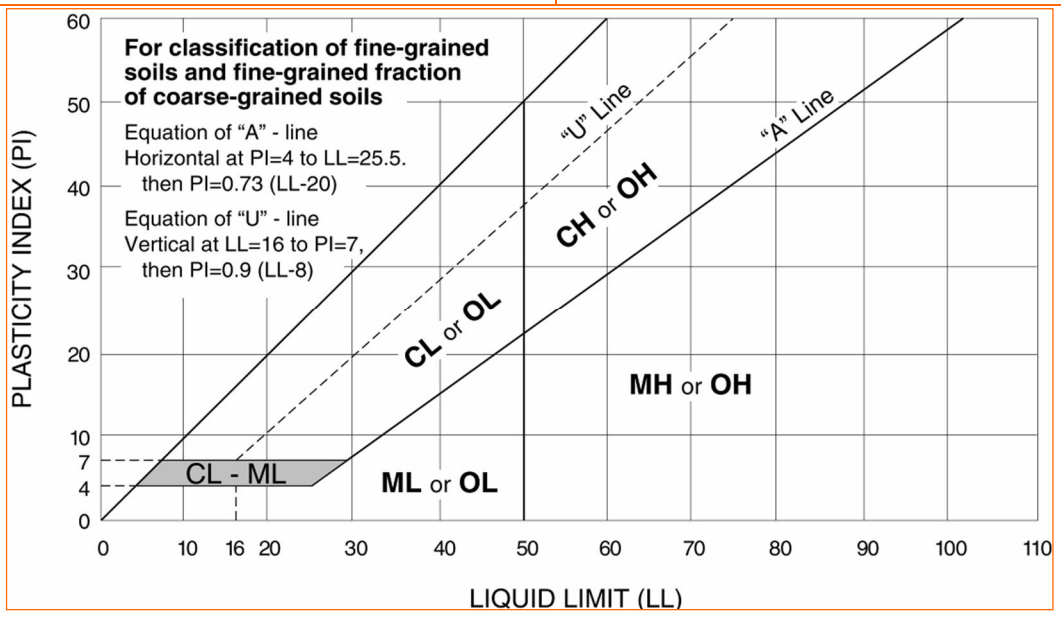
[M] If soil contains ³ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] PI ³ 4 and plots on or above “A” line.

[O] PI < 4 or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.



Geotechnical Engineering Report

GSOU Akins Boulevard Extension
Statesboro, Bulloch County, Georgia
June 15, 2020
Terracon Project No. ES205117

Prepared for:
Georgia Southern University
Statesboro, Georgia

Prepared by:
Terracon Consultants, Inc.
Savannah, Georgia

June 15, 2020

Georgia Southern University
405 Squire Pope Road
Statesboro, Georgia 29926

Attn: Mr. Kirk Tatum – P.E.
P: (912) 478 0686
E: vtatum@georgiasouthern.edu

Re: Geotechnical Engineering Report
GSOU Akins Boulevard Extension
Statesboro, Bulloch County, Georgia
Terracon Project No. ES205117

Dear Mr. Tatum:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PES205117 dated April 14, 2020. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning recommended pavement options and design parameters for the proposed project.

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

Sincerely,
Terracon Consultants, Inc.

Daniel Laitano, E.I.T.
Staff Geotechnical Engineer

Guoming Lin, Ph.D., P.E., D.GE
Senior Consultant

REPORT TOPICS

REPORT COVER PAGE 1
REPORT COVER LETTER TO SIGN 1
REPORT TOPICS 1
REPORT SUMMARY I
INTRODUCTION 1
SITE CONDITIONS 1
PROJECT DESCRIPTION 2
GEOTECHNICAL CHARACTERIZATION 2
RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION 4
EARTHWORK 5
PAVEMENTS 7
GENERAL COMMENTS 11
ATTACHMENTS 13

Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

APPENDIX A – EXPLORATION PLAN AND PROCEDURES
APPENDIX B – EXPLORATION AND TESTING RESULTS
APPENDIX C – SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

Topic [1]	Overview Statement [2]
Project Description	- Georgia Southern University plans to extend Akins Boulevard approximately 0.28 miles south of its intersection with Veterans Memorial Parkway. The roadway will serve as an addition to the university's bus routes to help students commute between campus and the future commercial development via Tormenta Way (southwest of bypass connection).
Geotechnical Characterization	- Approximately 6 inches of topsoil. The thickness of topsoil will vary, depending upon the near-surface soil disturbance during the site preparation. Please refer to the **Geotechnical Characterization** section. - In general, the site consists of varying soils, from loose to medium dense/dense sands with interbedded soft/medium stiff sandy silts/clays to approximately 32 to 35 feet. - Groundwater was encountered at approximately 0.5 and 5 feet below ground surface (BGS) at the time of our field exploration.
Earthwork	- Install a site drainage system, - Strip/grub topsoil - Level, densify, proofroll subgrade during subgrade preparation. If detected any soft/weak areas, repair subgrade by densification or undercut and backfill. For details, please refer to the **Earthwork** section.
Pavements	Based on the traffic information provided, we recommend the following pavements after the subgrade has been prepared as noted in **Earthwork** section. <u>Concrete:</u> ■ 7" PCC over 4" graded aggregate base (GAB) <u>Asphalt:</u> ■ 4" ACC over 8" graded aggregate base (GAB)
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Geotechnical Engineering Report

GSOU Akins Boulevard Extension

Statesboro, Bulloch County, Georgia

Terracon Project No. ES205117

June 15, 2020

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed improvements to be located southeast of the intersection of Veterans Memorial Parkway and Old Register Road in Statesboro, Georgia. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of 2 CPT borings and 9 Hand Auger borings to depths ranging from approximately 5 to 35 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Appendix A**.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located southeast of Veterans Memorial Parkway and Old Register Road intersection in Statesboro, Bulloch County, Georgia. See **Appendix A.**
Existing Improvements	None.
Current Ground Cover	Partially-wooded areas.
Existing Topography	Relatively level.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. Our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Georgia Southern University plans to extend Akins Boulevard approximately 0.28 miles south of its intersection with Veterans Memorial Parkway.
Project Description	We understand the site has no previous improvements, however it is noted that the project location is adjacent to an active construction area to the northwest. Underground utility lines are expected near the project's boundaries with existing roads.
Proposed Structure	Boulevard extension.
Finished Grade Elevation[1]	EL.=200 ft., NAVD 88. Based on information provided by the client, 15 feet of fill material will be placed near the bypass connection.
Pavements[1]	Both rigid (concrete) and flexible (asphalt) pavement sections may be considered. Anticipated traffic is as follows: ■ Autos/light trucks: 3,000 vehicles per day ■ Light delivery and trash collection vehicles: 20-30 vehicles per day ■ Tractor-trailer trucks: <3 vehicles per week The pavement design period is 20 years.

1. Information provided by the client.

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned construction. The following table provides our geotechnical characterization.

Typical Soil Profile

Soil Profile 1 (based on CPT Sounding C1)

Stratum	Approx. Depth to Bottom of Stratum (feet) BGS[1]	Material Characterization	Consistency/ Relative Density
Topsoil[2]	0.75 to 1	Silty sands with grass roots.	n/a
1	7	Silty sands or sands with silt	Loose to medium dense

Stratum	Approx. Depth to Bottom of Stratum (feet) BGS[1]	Material Characterization	Consistency/ Relative Density
2	10	Sandy silts	Medium stiff
3 (varying soils)	18	Silty sand with interbedded sandy silt	Medium dense
		Sandy silt with interbedded silty sand	Stiff to very stiff
4 (varying soils)	28.5	Sandy clay with interbedded sandy silt	Stiff
		Sandy silt with interbedded sandy clay	
5 (varying soils)	35, end of sounding	Silty sand with interbedded sandy silt	Medium dense
		Sandy silt with interbedded silty sand	Very stiff to hard

Notes:

1. BGS = Below Ground Surface
2. The depth/thickness of topsoil will vary, depending upon the near-surface soil disturbance during the site preparation.

