# Revised Report of Geotechnical Exploration
# Ibis Avenue, Navajo Trail & Arapaho Drive, Simone Court & Royal Pines Drive
# Georgetown, South Carolina
# S&ME Project No. 1363-20-020

PREPARED FOR:

**Davis & Floyd Engineering, Inc.**
**3229 W. Montague Street**
**North Charleston, South Carolina 29418**

PREPARED BY:

**S&ME, Inc.**
**1330 Highway 501 Business**
**Conway, SC 29526**

**November 16, 2020**

November 16, 2020

Davis & Floyd Engineering, Inc.
3229 W. Montague Street
North Charleston, South Carolina 29418

Attention: Lindsey Keziah, P.E.

Reference: **Revised Report of Geotechnical Exploration**
**Ibis Avenue, Navajo Trail & Arapaho Drive, and Simone Court & Royal Pines Drive**
Georgetown, South Carolina
S&ME Project No. 1363-20-020

Dear Ms. Keziah:

We have completed our geotechnical exploration for the referenced project in Georgetown, South Carolina. Our exploration was performed pursuant to a *Geotechnical Master Services Agreement* between S&ME, Inc., and Davis & Floyd, Inc., dated May 21, 2004, and S&ME Proposal No. 14-1900754, dated November 7, 2019, authorized by Brice Urquhart on March 5, 2020, and for which notice to proceed was received on May 21, 2020. The purpose of this exploration was to evaluate subsurface conditions within the existing roadways, and to provide pavement section thickness and pavement section construction recommendations. This report presents our understanding of the proposed construction, the site and subsurface conditions encountered, and our geotechnical conclusions and recommendations.

## ♦ Project Information

Project information was provided via email correspondence and telephone conversations between Lindsey Keziah (Davis & Floyd) and Worth King (S&ME) between November 1 and 6, 2019. The project site is comprised of the following roadways in Georgetown County, South Carolina:

- Ibis Avenue – Approximately 2,800 ft length
- Navajo Trail and Arapaho Drive – Approximately 2,600 ft combined length
- Simone Court and Royal Pines Drive – Approximately 1,400 ft combined length

The email correspondence included plats and drawings depicting the project areas. We understand that the project includes improving and paving these roads along their existing alignments. The client requested a subsurface exploration for roadway design purposes, with pavement section thickness and pavement section construction recommendations.

This revised report is provided at the request of Lindsey Keziah to provide an alternative pavement section than that which we previously provided.

# Exploration Procedures

## Field Exploration

Our exploration included a site reconnaissance by a geotechnical professional and the performance of eight standard penetration test (SPT) borings (P-1 through P-8) along the various roadway alignments. Each boring was advanced to a depth of 10 feet each below the existing ground surface. The test locations were selected in the field by S&ME engineers to be approximately evenly spaced along the roadways. The approximate test locations are shown on the Test Location Sketches (Figures 1a through 1c) attached in the appendix.

- Borings P-1 through P-3 were performed along Navajo Trail and Arapaho Drive (Figure 1a)
- Borings P-4 through P-5 were performed along Simone Court and Royal Pines Drive (Figure 1b)
- Borings P-6 through P-8 were performed along Ibis Avenue (Figure 1c)

Hollow stem augers were used to extract soils from the ground. In conjunction with the hollow stem auger borings, split-spoon disturbed samples were recovered at evenly spaced 2.5-ft. depth intervals for classification. Three bulk samples (one from each group of roadways) were obtained from the auger cuttings for laboratory testing. Water levels were measured at the time of drilling and then the borings were left open for a period of at least 24-hours before the water levels were measured again and the borings backfilled to the original ground surface.

More detailed descriptions of our field exploration procedures and the boring logs are also included in the appendix.

## Laboratory Testing

Soil samples that we obtained were transported to our laboratory, and three bulk samples of the near surface subgrade soils was subjected to the following laboratory testing:

- Natural Moisture Content (ASTM D 2216)
- Fines Content percent passing the No. 200 sieve by weight (ASTM D 1140)
- Modified Proctor Moisture-Density Relationship (ASTM D 1557)
- California Bearing Ratio (CBR) (ASTM D 1883)

A summary of the laboratory procedures used to perform these tests is presented in the appendix. The individual test results are also included in the appendix.

# Site and Subsurface Conditions

## Site Conditions

Topsoil was not observed at our test locations along any of the roadways. Topographic information was not provided.

### *Navajo Trail and Arapaho Drive*

Navajo Trail and Arapaho Drive are unpaved. Most of the future pavement area consists of sandy subgrade with gravel randomly dispersed across the top. Ditches measuring roughly 1 foot in both width and depth were present along the sides of the roadway in most areas. Standing water was not observed in these ditches at the time of exploration. Wetland plants were present on either side of the road near test location P-3.

### *Simone Court and Royal Pines Drive*

At Simone Court and Royal Pines Drive the roadways seem to be have been paved at one point and not maintained. Some areas still have some deteriorated pavement and other areas had deteriorated to bare dirt with gravel loosely placed on top. Ditches measuring roughly 1 to 2 feet in both width and depth were present along much of the roadways. Water was present in the ditches and measured up to 1 foot in the bottom of the ditches at the time of our exploration.

### *Ibis Avenue*

Ibis Avenue is currently unpaved. Most of the pavement area consists of sandy subgrade overlaid by a few inches of gravel, appearing to be comprised of slag. A portion of the roadway to be paved is exposed sandy soils. Ditches measuring roughly 1 to 2 feet in both width and depth were present along the sides of the roadway. Ponded water measuring up to about 1 foot in depth was observed in the bottom of the ditches at the time of our exploration.

## Subsurface Conditions

Details of the subsurface conditions encountered by the borings are shown on the boring logs in the appendix. These logs represent our interpretation of the subsurface conditions based upon field data. Stratification lines on the boring logs represent approximate boundaries between soil types; however, the actual transition may be gradual.

### *Navajo Trail and Arapaho Drive*

On Navajo Trail and Arapaho Drive borings P-1 through P-3 encountered typically sandy subsurface soils, consisting of poorly graded sand with silt (USCS Classification “SP-SM”). The SPT N-values of these soils ranged from 6 blows per foot (bpf) to 14 bpf. This indicates a very loose to medium dense relative density.

In boring P-3 on Navajo Trail, we encountered a clayey sand (SC) from a depth of 3 ½ to 9 feet below the surface. The SPT N-values of this clayey sand averaged approximately 5 bpf, indicating a loose relative density. The soils from this area were typically moist to wet and white, orange, and tan in coloration.

One composite bulk sample was collected from the three borings and was classified as poorly graded sand with silt (SP-SM) with a fines content of 6.3 percent by weight passing the No. 200 sieve. The natural moisture content was measured to be 5.9 percent. Modified Proctor testing indicated a maximum dry density of 102.8 pounds per cubic foot (pcf) at an optimum moisture content for compaction of 14.5 percent, indicating that the soil as-sampled is about 8.6 percent dry of the optimum moisture content for compaction. The sample exhibited non-plastic behavior. The CBR value measured for this soil, when a sample was remolded to approximately 95 percent compaction near its optimum moisture content, was 25.4 percent at 0.1 inches of penetration.

### *Simone Court and Royal Pines Drive*

On Simone Court and Royal Pines Drive, borings P-4 and P-5 typically encountered sandy soils, consisting of poorly graded sand with silt (SP-SM). The SPT N-values of these sands ranged from 5 bpf to 20 bpf, indicating a loose to medium dense relative density. The soils from this area were moist to wet and orange, tan, dark brown, light brown, and white in coloration.

One composite bulk sample was collected from the two borings and was classified as poorly graded sand with silt (SP-SM) with a fines content of 5.8 percent by weight passing the No. 200 sieve. The natural moisture content was measured to be 22.2 percent. The sample exhibited non-plastic behavior. Modified Proctor testing indicated a maximum dry density of 103.6 pounds per cubic foot (pcf) at an optimum moisture content for compaction of 14.3 percent, indicating that the soil as-sampled is about 7.9 percent wet of the optimum moisture content for compaction. The CBR value measured for this soil, when a sample was remolded to approximately 95 percent compaction near its optimum moisture content, was 20.1 percent at 0.1 inches of penetration.

### *Ibis Avenue*

On Ibis Avenue, borings P-6, P-7 and P-8 encountered typically sandy soils consisting of poorly graded sand with silt (SP-SM). The SPT N-values of this soil ranged from 5 bpf to 20 bpf, indicating a loose to medium dense relative density. The soils from this area were moist to wet and tan, orange, grey, and brown in coloration.

One composite bulk sample was collected from the three borings and was classified as poorly graded sand with silt (SP-SM) with a fines content of 5.8 percent by weight passing the No. 200 sieve. The sample exhibited non-plastic behavior. The natural moisture content was measured to be 22.8 percent. Modified Proctor testing indicated a maximum dry density of 105.8 pounds per cubic foot (pcf) at an optimum moisture content for compaction of 11.4 percent, indicating that the soil as-sampled is about 11.4 percent wet of the optimum moisture content for compaction. The CBR value measured for this soil, when a sample was remolded to approximately 95 percent compaction near its optimum moisture content, was 20.5 percent at 0.1 inches of penetration.

## Subsurface Water

At the time of drilling, subsurface water was only observed in boring P-3 at a depth of 9 ½ feet on Navajo Trail. After a period of 24-hours, water was observed within boring P-3 at a depth of 3 ½ feet. Borings P-1 and P-2 on Arapaho Drive had dry-caved to depths of 7 to 7 ½ feet below the surface with no water present.

At the time of drilling, subsurface water was observed in borings P-4 and P-5 at a depth of 2 feet at Simone Court and Royal Pines Drive. After a period of 24-hours water was not observed within either of these borings but the borings had dry-caved to a depth of 1 to 1 ½ feet below the surface.

At the time of drilling, subsurface water was observed in borings P-6 thru P-8 at depths ranging from 2 feet to 3 ½ feet at Ibis Avenue. After a period of 24-hours water was observed within borings P-6 thru P-8 to range from 20 inches to 24 inches below the surface.

Subsurface water levels at the site will fluctuate during the year due to such things as seasonal and climatic variations and the construction activity in the area. Clayey soils of low permeability such as those observed in P-3 are susceptible to "perched" water conditions, where water is trapped above and within the clayey soils, especially during wetter periods of the year.

## ♦ Conclusions and Recommendations

The exploration indicates the site is adaptable for the proposed construction, with some subgrade improvements. The primary geotechnical considerations will be subgrade stabilization, moisture content adjustment, and fill placement and compaction.

The following presents our geotechnical recommendations regarding subgrade stabilization and earthwork. When reviewing these recommendations, it must be recognized that unexpected subsurface conditions may be encountered between test locations. Unexpected conditions can normally be handled during construction by on-site engineering evaluation.

### Surface Preparation

The following surface preparation recommendations are provided. Except where otherwise noted, these recommendations apply to each of the roadways explored.