Soil Profile 2 (based on CPT Sounding C2)

Stratum	Approx. Depth to Bottom of Stratum (feet) BGS[1]	Material Characterization	Consistency/ Relative Density
Topsoil[2]	0.5	Clayey sands with grass roots.	n/a
1	5	Clayey to silty sands	Loose to medium dense
2	8	Sandy silts	Medium stiff
3	32, end of sounding	Silty sands	Medium dense to very dense

Notes:

1. BGS = Below Ground Surface
2. The depth/thickness of topsoil will vary, depending upon the near-surface soil disturbance during the site preparation.
3. Based on HA3, wood debris was encountered at approximately 2 feet BGS.

Conditions encountered at each exploration location are indicated on the individual logs shown in the **Appendix B** section and are attached to this report. Stratification boundaries on the CPT/boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. The water levels observed in the boreholes can be found on the logs in **Appendix B**, and are summarized below.

Groundwater was observed between 2 and 5 feet below ground surface at Hand Auger boring locations HA1 through HA4 and HA8.A layer of perched groundwater was discovered between 0.5 and 1 foot below ground surface, according to CPT Borings C1 and C2.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed.

Therefore, groundwater levels during construction or at other times in the life of the pavements may be higher or lower than the levels indicated on the logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

The following evaluation and recommendations are based upon our understanding of the proposed construction and the results from our field exploration. If the above-described project conditions are incorrect or changed after this report, or subsurface conditions encountered during construction are significantly different from those reported, Terracon should be notified, and these recommendations must be re-evaluated to make appropriate revisions.

Geotechnical Considerations

The subsurface conditions in the upper 15 feet BGS are relatively consistent across the site and are considered typical for the area. The generalized soil profile is presented in **Geotechnical Characterization**.

The information regarding the structural loads is included in **Project Description** of this report. Shallow foundation settlement analyses were performed at each sounding location using the soil parameters derived from the CPT soundings and the provided estimated fill height of 15 feet near the bypass connection. Based on the settlement analyses, total settlements from the embankment were estimated to be less than 1 inch in the roadway areas.

The information regarding the traffic loads is included in **Project Description** of this report. In general, the insitu soils are adequate for pavement support as subgrade material after proper densification and proofrolling has been performed. However, based on the soil profile determined by the hand auger borings, it is expected that organics will be present approximately 0.5 to 2 feet

below ground surface. A more detailed discussion of the site preparation for construction can be found in the **Earthwork** section.

During the site preparation, the clayey soils below the existing ground surface will be exposed and will likely cause an unstable subgrade for support, especially if the subgrade is exposed to rainwater. To achieve a stable subgrade, the contractor should expect undercutting and backfilling of these soft areas or use cement or lime to stabilization to treat the subgrade. It is anticipated that subgrade undercutting and backfilling will be required in that soft area for support and pavement area unless cement stabilization is used. The need and extent of subgrade improvement should also be evaluated in consideration of the fill thickness and site drainage conditions. We recommend undercutting and backing be performed at least 2 feet below the roadway at locations near C2 if the proposed final elevation is closer to that of the existing grade elevation.

We recommend hand auger borings, and dynamic cone penetration (DCP) testing be performed during construction to evaluate and confirm the subgrade conditions under the embankment. It is anticipated that subgrade soil undercutting will be required during subgrade preparation for the foundation.

EARTHWORK

Earthwork is anticipated to include clearing and grubbing, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for the proposed pavements. The site work conditions will be largely dependent on the weather conditions and the contractor's means and methods for controlling surface drainage and protecting the subgrade.

Site Preparation

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed paving areas.

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck. The proofrolling should be performed under the direction of the Geotechnical Engineer. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. Excessively wet or dry material should either be removed, or moisture conditioned and recompacted.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill. Earthen materials used for structural should meet the following material property requirements:

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Granular	GW, GP, GM, GC, SW, SP, SM, SC	Less than 25% Passing No. 200 sieve

1. Structural should consist of approved materials free of organic matter and debris. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.

Based on the findings from our hand auger borings, the subject site consists of soils varying from silty sands (SM) to clayey sands (SC) to sandy clays (CL) in the upper 5 feet BGS. The silty sands (SM) are generally considered marginally suitable for structural fill, provided that the soils are free of roots, organics or other foreign materials. Clayey sands (SC) may be considered marginally suitable; and the sandy clays (CL) are deemed unsuitable for structural fill.

We define marginally suitable as the soils that may require extra effort to adjust moisture before they can be compacted. The amount of effort required will be highly dependent on the season and the weather conditions during construction. We recommend Terracon be retained during construction to determine the suitability of the onsite soil as fill material.

Fill Compaction Requirements

Structural should meet the following compaction requirements.

Item	Structural Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Minimum Compaction Requirements [1]	95% of max. below foundations and below finished pavement subgrade
Water Content Range [1]	Granular: -3% to +3% of optimum

1. Maximum density and optimum water content as determined by the modified Proctor test (ASTM D 1557).

Some manipulation of the moisture content (such as wetting, drying) will be required during the filling operations to obtain the required degree of compaction. The manipulation of the moisture content is highly dependent on weather conditions and site drainage conditions. Therefore, the contractor should prepare both dry and wet fill materials to obtain the specified compaction during

grading. A sufficient number of density tests should be performed to confirm the required compaction of the fill material.

Site Drainage

An effective drainage system should be installed prior to site preparation and grading activities to intercept surface water and to improve overall shallow drainage. The drainage system may consist of perimeter ditches supplemented with parallel ditches and swales. Pumping equipment should be prepared if the above ditch system cannot effectively drain water away from the site, especially during the rainy season. The site should be graded to shed water and avoid ponding over the subgrade.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling, and mitigation of areas delineated by the proofroll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 5,000 square feet in pavement areas.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

PAVEMENTS

General Pavement Comments

We understand the proposed development will include the extension of Akins Boulevard located south from its intersection with Veterans Memorial Parkway. This section presents thickness recommendations for asphalt concrete and Portland cement concrete pavements and general considerations for the pavement construction. Pavement thickness design is dependent upon:

- The traffic loads including traffic pattern and the service life of the pavement;
- Subgrade conditions including soil strength and drainage characteristics;
- Paving material characteristics;
- Climatic conditions of the region.

We understand the boulevard extension will include pavements for approximately 3000 car/light truck vehicles per day, 20 to 30 light delivery trucks/buses per day, and 2 to 3 tractor-trailer trucks per day. Based on our experience with similar projects in this area, we have provided rigid and flexible pavement sections shown in the following tables.

A detailed pavement evaluation can be performed if traffic load information is made available. As typical for pavement, it should be noted maintenance repairs are typically required after a period of 7 to 10 years to keep the pavement in acceptable condition.

The following tables provide options for AC and PCC Sections. If asphalt pavement is used for the truck parking area, we recommend concrete pads be constructed in areas with truck turning. In general, concrete pavement performs better in areas with frequent turning and concrete pavements are more commonly used for trailer truck parking.

Recommended paving material characteristics, taken from the Georgia Department of Transportation's (GDOT) 2001 edition of Standard Specifications for Construction of Transportation Systems, are included for the asphalt concrete sections.