1. Drainage should be implemented and maintained as soon as possible prior to construction. Surface and subsurface water conditions at the time of construction, largely influenced by prevailing weather patterns, will determine the need for and extent of drainage measures. Water conditions can change with construction activities and precipitation effects.
2. Strip surface vegetation, root mat, slag, and organic-laden or debris-laden soils where encountered and dispose of outside the pavement footprints. Organics are not expected to be present in significant quantities unless the roadway is widened, in which case some organic materials may be encountered along the edges in the widened areas.
3. In any areas that must be cut down to reach design final soil subgrade (FSG) elevation, the soil should be densified in place across the entire roadway alignment with a heavy vibratory roller at the cut grade elevation. In any areas that will require new fill to reach design final subgrade (FSG) elevation, the soil surface should be densified in place across the entire roadway alignment with a heavy vibratory roller *after* the surface has been stripped of organics and slag but *prior to* any new fill placement.

    A. The exposed surfaces should be densified in place to at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) to a depth of at least 8 inches, in order to compact the existing loose, sandy soils. Under favorable moisture conditions and with the proper equipment, this may be able to be accomplished by densifying the soil from the top. However, under less favorable conditions, it may be necessary for the contractor to re-work (or remove, condition, and replace) the material, using moistening or drying techniques, in order to achieve the desired level of compaction. The densification of these soils should be performed under the observation of an S&ME representative.

- B. **Navajo Trail and Arapaho Drive:** Sampled near-surface soils on Arapaho Drive were 8.6 percent dry of the optimum moisture content for compaction at the time of sampling, indicating that wetting of the soils may be needed prior to surface densification.
- C. **Simone Court and Royal Pines Drive:** Sampled near-surface soils were about 7.9 percent wet of the optimum moisture content for compaction at the time of sampling, indicating that discing and drying of the soils may be needed prior to surface densification.
- D. **Ibis Avenue:** Sampled near-surface soils were about 11.4 percent wet of the optimum moisture content for compaction at the time of sampling, indicating that discing and drying of the soils may be needed prior to surface densification.
- E. Recognize that soil moisture conditions may change between the time that we sampled these materials and when the construction is performed.

4. After densification of the surface, the subgrade in all areas to receive new fill (except ditches) should be proofrolled by the contractor under the observation of a representative of the Geotechnical Engineer to observe the subgrade for stability prior to fill placement.

   - A. Where needed, based on the results of the proofroll, it may become necessary to perform undercutting and replacement of unstable soils. This is not expected to be a widespread condition at these sites, but could occur in some areas. This should be a decision made at the time of construction based on the conditions observed.
   - B. Unsatisfactory proofroll results (unstable roadbed conditions) appear most likely to occur in the area around boring P-3 on Navajo Trail. It is possible that the clayey sands in that area may need to be removed and replaced with imported fill sand. However, it is also possible that the sandier soils located above the clayey sands can be stabilized enough to provide sufficient support without removing and replacing the clayey sand materials, so this should be a decision made in the field by a representative of the Geotechnical Engineer at the time of construction. We recommend that you include a contingency budget for additional earthwork (removal and replacement of soils) that may need to be performed in this area.

5. Ditches should be dewatered and mucked out, then visually observed for bottom stability by a representative of the Geotechnical Engineer prior to backfilling.

## Fill Placement and Compaction

The fill soils used to construct the roadbeds and to fill-in any ditches that are being modified should meet the requirements and be installed as directed below.

1. Controlled fill material should be cohesionless, non-plastic, sandy soil containing no more than 10 percent fines (material passing the No. 200 sieve) by weight as measured by ASTM D 1140, and exhibiting a CBR value of at least 15 percent when re-compacted to 95% of the maximum dry density measured by

modified Proctor testing (ASTM D 1557 and D 1883). The soil should be relatively free of organics or other deleterious matter.

   A. The samples that we tested in our laboratory meet these fill requirements.
   B. It is important to note that the clayey sand encountered in P-3 was excluded from the soils tested in the laboratory.

2. All fill should be placed in uniform lifts of 8 in. or less (loose measure) and compacted to at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557), within plus or minus 3 percent of the optimum moisture content for compaction. Adjustment of the soil moisture content by either wetting or drying may be required depending upon the source of the fill.
3. Prior to placement of aggregate base course stone, all subgrades should be methodically proofrolled at FSG elevation by the contractor under the observation of the Geotechnical Engineer, and any identified unstable areas should be repaired as directed. Please note that the SP-SM soils that we tested in our laboratory for the select sandy subbase layer had less than 10 percent silt and clay fines. This soil also has no cohesion, and may rut during proofrolling, particularly if dry on top. It may be necessary to moisten the subgrade surface shortly prior to proofrolling. Dry rutting does not necessarily indicate instability on the surface of cohesionless sands, and this should be recognized.

   A. Where needed, based on the results of the proofroll, it may become necessary to perform undercutting and replacement of any unstable soils that are identified. This is not expected to be a widespread condition at these sites, but could occur in some areas. This should be a decision made at the time of construction based on the conditions observed.
   B. Unsatisfactory proofroll results (unstable roadbed conditions) appear most likely to occur in the area around boring P-3 on Navajo Trail. It is possible that the clayey sands in that area may need to be removed and replaced with imported fill sand. However, it is also possible that the sandier soils located above these clayey sands can be stabilized enough to provide sufficient support without removing and replacing the materials, so this should be a decision made in the field by a representative of the Geotechnical Engineer at the time of construction, but we recommend that you include a contingency budget for additional earthwork (removal and replacement of soils) that may need to be performed in this area.

## Pavement Section Recommendations

Since similar soils were encountered at each of the three sets of roads, these pavement recommendations apply to each of the roadways explored. We understand that the site pavements will consist of flexible hot mix asphalt pavements. Based upon the assumption that the pavement support soils will consist of compacted fill and near surface sandy soils, we estimate that an average combined California Bearing Ratio (CBR) value of at least 15 percent will be available for pavement support. This results in a resilient modulus of at least 14,457 psi available for flexible pavement design. This assumes that any fill materials used in the upper 2 feet will have a CBR value of at least 15 percent when properly compacted. If materials having lesser subgrade support values are to be considered for use, the pavement design should be reevaluated and required pavement thickness may need to be increased as a result.

Traffic volumes for the proposed development were not provided to us in preparation for our pavement section analysis; therefore, we have performed our calculations based on typical pavement section thicknesses. These pavement section components are provided in Table 1 below.

Flexible pavement design assumes an initial serviceability of 4.2 and a terminal serviceability index of 2.0, and a reliability factor of 95 percent. ESALs per axle were estimated using data provided in AASHTO literature. Assuming that only SCDOT approved source materials will be used in flexible pavement section construction, we used a structural layer coefficient of 0.44 for the HMA layers and a coefficient of 0.18 for the graded aggregate base course (GABC). A sub-base drainage factor of 1.0 was assigned, based upon the assumption that the sub-base soils will consist of sandy fill soils.

- If the actual ESAL demand is found to be greater than the *Theoretical Available Traffic Capacity* value shown in the table below, then the pavement section thicknesses may need increased and we can be contacted for further recommendations.

### Table 1 – Recommended Minimum Pavement Section[(a)]

| Pavement Type | Theoretical Available Traffic Capacity (ESALs) | HMA Surface Course Type C (inches) | Compacted SCDOT Graded Aggregate Base Course [GABC] (inches) | Compacted Subgrade at 95% modified Proctor Maximum Dry Density (inches) |
|---|---|---|---|---|
| HMA Flexible Standard-duty | 469,000 | 2.5 | 8.0 | 8.0 |

(a) Single-stage construction and soil compaction as recommended is assumed; S&ME, Inc. must observe pavement subgrade preparations and pavement installation operations.

## *General Recommendations for Pavement Areas*

1. At least one laboratory California Bearing Ratio (CBR) test should be performed upon a representative soil sample of each soil type which is planned to be used as pavement subgrade material. This is to establish the relationship between relative compaction and CBR for the soil in question, and to confirm that the obtained CBR value at the required level of compaction is equal to or greater than the CBR value utilized during design of the pavement section.
2. All fill placed in pavement areas should be compacted as recommended in "Fill Placement and Compaction". Prior to placement of graded aggregate base course stone, all exposed pavement subgrades should be methodically proofrolled under the observation of the Geotechnical Engineer (S&ME), and any identified unstable areas should be repaired as directed.

### *Base Course and Pavement Section Construction*

The following recommendations are provided for base course and pavement section construction:

1. Crushed stone aggregate base material used in pavement section construction should consist of either macadam or marine limestone graded aggregate base course (GABC) as defined by Section 305 of the South Carolina Department of Transportation Standard Specifications for Highway Construction (2007). The base course should be compacted to at least 100 percent of the modified Proctor maximum dry density (SC-T-140).

   A. Do not substitute Coquina type base course for the specified GABC material.
   B. Do not substitute slag or other steel production waste by-products for the specified GABC material.
   C. Do not substitute recycled Portland cement concrete for the specified GABC material.

2. Heavy compaction equipment is likely to be required in order to achieve the required base course compaction, and the moisture content of the material will likely need to be maintained near optimum moisture content in order to facilitate proper compaction.
3. After placement of base course stone, the surface should be methodically proofrolled at final base grade elevation by the contractor under the observation of the Geotechnical Engineer (S&ME), and any identified unstable areas should be repaired. The base course material should not exhibit pumping or rutting under equipment traffic. Rutting or pumping areas shall be undercut and replaced and/or stabilized as directed by the engineer.
4. Construct the surface and intermediate course HMA in accordance with the specifications of Sections 401, 402, and 403 of the South Carolina Department of Transportation Standard Specifications for Highway Construction (2007 edition).
5. Sufficient testing should be performed during flexible pavement installation to confirm that the required thickness, density, and quality requirements of the pavement specifications are followed.
6. Experience indicates that a thin surface overlay of asphalt pavement may be required in about 10 years due to normal wear and weathering of the surface. Such wear is typically visible in several forms of pavement distress, such as aggregate exposure and polishing, aggregate stripping, asphalt bleeding, and various types of cracking. There are means to methodically estimate the remaining pavement life based on a systematic statistical evaluation of pavement distress density and mode of failure. We recommend the pavement be evaluated in about 7 years to assess the pavement condition and remaining life.

## Testing Services during Construction

We recommend that you retain S&ME to provide the variety of testing services and ongoing geotechnical consultations as described in the preceding sections of this report. There are several milestones where either consultation with the Geotechnical Engineer is recommended, and/or where testing should be performed.

## ♦ Limitations of Report

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

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

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

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

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

## ♦ Closure

S&ME, Inc. appreciates the opportunity to be of service to you on this project. Please call if you have questions concerning this report or any of our services.

Sincerely,

**S&ME, Inc.**

Kara Fugate

S&ME, INC.
No. C00473

Kara Fugate, E.I.T.
Staff Professional

Ron Forest

Ronald P. Forest, Jr., P.E.
Senior Engineer

No. 21248
11/16/20
RON FOREST JR.

Attachments: Appendix

# Appendix

Figures 1a through 1c: Test Location Sketches

Summary of Exploration Procedures

Soil Classification Chart

SPT Boring Logs

Summary of Laboratory Procedures

Laboratory Test Results

## Test Location Sketch

Ibis Avenue, Navajo Trail & Arapaho Drive, and Simone Court & Royal Pines Drive
Georgetown, South Carolina

SCALE:
AS SHOWN

DATE:
6-10-2020

PROJECT NO.
1363-20-020

FIGURE NO.
1a

## Test Location Sketch

Ibis Avenue, Navajo Trail & Arapaho Drive, and Simone Court & Royal Pines Drive
Georgetown, South Carolina

| | |
|---|---|
| SCALE: | AS SHOWN |
| DATE: | 6-10-2020 |
| PROJECT NO. | 1363-20-020 |
| FIGURE NO. | 1b |

# Test Location Sketch

Ibis Avenue, Navajo Trail & Arapaho Drive, and Simone Court & Royal Pines Drive
Georgetown, South Carolina

SCALE:
AS SHOWN

DATE:
6-10-2020

PROJECT NO.
1363-20-020

FIGURE NO.
1c

## ♦ Summary of Exploration Procedures

The American Society for Testing and Materials (ASTM) publishes standard methods to explore soil, rock and ground water conditions in Practice D-420-18, "*Standard Guide for Site Characterization for Engineering Design and Construction Purposes.*" The boring and sampling plan must consider the geologic or topographic setting. It must consider the proposed construction. It must also allow for the background, training, and experience of the geotechnical engineer. While the scope and extent of the exploration may vary with the objectives of the client, each exploration includes the following key tasks:

- Reconnaissance of the Project Area
- Preparation of Exploration Plan
- Layout and Access to Field Sampling Locations
- Field Sampling and Testing of Earth Materials
- Laboratory Evaluation of Recovered Field Samples
- Evaluation of Subsurface Conditions

The standard methods do not apply to all conditions or to every site. Nor do they replace education and experience, which together make up engineering judgment. Finally, ASTM D 420 does not apply to environmental investigations.

## ♦ Reconnaissance of the Project Area

We walked over the site to note land use, topography, ground cover, and surface drainage. We observed general access to proposed sampling points and noted any existing structures.

Checks for Hazardous Conditions - State law requires that we notify the Palmetto Utility Protection Service (SC811) before we drill or excavate at any site. SC811 is operated by the major water, sewer, electrical, telephone, CATV, and natural gas suppliers of South Carolina. SC811 forwarded our location request to the participating utilities. Location crews then marked buried lines with colored flags within 72 hours. They did not mark utility lines beyond junction boxes or meters. We checked proposed sampling points for conflicts with marked utilities, overhead power lines, tree limbs, or man-made structures during the site walkover.

## ♦ Boring and Sampling

### Soil Test Boring with Hollow Stem Augers

Soil sampling and penetration testing were performed in general accordance with ASTM D1586, "Standard Test Method for Penetration Test and Split Barrel Sampling of Soils. Rotary drilling processes were used to advance the hole with hollow stem augers. At continuous, consecutive intervals, soil samples were obtained with a standard 1.4 inch I. D., two-inch O. D., split barrel sampler. The sampler was first seated six inches to penetrate any loose cuttings, then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through the two final six inch increments was recorded as the penetration resistance (SPT N) value. The N-value, when properly interpreted by qualified professional staff, is an index of the soil strength and foundation support capability.

## Water Level Measurement

Subsurface water levels in the boreholes were measured during the onsite exploration and after a period of 24-hours by measuring depths from the existing grade to the current water level using a tape.

## Backfilling of Borings

Once subsurface water levels were obtained, boring spoils were backfilled into the open bore holes.  Bore holes were backfilled to the existing ground surface using soil cuttings.

# LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

## SOIL TYPES

(Shown in Graphic Log)

- ▩ Fill
- 🟦 Asphalt
- ⁂ Concrete
- 🟩 Topsoil
- ⬚ Gravel
- ⁘ Sand
- ▥ Silt
- ▨ Clay
- ▤ Organic
- ▥ Silty Sand
- ▨ Clayey Sand
- ▥ Sandy Silt
- ▨ Clayey Silt
- ▨ Sandy Clay
- ▨ Silty Clay
- ▒ Partially Weathered Rock
- ▱ Cored Rock

## WATER LEVELS

(Shown in Water Level Column)

▽ = Water Level At Termination of Boring

▼ = Water Level Taken After 24 Hours

◄ = Loss of Drilling Water

HC = Hole Cave

## CONSISTENCY OF COHESIVE SOILS

| CONSISTENCY | STD. PENETRATION RESISTANCE BLOWS/FOOT |
|---|---|
| Very Soft | 0 to 2 |
| Soft | 3 to 4 |
| Firm | 5 to 8 |
| Stiff | 9 to 15 |
| Very Stiff | 16 to 30 |
| Hard | 31 to 50 |
| Very Hard | Over 50 |

## RELATIVE DENSITY OF COHESIONLESS SOILS

| RELATIVE DENSITY | STD. PENETRATION RESISTANCE BLOWS/FOOT |
|---|---|
| Very Loose | 0 to 4 |
| Loose | 5 to 10 |
| Medium Dense | 11 to 30 |
| Dense | 31 to 50 |
| Very Dense | Over 50 |

## SAMPLER TYPES

(Shown in Samples Column)

- Shelby Tube
- ⧗ Split Spoon
- ◫ Rock Core
- ⁘ No Recovery

## TERMS

| | |
|---|---|
| **Standard Penetration Resistance** | The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586. |
| **REC** | Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%. |
| **RQD** | Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%. |

**Ibis Ave, Navajo Tr & Arapaho Dr, and Simone Ct & Royal Pines Dr**
**Georgetown, South Carolina**
**S&ME Project No. 1363-20-020**

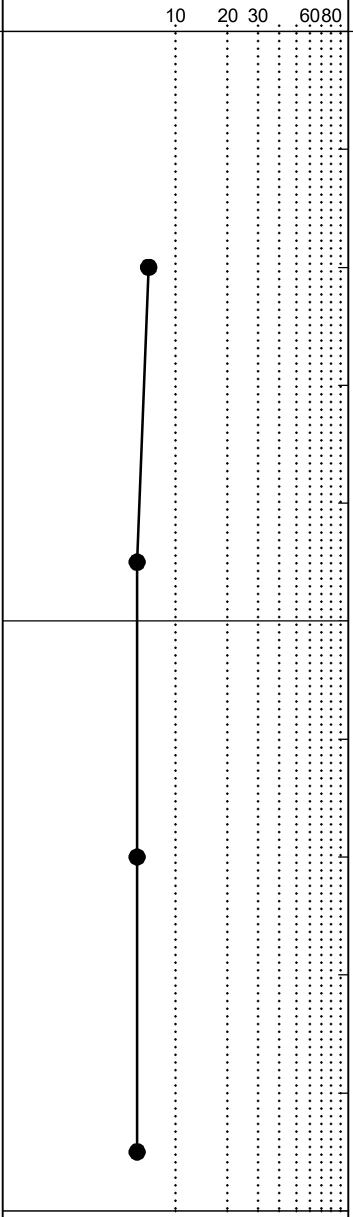
# BORING LOG P-1

DATE DRILLED: **6/2/20**
ELEVATION:
DRILL RIG: **ATV**
BORING DEPTH: **10.0 ft**
DRILLER: **M. Wright**
WATER LEVEL: **Not encountered.**
HAMMER TYPE: **Auto**
LOGGED BY: **K. Fugate**
SAMPLING METHOD: **Split Spoon**
DRILLING METHOD: **3¼" H.S.A.**

NOTES: **Elevation unknown.**

| DEPTH (feet) | MATERIAL DESCRIPTION | WATER LEVEL | ELEVATION (feet) | SAMPLE NO. | 1st 6in / RUN # | 2nd 6in / REC | 3rd 6in / RQD | N VALUE |
|---|---|---|---|---|---|---|---|---|
| | **POORLY GRADED SAND WITH GRAVEL (SP)** - Mostly fine sand, trace fines, few subangular gravel, white, dry, loose. | | | | | | | |
| | **POORLY GRADED SAND WITH SILT (SP-SM)** - Mostly fine sand, few fine to medium fines, orange, moist, loose. | | | | | | | |
| | | | | 1 | 4 | 3 | 4 | 7 |
| | | | | 2 | 2 | 2 | 4 | 6 |
| 5 | | | | | | | | |
| | | HC | | 3 | 2 | 3 | 3 | 6 |
| | | | | 4 | 3 | 3 | 3 | 6 |
| | - - - - White, wet. | | | | | | | |
| 10 | Boring terminated at 10 ft | | | | | | | |

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS



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2. ***BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.***
3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

## Ibis Ave, Navajo Tr & Arapaho Dr, and Simone Ct & Royal Pines Dr
## Georgetown, South Carolina
**S&ME Project No. 1363-20-020**

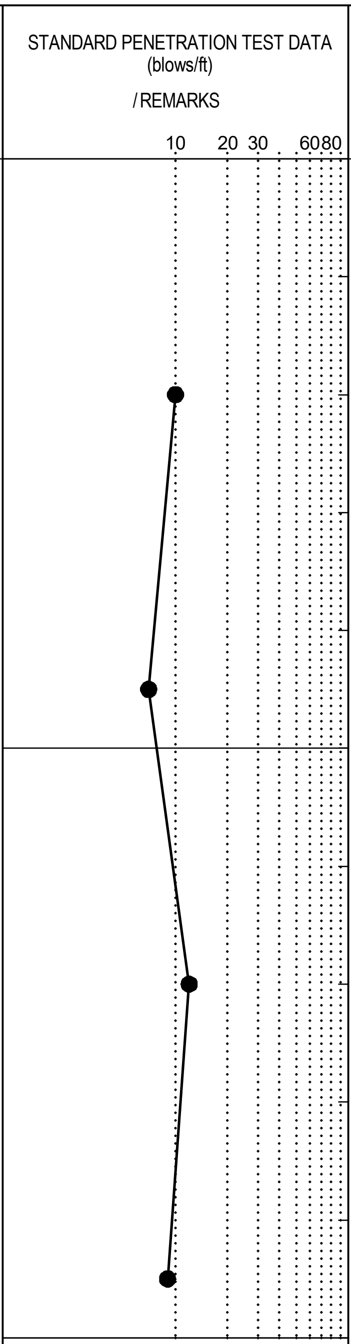
## BORING LOG P-2

DATE DRILLED: **6/2/20**
ELEVATION:
DRILL RIG: **ATV**
BORING DEPTH: **10.0 ft**
DRILLER: **M. Wright**
WATER LEVEL: **Not encountered.**
HAMMER TYPE: **Auto**
LOGGED BY: **K. Fugate**
SAMPLING METHOD: **Split Spoon**
DRILLING METHOD: **3¼" H.S.A.**