Asphalt Pavement Design Recommendations

Material	**Minimum Section Thickness** (inch)
Asphalt Surface Course[1]	2
Asphalt Intermediate Course[1]	2
Aggregate Base Course[1]	8
Total Pavement Section	**12**
Select fill[2] / improved subgrade[3]	24

1. Asphalt concrete and base course materials should conform to the following GDOT material specifications.
   - Section 815 for Graded Aggregate
   - Section 828 for Hot Mix Asphalt Concrete Mixture. Surface course may use 12.5 mm Superpave.
2. The select fill should be relatively clean sands with percent fines less than 15%. The fill material should be compacted to a minimum of 95% of the soil's Modified Proctor maximum dry density (ASTM D-1557).
3. If SP or SP-SM or SM soils exist at the proposed subgrade elevation extending to a depth at least 24 inches below the proposed subgrade level, the in-situ soils can replace the select fill, and the subgrade should be improved using densification as discussed in the **Earthwork** section.

Notes:

- Proper surface and subgrade drainage system should be installed to avoid saturation of subgrade soils underneath the asphalt pavements. The site drainage should be designed to maintain the groundwater at least 2 feet below the top of the subgrade.
- Some subgrade soil undercutting and backfilling with suitable structural fill will be required if unstable subgrade soils are encountered during subgrade preparation. The use of geogrid (Tensar BX1100 or equivalent) may be necessary to help reduce the depth of undercut to achieve stability if the unstable subgrade soils extend to greater depths. The need for geogrid and/or the need for undercutting and backfilling should be determined in the field during subgrade preparation.

Concrete Pavement Design Recommendations

Material	Minimum Section Thickness (inch)
Concrete[1]	7
Graded aggregate base[2]	4
Select fill[3] / improved subgrade[4]	24

1. The concrete should be air entrained and have a minimum compressive strength of 4,000 psi after 28 days of lab curing per ASTM C-31.
2. Graded aggregate base should conform to the GDOT material specification Section 815.
3. The select fill should be relatively clean sands with percent fines less than 15%. The fill material should be compacted to a minimum of 95% of the soil's Modified Proctor maximum dry density (ASTM D-1557).
4. If SP or SP-SM or SM soils exist at the proposed subgrade elevation extending to a depth at least 24 inches below the proposed subgrade level, the in-situ soils can replace the select fill and the subgrade should be improved using densification as discussed in **Earthwork** section.

Notes:

- Concrete joints should be sealed properly to avoid ingress of surface water into the subgrade soils. We recommend a joint spacing of 12 feet. A jointing plan should be developed to avoid irregular shaped panels to control shrinkage cracking. Proper surface and subgrade drainage system should be installed to avoid saturation of subgrade soils underneath the concrete pavements. The site drainage should be designed to maintain the groundwater at least 2 feet below the top of the subgrade.
- Some subgrade soil undercutting and backfilling with suitable structural fill will be required if unstable subgrade soils are encountered during subgrade preparation. The use of geogrid (Tensar BX1100 or equivalent) may be necessary to help reduce the depth of undercut to achieve stability if the unstable subgrade soils extend to greater depths. The need for geogrid and/or the need for undercutting and backfilling should be determined in the field during subgrade preparation.
- In the areas with truck turning, the pavement should be designed to resist lateral sliding from the truck turning force. Additional measures such as aggregate base course, tied edge panels and key ways along the curbs may be considered to add the lateral resistance against sliding.

For the pavement support, the subgrade conditions can often be the overriding factor in pavement performance. The subgrade conditions will depend on the in-situ soils at the subgrade level, characteristics of fill material for the subgrade, as well as site preparation procedures.

The site grading plan has not been available at this time. We anticipate the finished subgrade elevation will be near the existing ground surface. Beneath the top soil layer, our hand auger borings encountered soils varying from fine silty to clayey sands to sandy clays. The silty sands should have good drainage characteristics and are deemed suitable for the pavement subgrade support. The clayey sands/sandy clays should not be used for the subgrade support due to poor drainage.

If, during construction, clayey sands or sandy clays are encountered at the subgrade level, the upper (2) feet of the subgrade should be replaced with relatively clean sands with less than 15 percent fines. Based on the in-situ soils at the site and typical imported fills available in this area, a California Bearing Ratio (CBR) value of 8 has been estimated.

For the pavements subject to concentrated and repetitive heavy loading conditions such as container parks, truck delivery docks and ingress/egress aprons, we recommend Portland cement concrete pavement with a minimum thickness of 8 inches. The concrete pavement can be poured over compacted granular subgrade (sand) or on at least 4-inches of graded aggregate base (GAB stone).

We emphasize the use of the stone base under the pavement even though the stone base is not part of the pavement structural design. Based on our experience, the stone base can be significantly help improve the constructability during construction especially in rainy seasons. Furthermore, the stone base will help maintain subgrade stability and support when the subgrade is wet due to rise of groundwater or infiltration of surface water through the pavement joints or cracks. The stone base enhances pavement constructability condition during construction and long-term performance. We recommend the use of stone base be considered based on the cost benefit analysis.

The above rigid and flexible pavement sections represent the minimum design thicknesses and, as such, periodic maintenance should be anticipated. Prior to the placement of the crushed stones, the pavement subgrade should be thoroughly proofrolled.

Pavement Construction Considerations

Pavement subgrades prepared early in the project should be carefully evaluated as the time for pavement construction approaches. We recommend the pavement areas be rough graded and then thoroughly proofrolled with a loaded tandem-axle dump truck.

Particular attention should be paid to the high traffic areas that were rutted and disturbed, and to the areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fill. After

proofrolling and repairing subgrade deficiencies, the entire subgrade should be scarified to a depth of 12 inches, and uniformly compacted to at least 95% of the materials' modified Proctor maximum dry density.

Pavement and Subgrade Drainage

Poor subgrade drainage is the most common cause of pavement failure. Pavement should be sloped to provide rapid drainage of surface water. Water should not be allowed to pond on or adjacent to the pavement, which would saturate the subgrade soils and weaken the subgrade support. We recommend the site drainage be designed to maintain the groundwater at least two (2) feet below the top of the subgrade.

Pavement subgrade drainage should be installed surrounding the areas anticipated for frequent wetting or having poor natural drainage, such as landscaped islands, along curbs and gutters and around drainage structures. All landscaped areas in or adjacent to pavements should be sealed to reduce the moisture migration to subgrade soils. Subgrade drains should be installed with the pipe bottom at least two (2) feet below the top of the select fill. The civil engineer should decide the placement of the subgrade drains to avoid the saturation of pavement subgrade.