NOTES: **Elevation unknown.**

| DEPTH (feet) | MATERIAL DESCRIPTION | WATER LEVEL | ELEVATION (feet) | SAMPLE NO. | SAMPLE TYPE | BLOW COUNT / CORE DATA 1st 6in / RUN # | 2nd 6in / REC | 3rd 6in / RQD | N VALUE |
|---|---|---|---|---|---|---|---|---|---|
| | **POORLY GRADED SAND WITH GRAVEL (SP)** - Mostly fine sand, trace fines, few subangular gravel, white, dry, medium dense. | | | | | | | | |
| | **POORLY GRADED SAND WITH SILT (SP-SM)** - Mostly fine sand, few fine to medium fines, tan, moist, loose. | | | | | | | | |
| | | | | 1 | | 3 | 5 | 5 | 10 |
| | - - - - Orange. | | | | | | | | |
| | | | | 2 | | 2 | 3 | 4 | 7 |
| 5 | | | | | | | | | |
| | | | | 3 | | 3 | 5 | 7 | 12 |
| | - - - - Medium dense. | HC | | | | | | | |
| | | | | 4 | | 4 | 5 | 4 | 9 |
| | - - - - White, wet, loose. | | | | | | | | |
| 10 | Boring terminated at 10 ft | | | | | | | | |

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS



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3. *STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.*
4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

## Ibis Ave, Navajo Tr & Arapaho Dr, and Simone Ct & Royal Pines Dr
## Georgetown, South Carolina
S&ME Project No. 1363-20-020

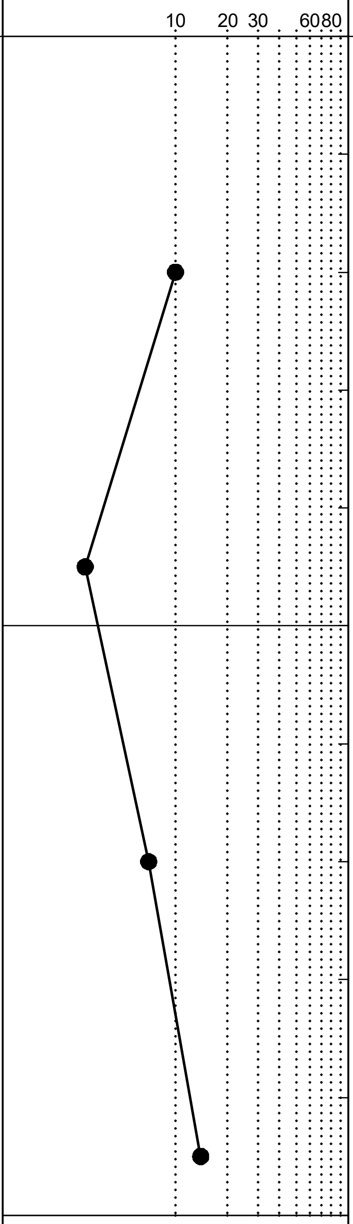
## BORING LOG P-3

DATE DRILLED: **6/2/20**
ELEVATION:
DRILL RIG: **ATV**
BORING DEPTH: **10.0 ft**
DRILLER: **M. Wright**
WATER LEVEL: **9.5' ATD, 3.5' 24 hr**
HAMMER TYPE: **Auto**
LOGGED BY: **K. Fugate**
SAMPLING METHOD: **Split Spoon**
DRILLING METHOD: **3¼" H.S.A.**

NOTES: **Elevation unknown.**

| DEPTH (feet) | MATERIAL DESCRIPTION | WATER LEVEL | ELEVATION (feet) | SAMPLE NO. | 1st 6in / RUN # | 2nd 6in / REC | 3rd 6in / RQD | N VALUE |
|---|---|---|---|---|---|---|---|---|
| | **POORLY GRADED SAND WITH GRAVEL (SP)** - Mostly fine sand, trace fines, few subangular gravel, white, dry, loose. | | | | | | | |
| | **POORLY GRADED SAND WITH SILT (SP-SM)** - Mostly fine sand, few fine to medium fines, orange, moist, loose. | | | 1 | 5 | 5 | 5 | 10 |
| | | ▼ | | | | | | |
| | **CLAYEY SAND (SC)** - Mostly fine sand, some low to medium plasticity fines, trace organics, light grey, orange, and dark grey, wet, very loose. | | | 2 | 1 | 2 | 1 | 3 |
| 5 | | | | | | | | |
| | - - - - Loose. | | | 3 | 2 | 2 | 5 | 7 |
| | **POORLY GRADED SAND WITH SILT (SP-SM)** - Mostly fine to medium sand, few fines, white, wet, medium dense. | ▽ | | 4 | 2 | 7 | 7 | 14 |
| 10 | Boring terminated at 10 ft | | | | | | | |

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS



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2. *BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.*
3. *STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.*
4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

Ibis Ave, Navajo Tr & Arapaho Dr, and Simone Ct & Royal Pines Dr
Georgetown, South Carolina
S&ME Project No. 1363-20-020

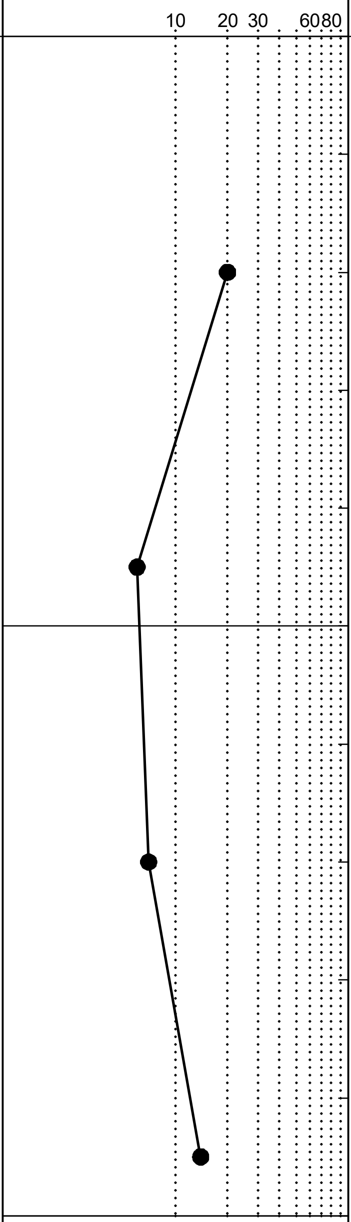
# BORING LOG P-4

DATE DRILLED: **6/2/20**
ELEVATION:
DRILL RIG: **ATV**
BORING DEPTH: **10.0 ft**
DRILLER: **M. Wright**
WATER LEVEL: **Not encountered.**
HAMMER TYPE: **Auto**
LOGGED BY: **K. Fugate**
SAMPLING METHOD: **Split Spoon**
DRILLING METHOD: **3¼" H.S.A.**

NOTES: **Elevation unknown.**

| DEPTH (feet) | MATERIAL DESCRIPTION | WATER LEVEL | ELEVATION (feet) | SAMPLE NO. | 1st 6in / RUN # | 2nd 6in / REC | 3rd 6in / RQD | N VALUE |
|---|---|---|---|---|---|---|---|---|
| | **GRAVEL (GP)** - Approximately 4 inches thick. | | | | | | | |
| | **POORLY GRADED SAND WITH SILT (SP-SM)** - Mostly fine sand, few fines, orange and tan, moist, medium dense. | | | | | | | |
| | | HC<br>▽ | | 1 | 5 | 10 | 10 | 20 |
| | ---- Wet. | | | | | | | |
| | | | | 2 | 2 | 3 | 3 | 6 |
| | ---- Loose. | | | | | | | |
| 5 | | | | | | | | |
| | ---- Dark brown. | | | | | | | |
| | ---- Light brown. | | | 3 | 2 | 2 | 5 | 7 |
| | ---- Medium dense. | | | 4 | 2 | 6 | 8 | 14 |
| 10 | Boring terminated at 10 ft | | | | | | | |

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS



S&ME BORING LOG \ HAND AUGER LOGS.GPJ \ LIBRARY 2011_06_28.GDT \ 6/16/20

***NOTES:***

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2. *BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.*
3. *STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.*
4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

**Ibis Ave, Navajo Tr & Arapaho Dr, and Simone Ct & Royal Pines Dr**
**Georgetown, South Carolina**
**S&ME Project No. 1363-20-020**

# BORING LOG P-5

DATE DRILLED: **6/2/20**

ELEVATION:

DRILL RIG: **ATV**

BORING DEPTH: **10.0 ft**

DRILLER: **M. Wright**

WATER LEVEL: **Not encountered.**

HAMMER TYPE: **Auto**

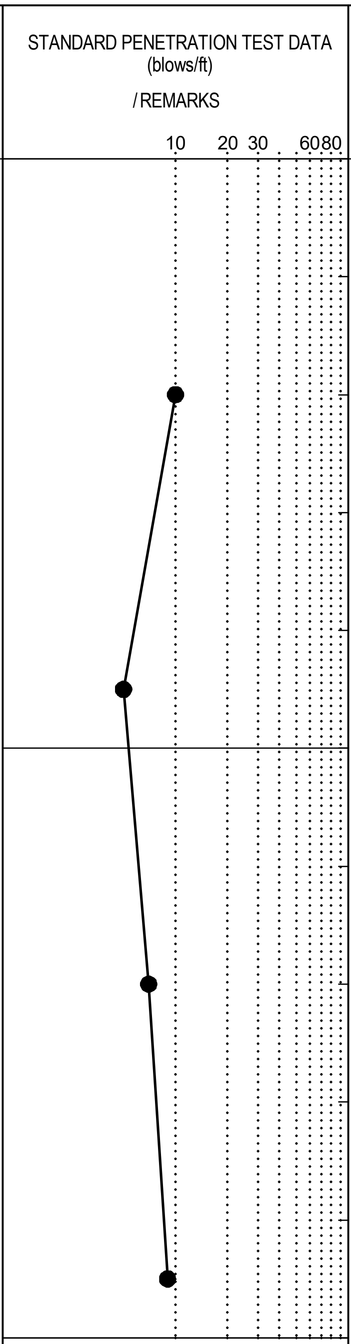
LOGGED BY: **K. Fugate**

SAMPLING METHOD: **Split Spoon**

DRILLING METHOD: **3¼" H.S.A.**

NOTES: **Elevation unknown.**

| DEPTH (feet) | MATERIAL DESCRIPTION | WATER LEVEL | ELEVATION (feet) | SAMPLE NO. | BLOW COUNT / CORE DATA 1st 6in / RUN # | 2nd 6in / REC | 3rd 6in / RQD | N VALUE |
|---|---|---|---|---|---|---|---|---|
| | **ASPHALT** - Deteriorated - Approximately 4 inches thick. | | | | | | | |
| | **POORLY GRADED SAND WITH SILT (SP-SM)** - Mostly fine sand, few fines, orange and tan, moist to wet, loose. | HC | | | | | | |
| | | ▽ | | 1 | 4 | 5 | 5 | 10 |
| | ---- Wet. | | | | | | | |
| | | | | 2 | 2 | 2 | 3 | 5 |
| 5 | | | | | | | | |
| | ---- Dark brown. | | | | | | | |
| | | | | 3 | 3 | 3 | 4 | 7 |
| | ---- White and dark brown. | | | | | | | |
| | | | | 4 | 2 | 3 | 6 | 9 |
| 10 | Boring terminated at 10 ft | | | | | | | |



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3. *STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.*
4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

**Ibis Ave, Navajo Tr & Arapaho Dr, and Simone Ct & Royal Pines Dr**
**Georgetown, South Carolina**
**S&ME Project No. 1363-20-020**

# BORING LOG P-6

DATE DRILLED: **6/2/20**

ELEVATION:

DRILL RIG: **ATV**

BORING DEPTH: **10.0 ft**

DRILLER: **M. Wright**

WATER LEVEL: **Not encountered.**

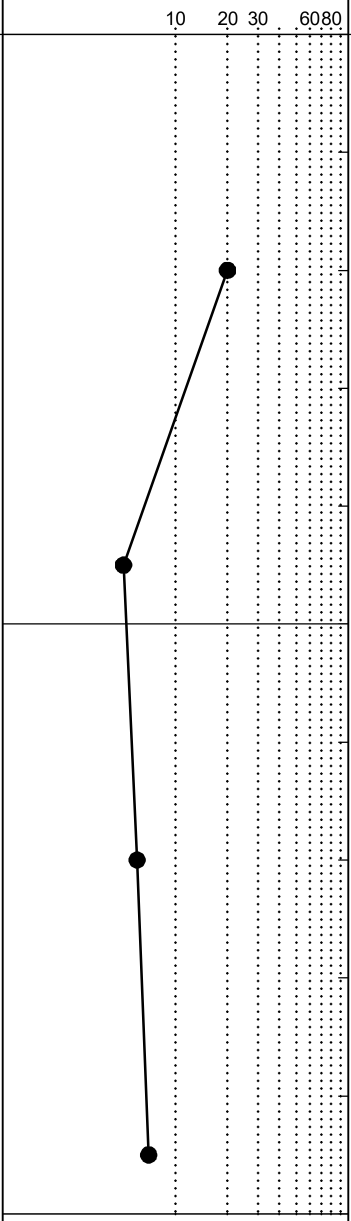
HAMMER TYPE: **Auto**

LOGGED BY: **K. Fugate**

SAMPLING METHOD: **Split Spoon**

DRILLING METHOD: **3¼" H.S.A.**

NOTES: **Elevation unknown.**

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | WATER LEVEL | ELEVATION (feet) | SAMPLE NO. | SAMPLE TYPE | BLOW COUNT / CORE DATA 1st 6in / RUN # | 2nd 6in / REC | 3rd 6in / RQD | STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS | N VALUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **GRAVEL (GP)** - Approximately 2 inches thick. | | | | | | | |  | |
| | | **POORLY GRADED SAND WITH SILT (SP-SM)** - Mostly fine sand, few fines, grey and orange, moist, medium dense. | NC | | 1 | | 5 | 7 | 13 | | 20 |
| 5 | | - - - - Tan and orange, wet, loose. | | | 2 | | 4 | 3 | 2 | | 5 |
| | | | | | 3 | | 1 | 3 | 3 | | 6 |
| 10 | | - - - - Grey. | | | 4 | | 3 | 4 | 3 | | 7 |
| | | Boring terminated at 10 ft | | | | | | | | | |

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3. *STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.*
4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

**Ibis Ave, Navajo Tr & Arapaho Dr, and Simone Ct & Royal Pines Dr**
**Georgetown, South Carolina**
**S&ME Project No. 1363-20-020**

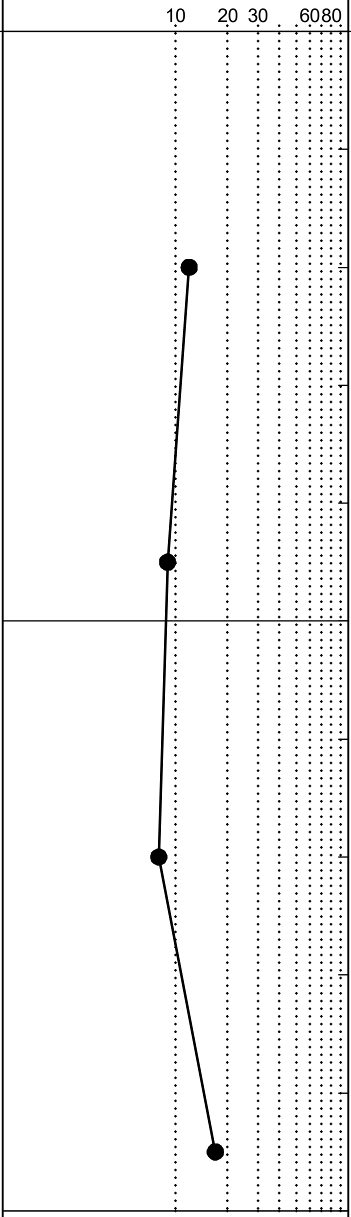
# BORING LOG P-7

DATE DRILLED: **6/2/20**
ELEVATION:
DRILL RIG: **ATV**
BORING DEPTH: **10.0 ft**
DRILLER: **M. Wright**
WATER LEVEL: **3.5' ATD, 1.75' 24 hr**
HAMMER TYPE: **Auto**
LOGGED BY: **K. Fugate**
SAMPLING METHOD: **Split Spoon**
DRILLING METHOD: **3¼" H.S.A.**

NOTES: **Elevation unknown.**

| DEPTH (feet) | MATERIAL DESCRIPTION | WATER LEVEL | ELEVATION (feet) | SAMPLE NO. | BLOW COUNT / CORE DATA 1st 6in / RUN # | 2nd 6in / REC | 3rd 6in / RQD | N VALUE |
|---|---|---|---|---|---|---|---|---|
| | **GRAVEL (GP)** - Approximately 1 inches thick. | | | | | | | |
| | **POORLY GRADED SAND WITH SILT (SP-SM)** - Mostly fine sand, few fines, tan, moist, loose to medium dense. | | | | | | | |
| | | ▼ | | | | | | |
| | | | | 1 | 6 | 3 | 9 | 12 |
| | - - - - Wet. | | | | | | | |
| | | ▽ | | | | | | |
| | - - - - Orange, brown and grey, loose. | | | | | | | |
| | | | | 2 | 3 | 3 | 6 | 9 |
| 5 | | | | | | | | |
| | | | | 3 | 2 | 3 | 5 | 8 |
| | | | | 4 | 3 | 7 | 10 | 17 |
| | - - - - Grey, medium dense. | | | | | | | |
| 10 | Boring terminated at 10 ft | | | | | | | |

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS



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3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

S&ME BORING LOG \ HAND AUGER LOGS.GPJ \ LIBRARY 2011_06_28.GDT \ 6/16/20

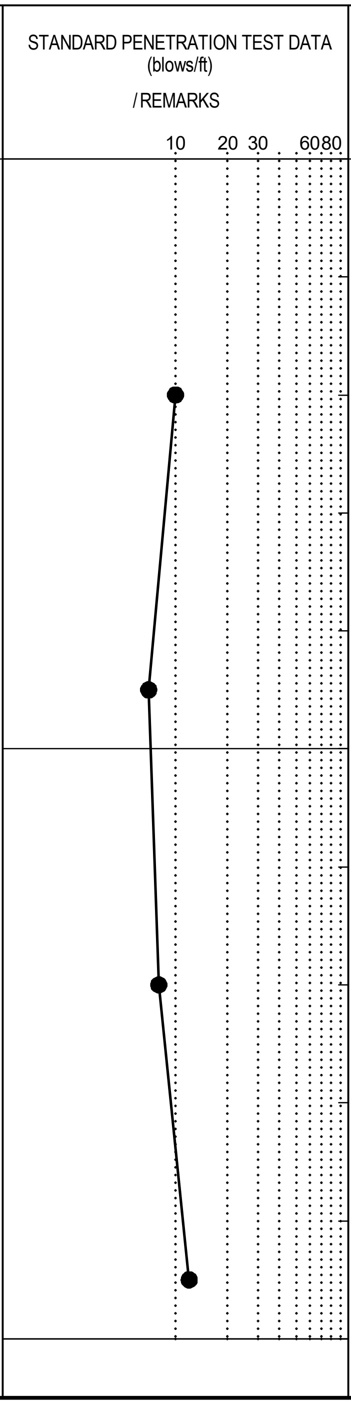
Ibis Ave, Navajo Tr & Arapaho Dr, and Simone Ct & Royal Pines Dr
Georgetown, South Carolina
**S&ME Project No. 1363-20-020**

# BORING LOG P-8

DATE DRILLED: **6/2/20**
ELEVATION:
DRILL RIG: **ATV**
BORING DEPTH: **10.0 ft**
DRILLER: **M. Wright**
WATER LEVEL: **2.5' ATD, 1.7' 24 hr**
HAMMER TYPE: **Auto**
LOGGED BY: **K. Fugate**
SAMPLING METHOD: **Split Spoon**
DRILLING METHOD: **3¼" H.S.A.**

NOTES: **Elevation unknown.**

| DEPTH (feet) | MATERIAL DESCRIPTION | WATER LEVEL | ELEVATION (feet) | SAMPLE NO. | BLOW COUNT / CORE DATA 1st 6in / RUN # | 2nd 6in / REC | 3rd 6in / RQD | N VALUE |
|---|---|---|---|---|---|---|---|---|
| | **GRAVEL (GP)** - Approximately 3 inches thick. | | | | | | | |
| | **POORLY GRADED SAND WITH SILT (SP-SM)** - Mostly fine sand, few fines, grey, tan, and orange, moist, loose. | ▼ ▽ | | 1 | 4 | 3 | 7 | 10 |
| | - - - - Tan and brown, wet. | | | 2 | 3 | 2 | 5 | 7 |
| 5 | | | | | | | | |
| | | | | 3 | 2 | 3 | 5 | 8 |
| | - - - - Grey, medium dense. | | | 4 | 4 | 4 | 8 | 12 |
| 10 | Boring terminated at 10 ft | | | | | | | |



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4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

# ♦ Summary of Laboratory Procedures

## Examination of Recovered Soil Samples

Soil and field records were reviewed in the laboratory by the geotechnical professional.  Soils were classified in general accordance with the visual-manual method described in ASTM D 2488, "*Standard Practice for Description and Identification of Soils (Visual-Manual Method)*".  Representative soil samples were selected for classification testing to provide grain size and plasticity data to allow classification of the samples in general accordance with the Unified Soil Classification System method described in ASTM D 2487, "*Standard Practice for Classification of Soils for Engineering Purposes*".  The geotechnical professional also prepared the final boring and sounding records enclosed with this report.

## Moisture Content Testing of Soil Samples by Oven Drying

Moisture content was determined in general conformance with the methods outlined in ASTM D 2216, "*Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil or Rock by Mass*."  This method is limited in scope to Group B, C, or D samples of earth materials which do not contain appreciable amounts of organic material, soluble solids such as salt or reactive solids such as cement.  This method is also limited to samples which do not contain contamination.