Pavement Maintenance

The performance of pavements will require regular maintenance. One key component of the maintenance is to minimize infiltration of water into the pavement base and subgrade. Preventive maintenance should include crack and joint sealing and patching as well as overall surface sealing and overlay. Additional engineering observation and evaluation is recommended prior to any major maintenance.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of

pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

APPENDIX A – EXPLORATION PLAN AND PROCEDURES

APPENDIX B – EXPLORATION AND TESTING RESULTS

APPENDIX C – SUPPORTING INFORMATION

APPENDIX A

EXPLORATION PLAN AND PROCEDURES

- **Exhibit A-1** Site Location Plan
- **Exhibit A-2** Exploration Plan
- **Exhibit A-3** Exploration Procedures

EXHIBIT A-1 - SITE LOCATION PLAN

GSOU Akins Blvd Extension ■ Statesboro, Bulloch County, Georgia
June 15, 2020 ■ Terracon Project No. ES205117

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

MAP PROVIDED BY MICROSOFT BING MAPS

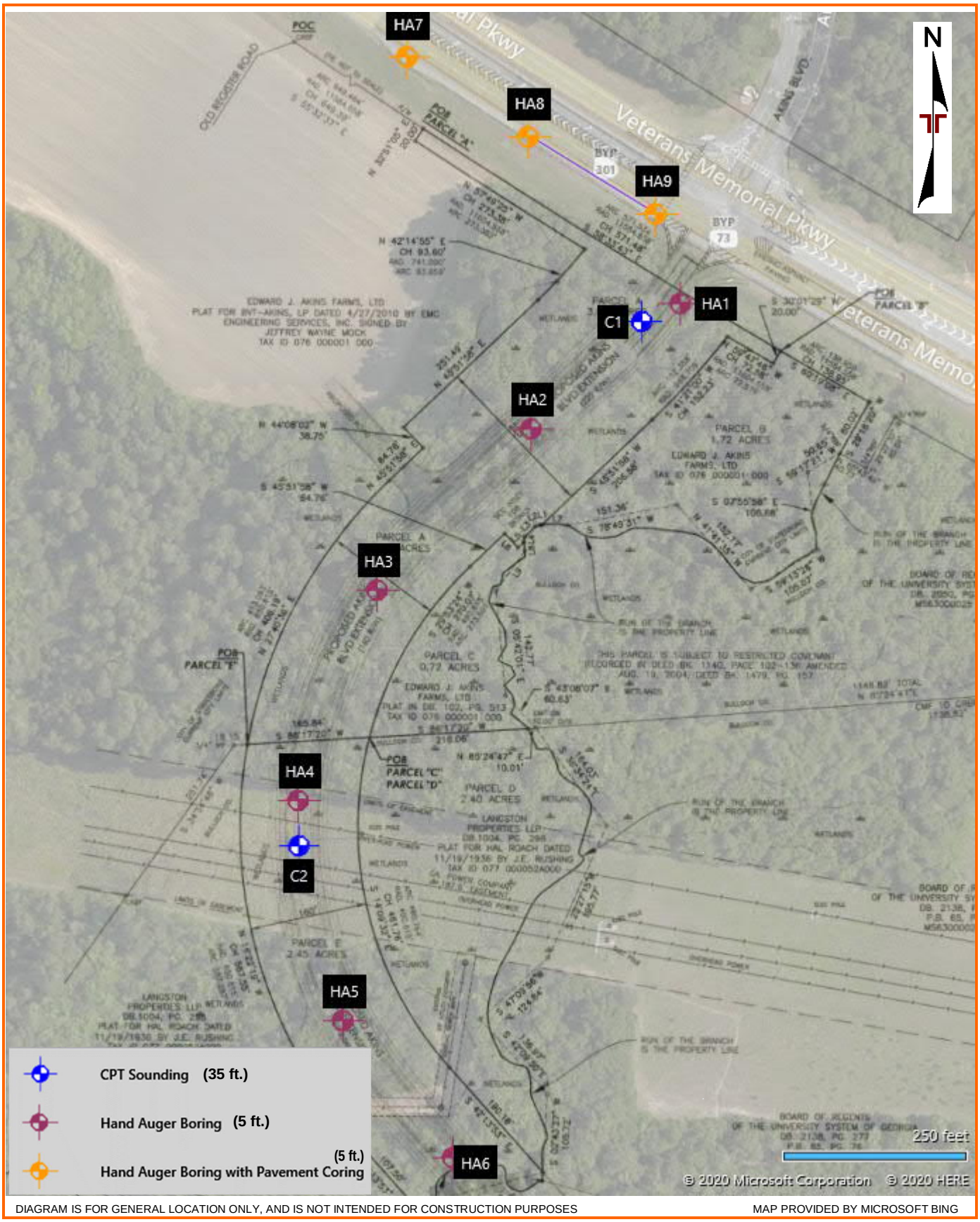


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING

Field Exploration

No. of Test	Type of Test	Location	Maximum Depth (feet, below ground surface)
1	Cone Penetration Test (CPT) Sounding	South side of Veterans Memorial Parkway and Akins Boulevard intersection	35
1	Cone Penetration Test (CPT) Sounding	Georgia Power easement	32
6	Hand Auger Boring	Proposed Akins Boulevard extension	5
3	Hand Auger Boring with Pavement Coring	Veterans Memorial Parkway (eastbound)	5

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet). The elevations on the borings were interpreted from the topographic survey plan provided the client and should be considered approximate.

Subsurface Exploration Procedures: CPT soundings were performed in accordance with ASTM D-5778. In the CPT soundings, an electronically instrumented cone penetrometer is hydraulically pushed through the soil to measure tip stress, sleeve friction and pore water pressure. The CPT data can be used to determine soil stratigraphy and to estimate soil parameters such as undrained shear strength and modulus of compression.

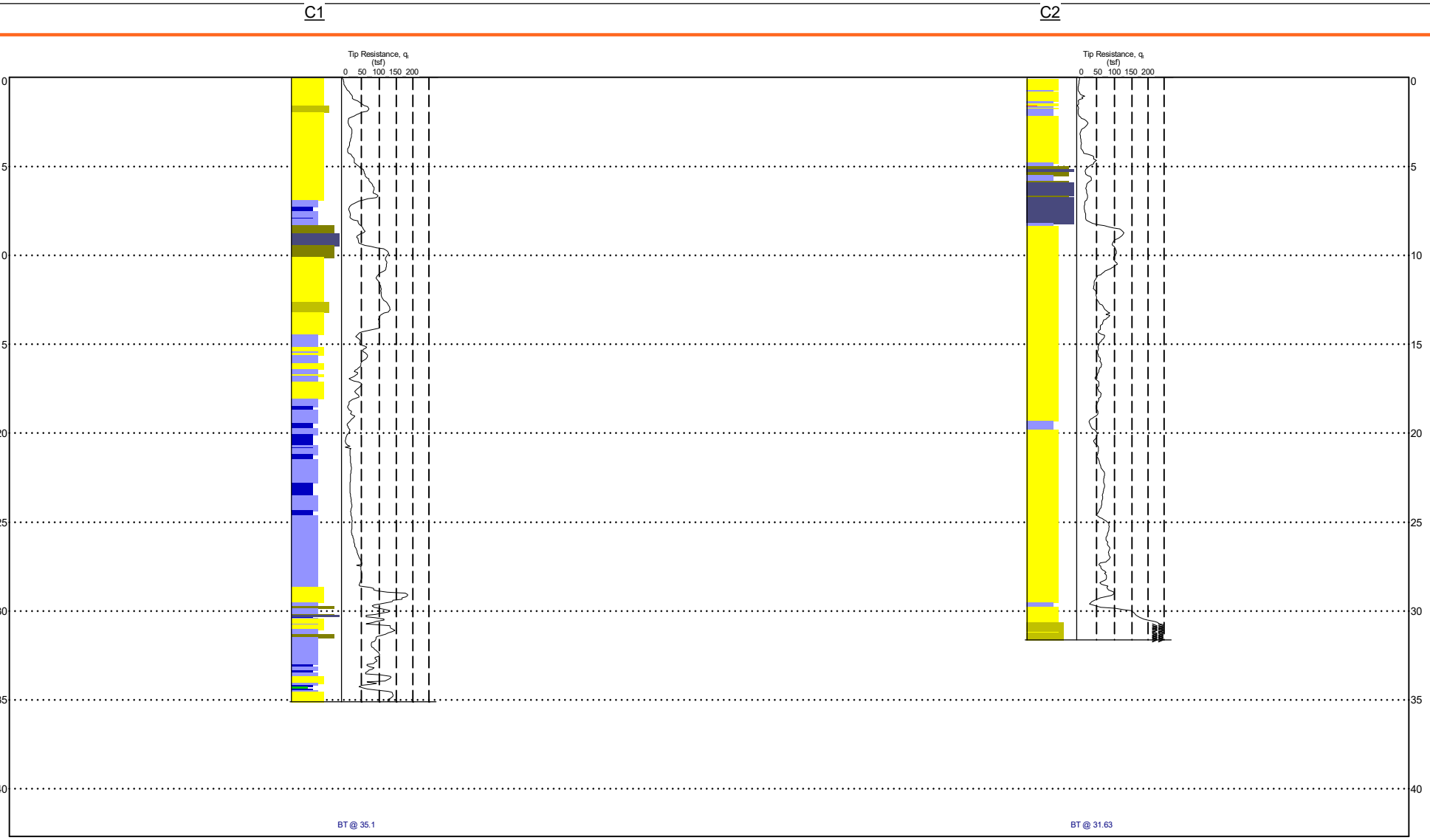
Hand auger borings were conducted in general accordance with ASTM D 1452-80 to determine the subsurface conditions at shallow depths. In this test, the hand auger boring is drilled by rotating and advancing a bucket auger to the desired depths while periodically removing the auger from the hole to clear and examine the auger cuttings. The soils will be visually classified by a geotechnical engineer or geologist in accordance with ASTM D-2488.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples.

APPENDIX B

EXPLORATION AND TESTING RESULTS

- **Exhibit B-1** Subsurface Profile
- **Exhibit B-2** CPT Sounding Logs
- **Exhibit B-3** Hand Auger Boring Logs
- **Exhibit B-4** Pavement Core Photos



Explanation

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

NOTES:
See Exhibit B-2 for orientation of soil profile.
See General Notes in Appendix C for symbols and soil classifications.
Soils profile provide dfor illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: DL	Project No.: ES205117
Drawn by: DL	Scale: N.T.S.
Approved by: GL	File Name: ES205117
Date: 6/8/2020	

Terracon
2201 Rowland Avenue
Savannah, Georgia
PH. 912-629-4000 FAX. 912-629-4001

SUBSURFACE PROFILE

GSOU AKINS BLVD EXTENSION
AKINS BOULVERAD
STATESBORO, GA

EXHIBIT
B-1

CPT LOG NO. C1

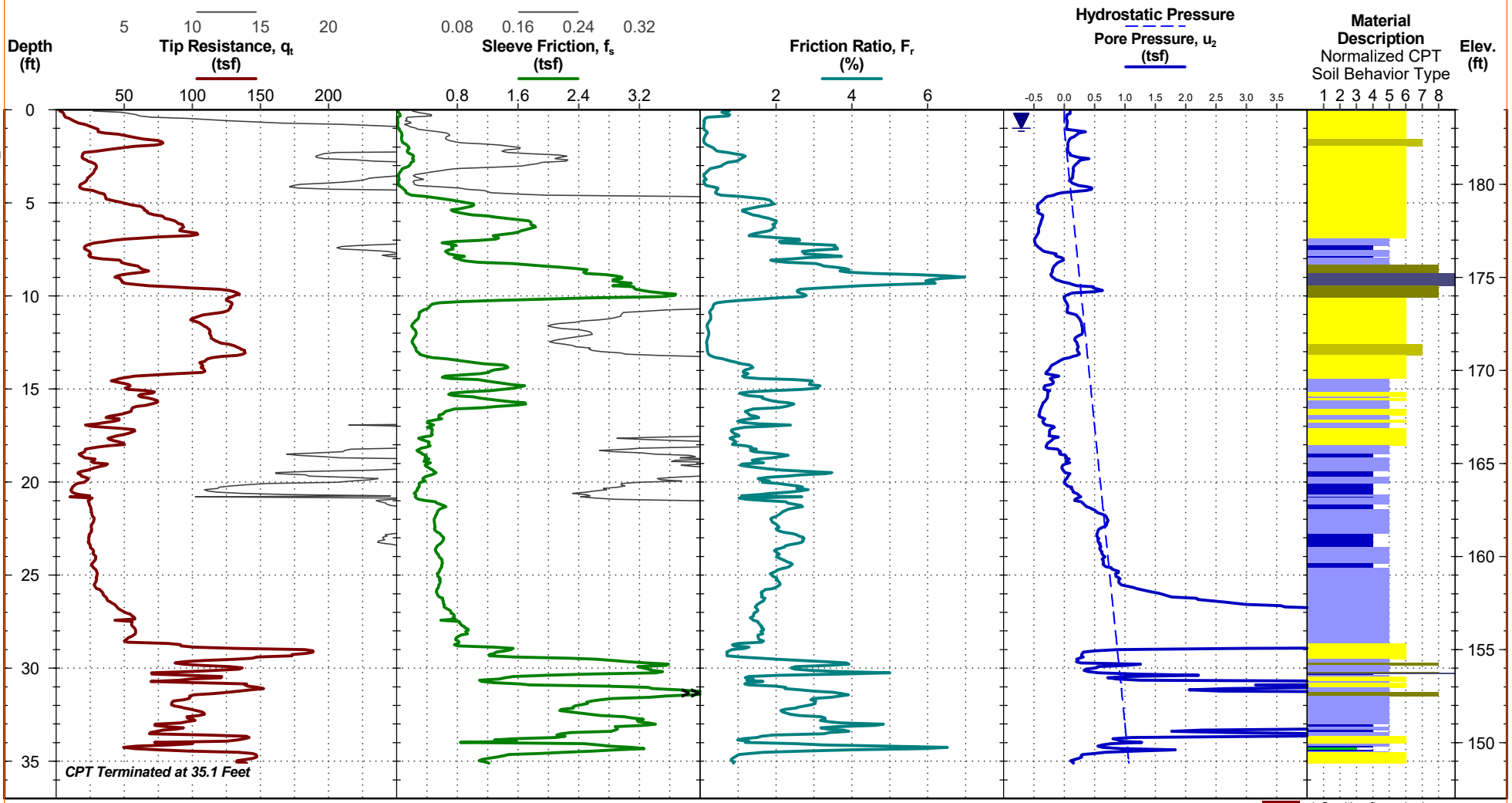
PROJECT: GSOU Akins Blvd Extension

CLIENT: Georgia Southern University
Statesboro, GA

TEST LOCATION: See Exploration Plan

Surface Elev.: 184 ft
Latitude: 32.40991°
Longitude: -81.79049°

SITE: Akins Boulverad
Statesboro, GA



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Elevations were provided by others.

CPT sensor calibration reports available upon request.