A representative portion of the soil was divided from the sample using one of the methods described in Section 9 of ASTM D 2216.  The split portion was  then placed in a drying oven and heated to approximately 110 degrees C overnight or until a constant mass was achieved after repetitive weighing.  The moisture content of the soil was then computed as the mass of water removed from the sample by drying, divided by the mass of the sample dry, times 100 percent.   No attempt was made to exclude any particular particle size from the portion split from the sample.

## Percent Fines Determination of Samples

A selected specimen of soils was washed over a No. 200 sieve after being thoroughly mixed and dried.  This test was conducted in general accordance with ASTM D 1140, "*Standard Test Method for Amount of Material Finer Than the No. 200 Sieve*."  Method B, using a dispersant solution to wash the sample through the sieve after soaking the sample for a prescribed period of time, was used and the percentage by weight of material washing through the sieve was deemed the "percent fines" or percent clay and silt fraction.

## Compaction Tests of Soils Using Modified Effort

Soil placed as engineering fill is compacted to a dense state to obtain satisfactory engineering properties.  Laboratory compaction tests provide the basis for determining the percent compaction and water content needed to achieve the required engineering properties, and for controlling construction to assure the required compaction and water contents are achieved.  Test procedures generally followed those described by ASTM D 1557,"*Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 lbf/ft$^3$).*"

The relationship between water content and the dry unit weight is determined for soils compacted in either 4 or 6 inch diameter molds with a 10 lbf rammer dropped from a height of 18 inches, producing a compactive effort of 56,000 lbf/ft$^3$.  ASTM D 1557 provides three alternative procedures depending on material gradation:

Method A

All material passes No. 4 sieve size
4 inch diameter mold
Shall be used if 20 percent or less by weight is retained on No. 4 sieve
Soil in 5 layers with 25 blows per layer

Method B

All material passes 3/8 inch sieve
4 inch diameter mold
Shall be used if 20 percent by weight is retained on the No. 4 sieve and 20 percent or less by weight is retained on the 3/8 Inch sieve.
Soil in 5 layers with 25 blows per layer

Method C

All material passes ¾ inch sieve
6-inch diameter mold
Shall be used if more than 20 percent by weight is retained on the 3/8 inch sieve and less than 30 percent is retained on the ¾inch sieve.
Soil in 5 layers with 56 blows per layer

Soil was compacted in the mold in five layers of approximately equal thickness, each compacted with either 25 or 56 blows of the rammer. After compaction of the sample in the mold, the resulting dry density and moisture content was determined and the procedure repeated. Separate soils were used for each sample point, adjusting the moisture content of the soil as described in Section 10.2 (Moist Preparation Method). The procedure was repeated for a sufficient number of water content values to allow the dry density vs. water content values to be plotted and the *maximum dry density* and *optimum moisture content* to be determined from the resulting curvilinear relationship.

## Laboratory California Bearing Ratio Tests of Compacted Samples

This method is used to evaluate the potential strength of subgrade, subbase, and base course material, including recycled materials, for use in road and airfield pavements. Laboratory CBR tests were run in general accordance with the procedures laid out in ASTM D 1883, "*Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils*." Specimens were prepared in standard molds using two different levels of compactive effort within plus or minus 0.5 percent of the optimum moisture content value. While embedded in the compaction mold, each sample was inundated for a minimum period of 96 hours to achieve saturation. During inundation the specimen was surcharged by a weight approximating the anticipated weight of the pavement and base course layers. After removing the sample from the soaking bath, the soil was then sheared by jacking a piston having a cross sectional area of 3 square inches into the end surface of the specimen. The piston was jacked 0.5 inches into the specimen at a constant rate of 0.05 inches per minute.

The CBR is defined as the load required to penetrate a material to a predetermined depth, compared to the load required to penetrate a standard sample of crushed stone to the same depth. The CBR value was usually based on the load ratio for a penetration of 0.10 inches, after correcting the load-deflection curves for surface irregularities or upward concavity. However, where the calculated CBR for a penetration of 0.20 inches was greater than the result obtained for a penetration of 0.10 inches, the test was repeated by reversing the specimen and shearing the opposite end surface. Where the second test indicated a greater CBR at 0.20 inches penetration, the CBR for 0.20 inches penetration was used.

Form No: TR-D2216-T265-1
Revision No. 1
Revision Date: 08/16/17

# LABORATORY DETERMINATION OF WATER CONTENT

*ASTM D 2216* ☑ *AASHTO T 265* ☐

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

| | | | |
|---|---|---|---|
| Project #: | 1363-20-020 | Report Date: | 6/9/2020 |
| Project Name: | Ibis, Navajo/Arapaho, Simone/Royal | Test Date(s): | 6/4/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. | | |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC | | |
| Sample by: | K. Fugate | Sample Date(s): | 6/2/2020 |

**Method:** **A** (1%) ☐ **B** (0.1%) ☑

| | | | |
|---|---|---|---|
| Balance ID. | 19608 | Calibration Date: | 2/28/19 |
| Oven ID. | 17745 | Calibration Date: | 4/8/19 |

| Boring No. | Sample No. | Sample Depth | Tare # | Tare Weight | Tare Wt.+ Wet Wt | Tare Wt. + Dry Wt | Water Weight | Percent Moisture | Note |
|---|---|---|---|---|---|---|---|---|---|
| | | ft. or m. | | grams | grams | grams | grams | % | |
| P-1 to P-3 | C-1 | 6"-5' | JKL | 83.40 | 163.60 | 159.10 | 4.50 | 5.9% | |
| | | | | | | | | | |
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*Notes / Deviations / References* Navajo Trail and Arapaho Drive

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

| Ron Forest, P.E. | RPF | Senior Reviewer | 12-Jun |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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Form No: TR-D1140-1
Revision No. 1
Revision Date: 8/2/17

# MATERIAL FINER THAN THE #200 SIEVE

ASTM D1140

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

| | | | |
|---|---|---|---|
| Project #: | 1363-20-020 | Report Date: | 6/9/2020 |
| Project Name: | Ibis, Navajo/Arapaho, Simone/Royal | Test Date(s): | 6/5/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. | | |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC | | |
| Sample by: | K. Fugate | **LAB#** | 169 |
| | | Sample Dates: | 6/2/2020 |

**Method;** **A** ☐ **B** ☑ Soaked ☑ Soak Time 2 Hrs

| Boring # | Sample # | Sample Depth | Tare # | Tare Weight | Tare Wt.+ Wet Wt | Tare Wt. + Dry Wt | Tare Wt. + Dry Wt. after Wash | % Passing #200 |
|---|---|---|---|---|---|---|---|---|
| | | ft. or m. | | grams | grams | grams | grams | % |
| P-1 to P-3 | C-1 | 6"-5' | JKL | 83.40 | 163.60 | 159.10 | 154.30 | **6.3%** |
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*Balance ID.* *19608* *Calibration Date:* *2/28/19* *#200 Sieve* *18775* *Calibration Date:* *2/28/20*

*Notes / Deviations / References:* ASTM D1140: Amount of Material in Soil Finer Than the No. 200 (75-um) ) Sieve

Navajo Trail and Arapaho Drive

| | | | |
|---|---|---|---|
| Ron Forest, P.E. | RPF | Senior Reviewer | 12-Jun |
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

# CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

*ASTM D 1883*

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

| | | | |
|---|---|---|---|
| Project #: | 1363-20-020 | Report Date: | 6/9/2020 |
| Project Name: | Ibis, Navajo/Arapaho, Simone/Royal | Test Date(s) | 6/4/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. | | |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC | | |

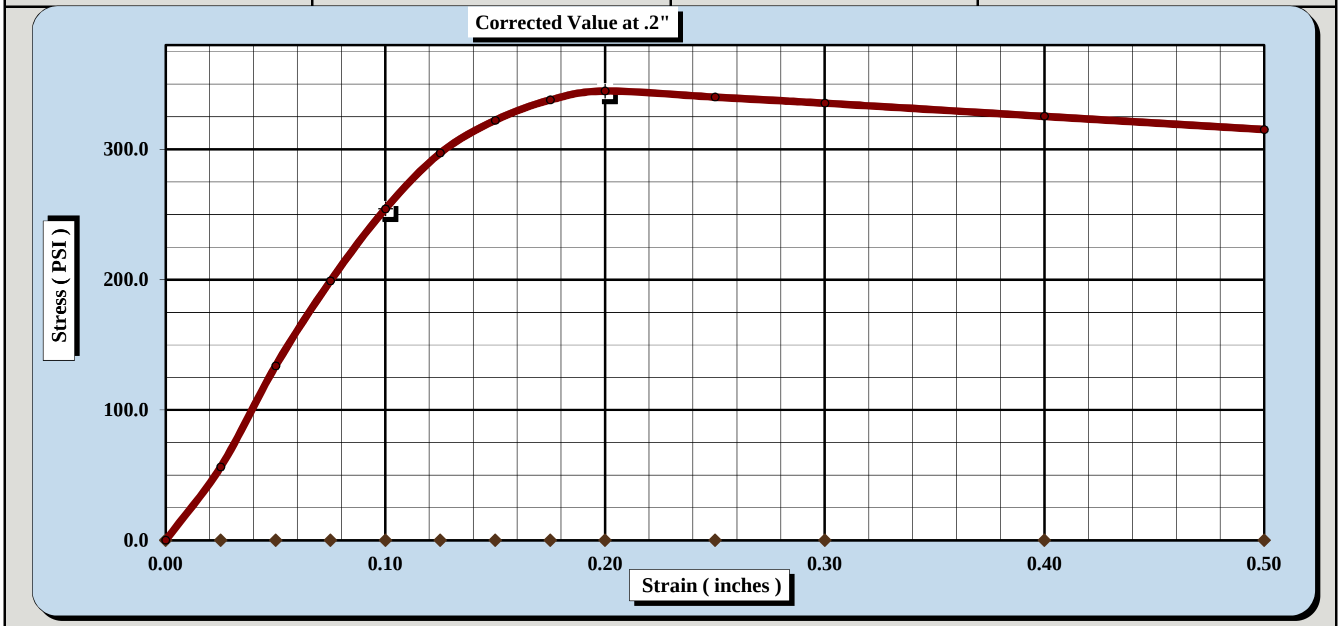
| | | | | | |
|---|---|---|---|---|---|
| Boring #: | P-1 to P-3 | Sample #: | C-1 | Sample Date: | 6/2/2020 |
| Location: | Arapaho Rd. - Navaho Tr. | LAB #: | 167 | Depth: | 3"-5' |

Sample Description: Brown Poorly Graded Sand with Silt (SP-SM)

*ASTM D1557* *Method A* Maximum Dry Density: 102.8 PCF Optimum Moisture Content: 14.5%

Compaction Test performed on grading complying with CBR spec. % Retained on the 3/4" sieve: 1.0%

| **Uncorrected CBR Values** | | | | **Corrected CBR Values** | | | |
|---|---|---|---|---|---|---|---|
| CBR at 0.1 in. | 25.4 | CBR at 0.2 in. | 23.0 | CBR at 0.1 in. | 25.4 | CBR at 0.2 in. | 23.0 |



CBR Sample Preparation:

*The entire gradation was used and compacted in a 6" CBR mold in accordance with* *ASTM D1883, Section 6.1.1*

| *Before Soaking* | | *After Soaking* | |
|---|---|---|---|
| Compactive Effort (Blows per Layer) | 25 | | |
| Initial Dry Density (PCF) | 98.0 | Final Dry Density (PCF) | 98.0 |
| Moisture Content of the Compacted Specimen | 14.3% | Moisture Content (top 1" after soaking) | 20.7% |
| Percent Compaction | 95.4% | Percent Swell | 0.0% |

| | | | | | |
|---|---|---|---|---|---|
| Soak Time: | 96 hrs. | Surcharge Weight | 20.0 | Surcharge Wt. per sq. Ft. | 101.8 |
| Liquid Limit | -- | Plastic Index | -- | Apparent Relative Density | -- |

Notes/Deviations/References: Liquid Limit: ASTM D 4318, Specific Gravity: ASTM D 854, Classification: ASTM D 2487

| | | | |
|---|---|---|---|
| Ron Forest, P.E. | | Senior Reviewer | |
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

# MOISTURE - DENSITY REPORT

*Quality Assurance*

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

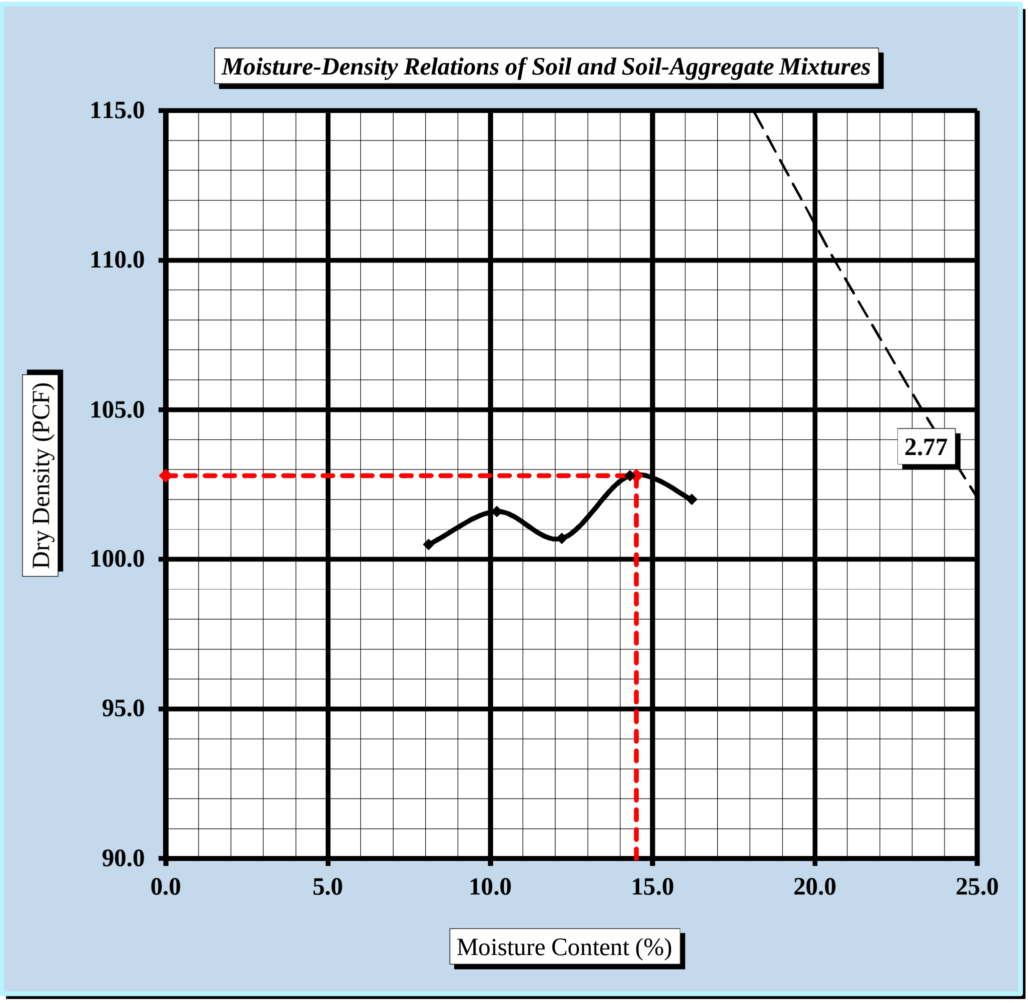
| | | | |
|---|---|---|---|
| S&ME Project #: | 1363-20-020 | Report Date: | 6/9/2020 |
| Project Name: | Ibis, Navajo/Arapaho, Simone/Royal | Test Date(s): | 6/3/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. | | |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | P-1 to P-3 | Sample #: | C-1 | Sample Date: | 6/2/2020 |
| Location: | Arapaho Rd. - Navaho Tr. | Lab #: | 167 | Depth: | 6"-5' |

Sample Description: Brown Poorly Graded Sand with Silt (SP-SM)

**Maximum Dry Density 102.8 PCF.** **Optimum Moisture Content 14.5%**

***ASTM D1557 - - Method A***



| ***Soil Properties*** | |
|---|---|
| *Natural Moisture Content* | 5.9% |
| *Specific Gravity of Soil* | -- |
| *Liquid Limit* | -- |
| *Plastic Limit* | -- |
| *Plastic Index* | -- |
| ***% Passing*** | |
| *3/4"* | -- |
| *3/8"* | -- |
| *#4* | -- |
| *#10* | -- |
| *#40* | -- |
| *#60* | -- |
| *#200* | 6.3% |
| ***Oversize Fraction*** | |
| *Bulk Gravity* | -- |
| *% Moisture* | -- |
| *% Oversize* | -- |
| *MDD* | -- |
| *Opt. MC* | -- |

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

*References / Comments / Deviations:*

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 1557: Laboratory Compaction Characteristics of Soil Using Modified Effort

| Ronald P. Forest, Jr. | RPF | Senior Engineer | 6/12/2020 |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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Form No: TR-D2216-T265-1
Revision No. 1
Revision Date: 08/16/17

# LABORATORY DETERMINATION OF WATER CONTENT

*ASTM D 2216* ☑ *AASHTO T 265* ☐

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

| | | | |
|---|---|---|---|
| Project #: | 1363-20-020 | Report Date: | 6/9/2020 |
| Project Name: | Ibis, Navajo/Arapaho, Simone/Royal | Test Date(s): | 6/4/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. | | |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC | | |
| Sample by: | K. Fugate | Sample Date(s): | 6/2/2020 |

**Method:** **A** **(1%)** ☐ **B** **(0.1%)** ☑

Balance ID. 19608 Calibration Date: 2/28/19
Oven ID. 17745 Calibration Date: 4/8/19

| Boring No. | Sample No. | Sample Depth | Tare # | Tare Weight | Tare Wt.+ Wet Wt | Tare Wt. + Dry Wt | Water Weight | Percent Moisture | Note |
|---|---|---|---|---|---|---|---|---|---|
| | | ft. or m. | | grams | grams | grams | grams | % | |
| P-4 to P-5 | C-2 | 6"-5' | H | 78.70 | 231.30 | 203.60 | 27.70 | 22.2% | |
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*Notes / Deviations / References* Simone Court and Royal Pines Drive

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

| Ron Forest, P.E. | RPF | Senior Reviewer | 12-Jun |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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Form No: TR-D1140-1
Revision No. 1
Revision Date: 8/2/17

# MATERIAL FINER THAN THE #200 SIEVE

ASTM D1140

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

| | | | |
|---|---|---|---|
| Project #: | 1363-20-020 | Report Date: | 6/9/2020 |
| Project Name: | Ibis, Navajo/Arapaho, Simone/Royal | Test Date(s): | 6/5/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. | | |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC | | |
| Sample by: | K. Fugate | **LAB#** | 169 |
| | | Sample Dates: | 6/2/2020 |

**Method;** **A** ☐ **B** ☑ Soaked ☑ Soak Time 2 Hrs

| Boring # | Sample # | Sample Depth | Tare # | Tare Weight | Tare Wt.+ Wet Wt | Tare Wt. + Dry Wt | Tare Wt. + Dry Wt. after Wash | % Passing #200 |
|---|---|---|---|---|---|---|---|---|
| | | ft. or m. | | grams | grams | grams | grams | % |
| P-4 to P-5 | C-2 | 6"-5' | H | 78.70 | 231.30 | 203.60 | 196.30 | **5.8%** |
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*Balance ID.* *19608* *Calibration Date:* *2/28/19* *#200 Sieve* *18775* *Calibration Date:* *2/28/20*

*Notes / Deviations / References:* ASTM D1140: Amount of Material in Soil Finer Than the No. 200 (75-um) ) Sieve

Simone Court and Royal Pines Drive

| Ron Forest, P.E. | RPF | Senior Reviewer | 12-Jun |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