WATER LEVEL OBSERVATION

1 ft estimated water depth
(used in normalizations and correlations; See Supporting Information)

Probe no. 5311 with net area ratio of .874
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 1/7/2020
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
2201 Rowland Ave
Savannah, GA

CPT Started: 5/6/2020
CPT Completed: 5/6/2020
Rig: Geoprobe
Operator: BR
Project No.: ES205117

Exhibit B-2-1

CPT LOG NO. C2

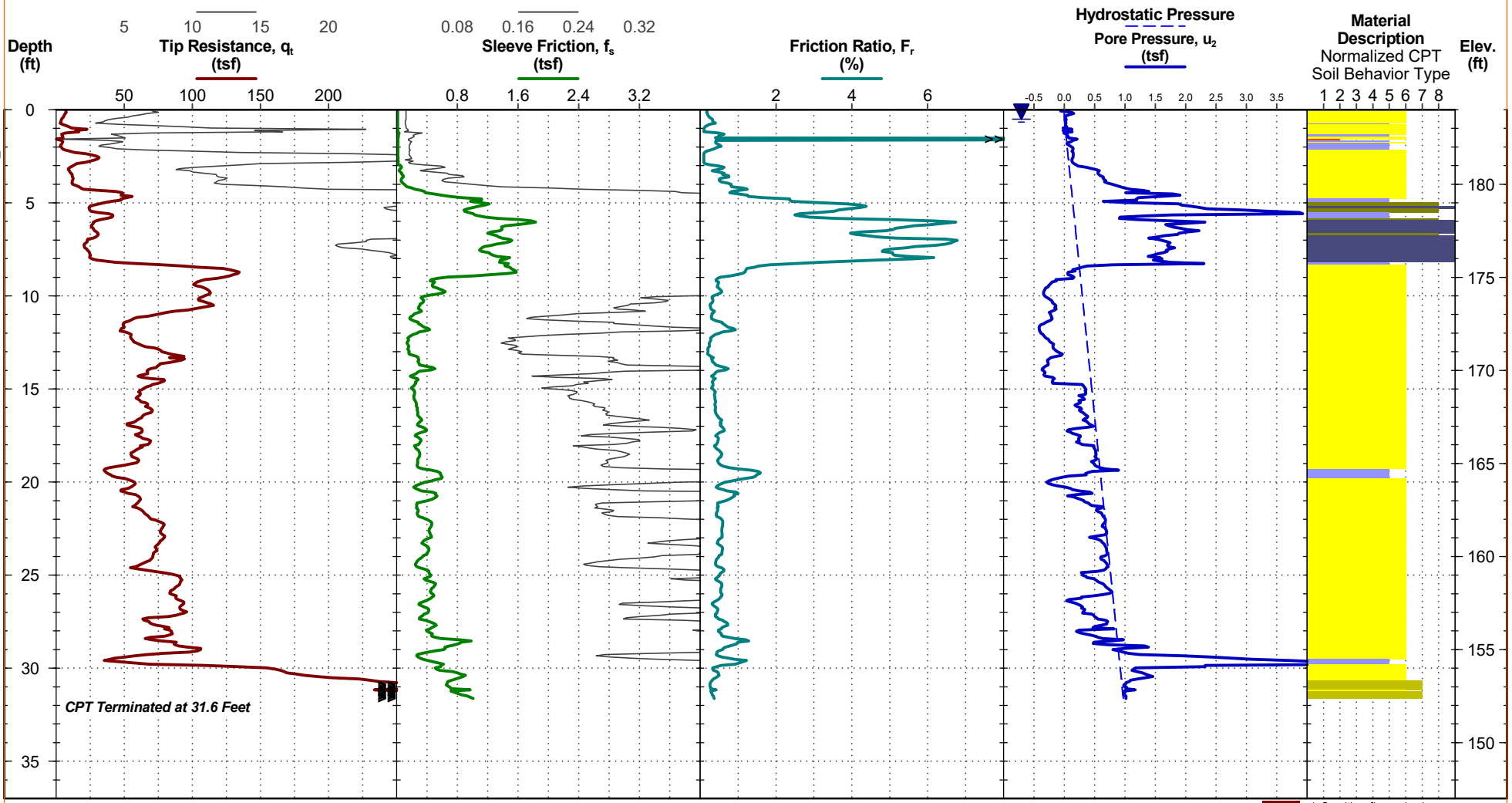
PROJECT: GSOU Akins Blvd Extension

CLIENT: Georgia Southern University
Statesboro, GA

TEST LOCATION: See Exploration Plan

Surface Elev.: 184 ft
Latitude: 32.4086°
Longitude: -81.79149°

SITE: Akins Boulverad
Statesboro, GA



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Elevations were provided by others.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 0.5 ft measured water depth
(used in normalizations and correlations; See Supporting Information)

Probe no. 5311 with net area ratio of .874
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 1/7/2020
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
2201 Rowland Ave
Savannah, GA

CPT Started: 5/6/2020
CPT Completed: 5/6/2020
Rig: Geoprobe
Operator: BR
Project No.: ES205117

Exhibit B-2-2

Hand Auger Boring Log

Project Name: GSOU Akins Boulevard Extension
Project No.: ES205117
Project Location: Statesboro, Bulloch County, Georgia

Test Date: 5/21/2020
Completed by: CRR

HA1			
Depth (in., BGS)	Material Description	Moisture	USCS Classification
0 to 12	Dark brown fine silty SAND with pine straw and roots	Moist	SM
12 to 30	Gray/orange fine clayey SAND	Moist	SC
30 to 36	Gray/orange sandy CLAY	Moist	CL
36to 60	Gray/orange sandy CLAY	Wet	CL
Groundwater @ 36" BGS		No mottling	

HA2			
Depth (in., BGS)	Material Description	Moisture	USCS Classification
0 to 8	Dark brown fine silty SAND with roots and pine straw	Moist	SM
8 to 18	Gray fine clayey SAND	Moist	SC
18 to 48	Gray fine clayey SAND	Wet	SC
48 to 60	Gray / orange sandy CLAY	Wet	CL
Groundwater @ 18" BGS		No mottling	

HA3			
Depth (in., BGS)	Material Description	Moisture	USCS Classification
0 to 48	Orange/red/brown/gray fine clayey SAND with wood @ 24" BGS	Moist	SC
48 to 60	Orange/red/brown/gray fine clayey SAND	Wet	SC
Groundwater @ 48" BGS		No mottling	

HA4			
Depth (in., BGS)	Material Description	Moisture	USCS Classification
0 to 24	Red/orange/brown fine clayey SAND	Moist	SC
24 to 60	Orange/gray/red clayey SAND	Wet	SC
Groundwater @ 24" BGS		Mottling @ 24" BGS	

HA5			
Depth (in., BGS)	Material Description	Moisture	USCS Classification
0 to 3	Orange/gray fine clayey SAND with roots	Moist	SC
3 to 8	Dark brown fine silty SAND with roots	Moist	SM
8 to 24	Dark brown fine silty SAND	Moist	SM
24 to 60	Dark brown/red/orange/gray sandy CLAY	Moist	CL
No groundwater		Mottling @ 42" BGS	

Note: BGS = Below Ground Surface

Hand Auger Boring Log

Project Name: GSOU Akins Boulevard Extension
Project No.: ES205117
Project Location: Statesboro, Bulloch County, Georgia

Test Date: 5/21/2020
Completed by: CRR

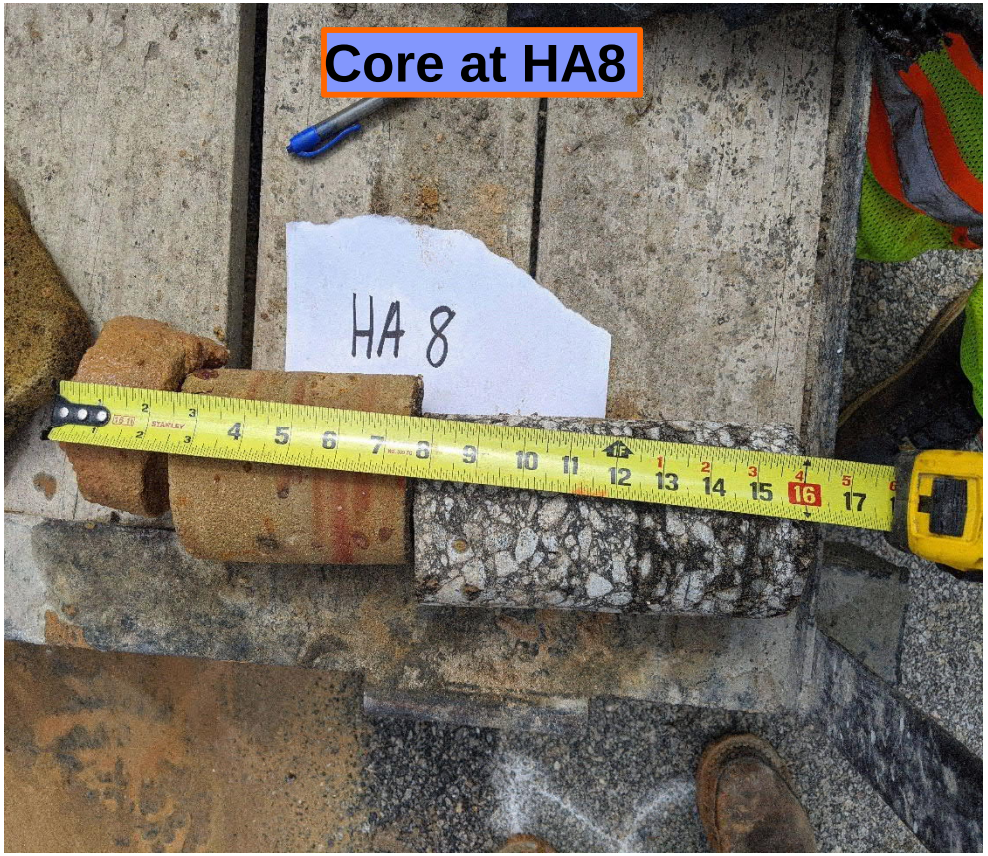
HA6			
Depth (in., BGS)	Material Description	Moisture	USCS Classification
0 to 5	Orange/gray fine clayey SAND	Moist	SC
5 to 36	Dark brown fine silty SAND	Moist	SM
36 to 48	Red/orange/brown fine to medium silty SAND	Wet	SM
48 to 60	Gray fine to medium SAND with silt	Wet	SP-SM
Groundwater @ 36" BGS		No mottling	

HA7			
Depth (in., BGS)	Material Description	Moisture	USCS Classification
0 to 9	Asphalt	--	--
9 to 17	Soil-cement mix course	--	--
17 to 60	Red/orange/brown fine clayey SAND	Moist	--
No groundwater		No mottling	

HA8			
Depth (in., BGS)	Material Description	Moisture	USCS Classification
0 to 8.5	Asphalt	--	--
8.5 to 16	Soil-cement mix course	--	--
16 to 60	Red/orange/brown fine clayey SAND	Moist	--
Groundwater @ 60"BGS		No mottling	

HA9			
Depth (in., BGS)	Material Description	Moisture	USCS Classification
0 to 9.25	Asphalt	--	--
9.25 to 48	Red/orange/brown fine clayey SAND	Moist	SC
at 48	Refusal due to gravel	--	--
No groundwater		No mottling	

Note: BGS = Below Ground Surface



Project Manager:	DL
Drawn by:	JS
Checked by:	GL
Approved by:	GL

Project No.	ES205117
Scale:	N.T.S.
File Name:	
Date:	5/21/2020

Terracon
Consulting Engineers & Scientists
2201 Rowland Avenue Savannah, Georgia 31404
Phone (912) 629 4000 Fax (912) 629 4001

PAVEMENT CORING SAMPLE PHOTOS

GSOU Akins Blvd Extension
Statesboro, Georgia

Exhibit:

B-4-1

Project Manager:	DL
Drawn by:	JS
Checked by:	GL
Approved by:	GL

Project No.	ES205117
Scale:	N.T.S.
File Name:	
Date:	5/21/2020

Terracon
Consulting Engineers & Scientists
2201 Rowland Avenue Savannah, Georgia 31404
Phone (912) 629 4000 Fax (912) 629 4001

PAVEMENT CORING SAMPLE PHOTOS

GSOU Akins Blvd Extension
Statesboro, Georgia

Exhibit:

B-4-2

APPENDIX C

SUPPORTING DOCUMENTS

- **Exhibit C-1** CPT General Notes
- **Exhibit C-2** General Notes
- **Exhibit C-3** Unified Soil Classification System

CPT GENERAL NOTES

DESCRIPTION OF MEASUREMENTS AND CALIBRATIONS

To be reported per ASTM D5778:

Uncorrected Tip Resistance, q_c
Measured force acting on the cone divided by the cone's projected area

Corrected Tip Resistance, q_t
Cone resistance corrected for porewater and net area ratio effects
$q_t = q_c + U2(1 - a)$

Where a is the net area ratio, a lab calibration of the cone typically between 0.70 and 0.85

Pore Pressure, U1/U2
Pore pressure generated during penetration
U1 - sensor on the face of the cone
U2 - sensor on the shoulder (more common)

Sleeve Friction, fs
Frictional force acting on the sleeve divided by its surface area

Normalized Friction Ratio, FR
The ratio as a percentage of fs to q_t, accounting for overburden pressure

To be reported per ASTM D7400, if collected:

Shear Wave Velocity, Vs
Measured in a Seismic CPT and provides direct measure of soil stiffness

DESCRIPTION OF GEOTECHNICAL CORRELATIONS

Normalized Tip Resistance, Q_t
$Q_t = (q_t - \sigma_{v0})/\sigma'_{v0}$

Over Consolidation Ratio, OCR
$OCR\ (1) = 0.25(Q_t)^{1.25}$
$OCR\ (2) = 0.33(Q_t)$

Undrained Shear Strength, Su
$Su = Q_t \times \sigma'_{v0}/N_{kt}$
N_{kt} is a geographical factor (shown on Su plot)

Sensitivy, St
$St = (q_t - \sigma_{v0}/N_{kt}) \times (1/fs)$

Effective Friction Angle, ϕ'
$\phi'\ (1) = \tan^{-1}(0.373[\log(q_t/\sigma'_{v0}) + 0.29])$
$\phi'\ (2) = 17.6 + 11[\log(Q_t)]$

Unit Weight
$UW = (0.27[\log(FR)]+0.36[\log(q_t/atm)]+1.236) \times UW_{water}$
σ_{v0} is taken as the incremental sum of the unit weights

SPT N_{60}
$N_{60} = (q_t/atm) / 10^{(1.1268 - 0.2817Ic)}$

Soil Behavior Type Index, Ic
$Ic = [(3.47 - \log(Q_t))^2 + (\log(FR) + 1.22)^2]^{0.5}$

Small Strain Modulus, G_0
$G_0 = \rho Vs^2$

Elastic Modulus, Es (assumes $q/q_{ultimate} \sim 0.3$, i.e. FS = 3)
$Es\ (1) = 2.6\Psi G_0$
where $\Psi = 0.56 - 0.33\log Q_{t,clean\ sand}$
$Es\ (2) = G_0$
$Es\ (3) = 0.015 \times 10^{(0.55Ic + 1.68)}(q_t - \sigma_{v0})$
$Es\ (4) = 2.5q_t$

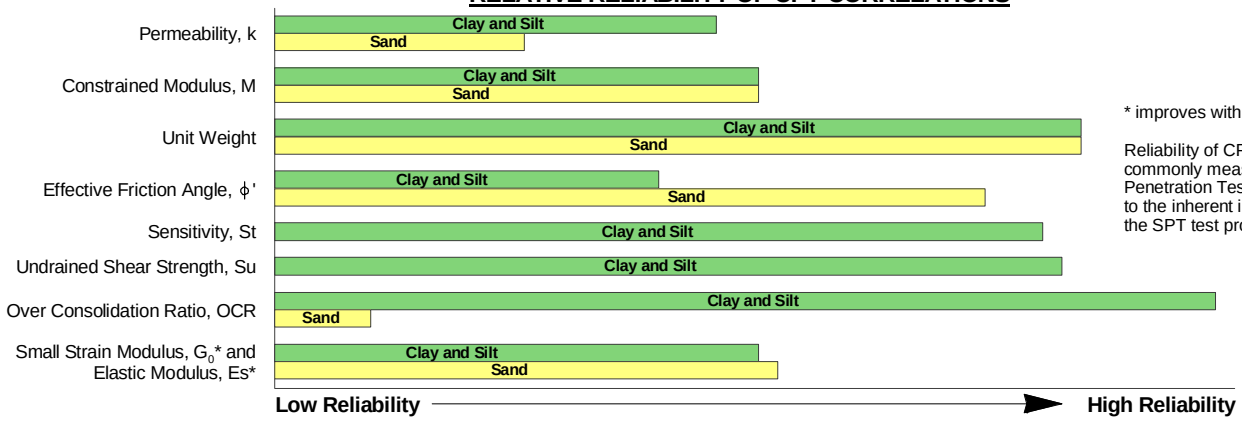
Constrained Modulus, M
$M = \alpha_M(q_t - \sigma_{v0})$
For Ic > 2.2 (fine-grained soils)
$\alpha_M = Q_t$ with maximum of 14
For Ic < 2.2 (coarse-grained soils)
$\alpha_M = 0.0188 \times 10^{(0.55Ic + 1.68)}$

Hydraulic Conductivity, k
For $1.0 < Ic < 3.27$ $k = 10^{(0.952 - 3.04Ic)}$
For $3.27 < Ic < 4.0$ $k = 10^{(-4.52 - 1.37Ic)}$

REPORTED PARAMETERS

CPT logs as provided, at a minimum, report the data as required by ASTM D5778 and ASTM D7400 (if applicable). This minimum data include tip resistance, sleeve resistance, and porewater pressure. Other correlated parameters may also be provided. These other correlated parameters are interpretations of the measured data based upon published and reliable references, but they do not necessarily represent the actual values that would be derived from direct testing to determine the various parameters. The following chart illustrates estimates of reliability associated with correlated parameters based upon the literature referenced below.

RELATIVE RELIABILITY OF CPT CORRELATIONS



* improves with seismic Vs measurements

Reliability of CPT-predicted N_{60} values as commonly measured by the Standard Penetration Test (SPT) is not provided due to the inherent inaccuracy associated with the SPT test procedure.

WATER LEVEL

The groundwater level at the CPT location is used to normalize the measurements for vertical overburden pressures and as a result influences the normalized soil behavior type classification and correlated soil parameters. The water level may either be "measured" or "estimated:"

Measured - Depth to water directly measured in the field

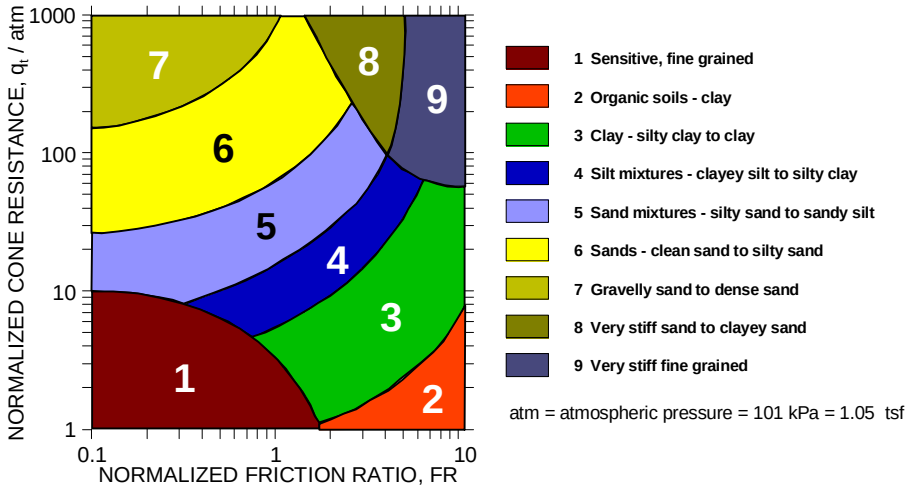
Estimated - Depth to water interpolated by the practitioner using pore pressure measurements in coarse grained soils and known site conditions

While groundwater levels displayed as "measured" more accurately represent site conditions at the time of testing than those "estimated," in either case the groundwater should be further defined prior to construction as groundwater level variations will occur over time.

CONE PENETRATION SOIL BEHAVIOR TYPE

The estimated stratigraphic profiles included in the CPT logs are based on relationships between corrected tip resistance (q_t), friction resistance (fs), and porewater pressure (U2). The normalized friction ratio (FR) is used to classify the soil behavior type.

Typically, silts and clays have high FR values and generate large excess penetration porewater pressures; sands have lower FRs and do not generate excess penetration porewater pressures. Negative pore pressure measurements are indicative of fissured fine-grained material. The adjacent graph (Robertson et al.) presents the soil behavior type correlation used for the logs. This normalized SBT chart, generally considered the most reliable, does not use pore pressure to determine SBT due to its lack of repeatability in onshore CPTs.



atm = atmospheric pressure = 101 kPa = 1.05 tsf

REFERENCES

Kulhawy, F.H., Mayne, P.W., (1997). "Manual on Estimating Soil Properties for Foundation Design," Electric Power Research Institute, Palo Alto, CA.

Mayne, P.W., (2013). "Geotechnical Site Exploration in the Year 2013," Georgia Institue of Technology, Atlanta, GA.

Robertson, P.K., Cabal, K.L. (2012). "Guide to Cone Penetration Testing for Geotechnical Engineering," Signal Hill, CA.

Schmertmann, J.H., (1970). "Static Cone to Compute Static Settlement over Sand," *Journal of the Soil Mechanics and Foundations Division*, 96(SM3), 1011-1043.

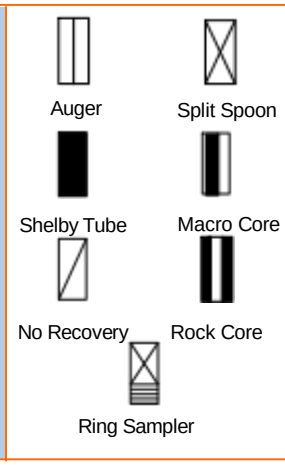
EXHIBIT C-2 – GENERAL NOTES

GSOU Akins Blvd Extension ■ Statesboro, Bulloch County, Georgia

May 21, 2020 ■ Terracon Project No. ES205117

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING



GROUNDWATER

- Groundwater Initially Encountered
- Groundwater Level After a Specified Period of Time
- Static Groundwater Level After a Specified Period of Time
- No Groundwater Observed

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	Std. Penetration Resistance (blows per foot)	Descriptive Term (Consistency)	Undrained Shear Strength (kips per square foot)	Std. Penetration Resistance (blows per foot)
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium-Stiff	0.50 to 1.00	5 - 7
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 14
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	above 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Descriptive Term(s) of other constituents	Percent of Dry Weight
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

EXHIBIT C-3 – UNIFIED SOIL CLASSIFICATION SYSTEM

GSOU Akins Blvd Extension ■ Statesboro, Bulloch County, Georgia
May 21, 2020 ■ Terracon Project No. ES205117

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or [Cc<1 or Cc>3.0] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or [Cc<1 or Cc>3.0] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.