# MOISTURE - DENSITY REPORT

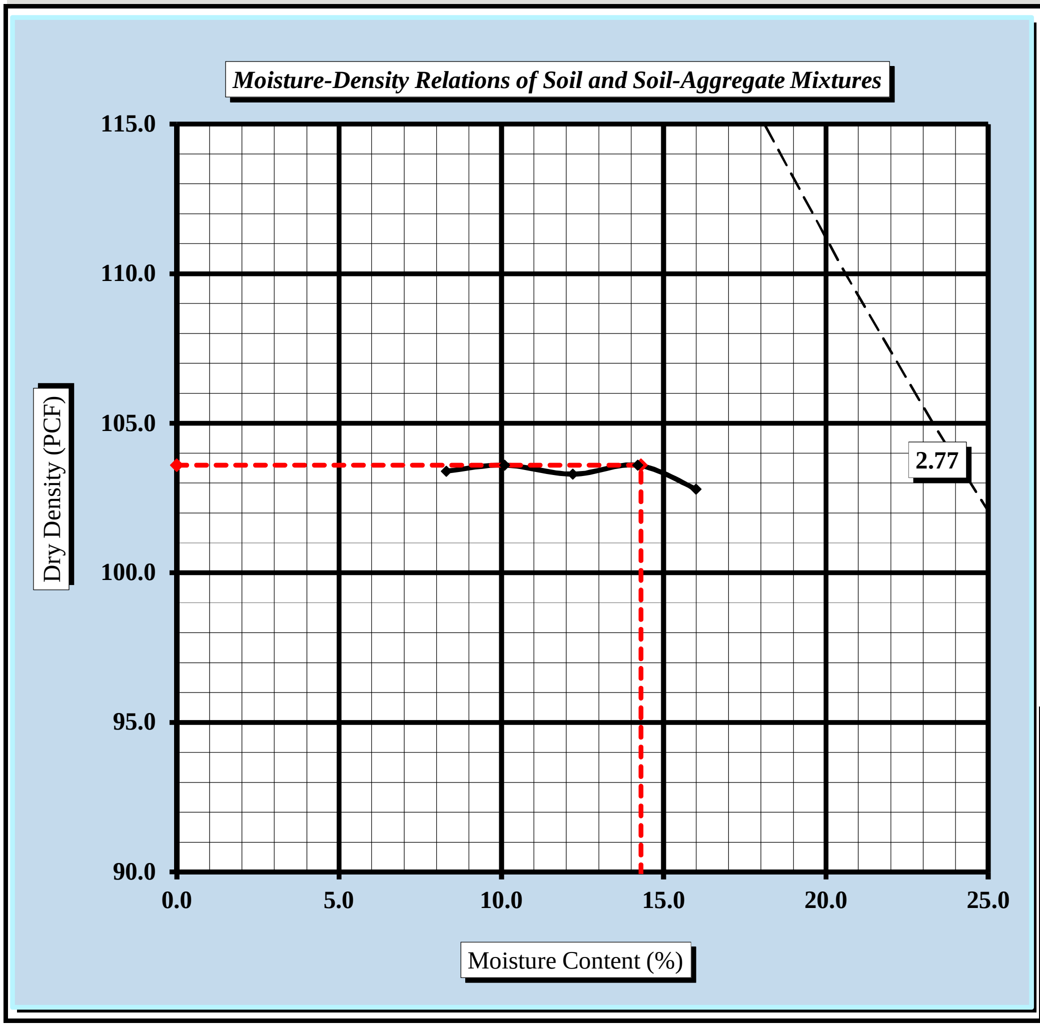
*Quality Assurance*

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

S&ME Project #: 1363-20-020
Report Date: 6/9/2020
Project Name: Ibis, Navajo/Arapaho, Simone/Royal
Test Date(s): 6/3/2020
Client Name: Davis & Floyd Engineering, Inc.
Client Address: 3229 West Montague Ave; N. Charleston, SC
Boring #: P-4 to P-5
Sample #: C-2
Sample Date: 6/2/2020
Location: Simone Ct. - Royal Pines
Lab #: 168
Depth: 6"-5'
Sample Description: Brown Poorly Graded Sand with Silt (SP-SM)

**Maximum Dry Density** **103.6** **PCF.**
**Optimum Moisture Content** **14.3%**

***ASTM D1557 - - Method A***



| | |
|---|---|
| ***Soil Properties*** | |
| *Natural Moisture Content* | 22.2% |
| *Specific Gravity of Soil* | -- |
| *Liquid Limit* | -- |
| *Plastic Limit* | -- |
| *Plastic Index* | -- |
| *% Passing* | |
| *3/4"* | -- |
| *3/8"* | -- |
| *#4* | -- |
| *#10* | -- |
| *#40* | -- |
| *#60* | -- |
| *#200* | 5.8% |
| *Oversize Fraction* | |
| *Bulk Gravity* | -- |
| *% Moisture* | -- |
| *% Oversize* | -- |
| *MDD* | -- |
| *Opt. MC* | -- |

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

*References / Comments / Deviations:*

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 1557: Laboratory Compaction Characteristics of Soil Using Modified Effort

| Ronald P. Forest, Jr. | RPF | Senior Engineer | 6/12/2020 |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

# CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

*ASTM D 1883*

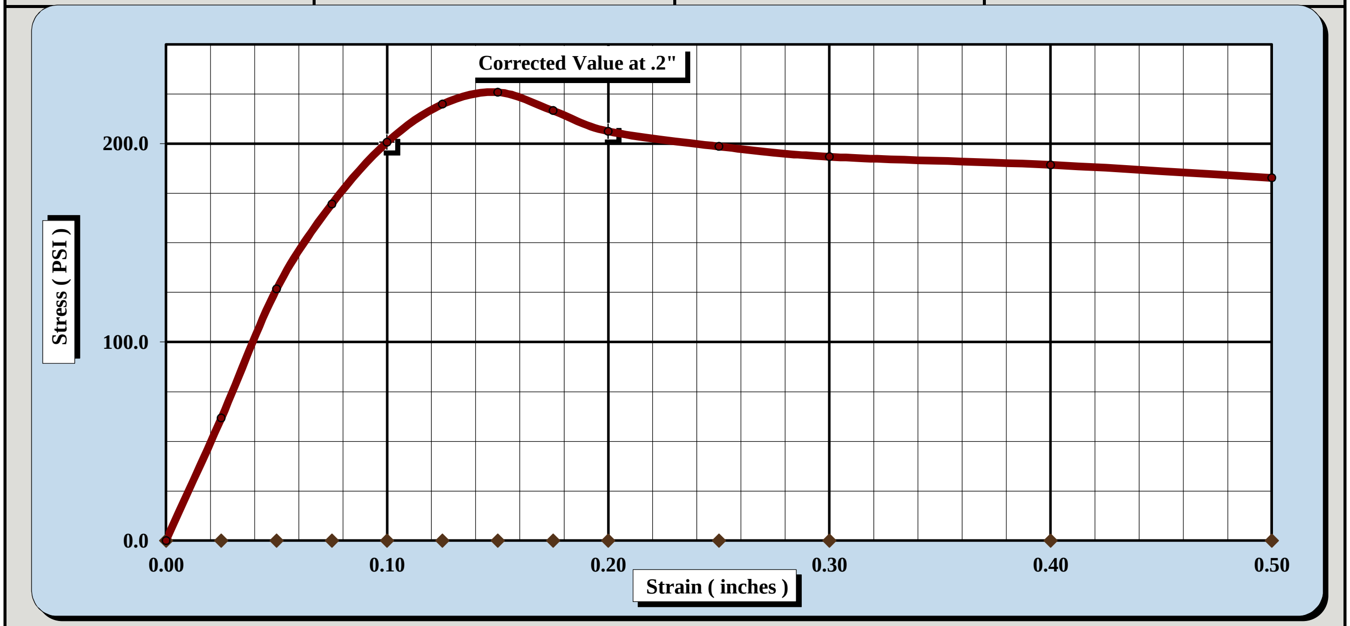
S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

|  |  |  |  |
|---|---|---|---|
| Project #: | 1363-20-020 | Report Date: | 6/9/2020 |
| Project Name: | Ibis, Navajo/Arapaho, Simone/Royal | Test Date(s) | 6/4/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. |  |  |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC |  |  |

Boring #: P-4 to P-5 Sample #: C-2 Sample Date: 6/2/2020
Location: Simone Ct. - Royal Pines Rd. LAB #: 168 Depth: 6"-5'
Sample Description: Brown Poorly Graded Sand with Silt (SP-SM)

*ASTM D1557* *Method A* Maximum Dry Density: 103.6 PCF Optimum Moisture Content: 14.3%
Compaction Test performed on grading complying with CBR spec. % Retained on the 3/4" sieve: 1.0%

| **Uncorrected CBR Values** |  |  |  | **Corrected CBR Values** |  |  |  |
|---|---|---|---|---|---|---|---|
| CBR at 0.1 in. | 20.1 | CBR at 0.2 in. | 13.7 | CBR at 0.1 in. | 20.1 | CBR at 0.2 in. | 13.7 |



CBR Sample Preparation:
*The entire gradation was used and compacted in a 6" CBR mold in accordance with* *ASTM D1883, Section 6.1.1*

| *Before Soaking* |  | *After Soaking* |  |
|---|---|---|---|
| Compactive Effort (Blows per Layer) | 25 |  |  |
| Initial Dry Density (PCF) | 98.6 | Final Dry Density (PCF) | 98.6 |
| Moisture Content of the Compacted Specimen | 14.3% | Moisture Content (top 1" after soaking) | 15.3% |
| Percent Compaction | 95.1% | Percent Swell | 0.0% |

Soak Time: 96 hrs. Surcharge Weight 20.0 Surcharge Wt. per sq. Ft. 102.0
Liquid Limit -- Plastic Index -- Apparent Relative Density --

Notes/Deviations/References: Liquid Limit: ASTM D 4318, Specific Gravity: ASTM D 854, Classification: ASTM D 2487

| Ron Forest, P.E. | RPF | Senior Reviewer | 6/12/2020 |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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Form No: TR-D2216-T265-1
Revision No. 1
Revision Date: 08/16/17

# LABORATORY DETERMINATION OF WATER CONTENT

*ASTM D 2216* ☑ *AASHTO T 265* ☐

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

| | | | |
|---|---|---|---|
| Project #: | 1363-20-020 | Report Date: | 6/9/2020 |
| Project Name: | Ibis, Navajo/Arapaho, Simone/Royal | Test Date(s): | 6/4/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. | | |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC | | |
| Sample by: | K. Fugate | Sample Date(s): | 6/2/2020 |

**Method:** **A** **(1%)** ☐ **B** **(0.1%)** ☑

Balance ID. 19608 Calibration Date: 2/28/19
Oven ID. 17745 Calibration Date: 4/8/19

| Boring No. | Sample No. | Sample Depth | Tare # | Tare Weight | Tare Wt.+ Wet Wt | Tare Wt. + Dry Wt | Water Weight | Percent Moisture | Note |
|---|---|---|---|---|---|---|---|---|---|
| | | ft. or m. | | grams | grams | grams | grams | % | |
| P-6 to P-8 | C-3 | 6"-5' | EEE | 81.00 | 222.00 | 195.80 | 26.20 | 22.8% | |
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*Notes / Deviations / References* Ibis Avenue

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

| | | | |
|---|---|---|---|
| Ron Forest, P.E. | RPF | Senior Reviewer | 12-Jun |
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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Form No: TR-D1140-1
Revision No. 1
Revision Date: 8/2/17

# MATERIAL FINER THAN THE #200 SIEVE

ASTM D1140

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

Project #: 1363-20-020
Report Date: 6/9/2020
Project Name: Ibis, Navajo/Arapaho, Simone/Royal
Test Date(s): 6/5/2020
Client Name: Davis & Floyd Engineering, Inc.
Client Address: 3229 West Montague Ave; N. Charleston, SC
Sample by: K. Fugate
**LAB#** 169
Sample Dates: 6/2/2020

**Method; A** ☐ **B** ☑ Soaked ☑ Soak Time 2 Hrs

| Boring # | Sample # | Sample Depth | Tare # | Tare Weight | Tare Wt.+ Wet Wt | Tare Wt. + Dry Wt | Tare Wt. + Dry Wt. after Wash | % Passing #200 |
|---|---|---|---|---|---|---|---|---|
| | | ft. or m. | | grams | grams | grams | grams | % |
| P-6 to P-8 | C-3 | 6"-5' | EEE | 81.00 | 222.00 | 195.80 | 189.10 | **5.8%** |
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*Balance ID.* *19608* *Calibration Date:* *2/28/19* *#200 Sieve* *18775* *Calibration Date:* *2/28/20*

*Notes / Deviations / References:* ASTM D1140: Amount of Material in Soil Finer Than the No. 200 (75-um) ) Sieve

Ibis Avenue

Ron Forest, P.E. — *Technical Responsibility*
RPF — *Signature*
Senior Reviewer — *Position*
12-Jun — *Date*

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Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

# MOISTURE - DENSITY REPORT

*Quality Assurance*

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

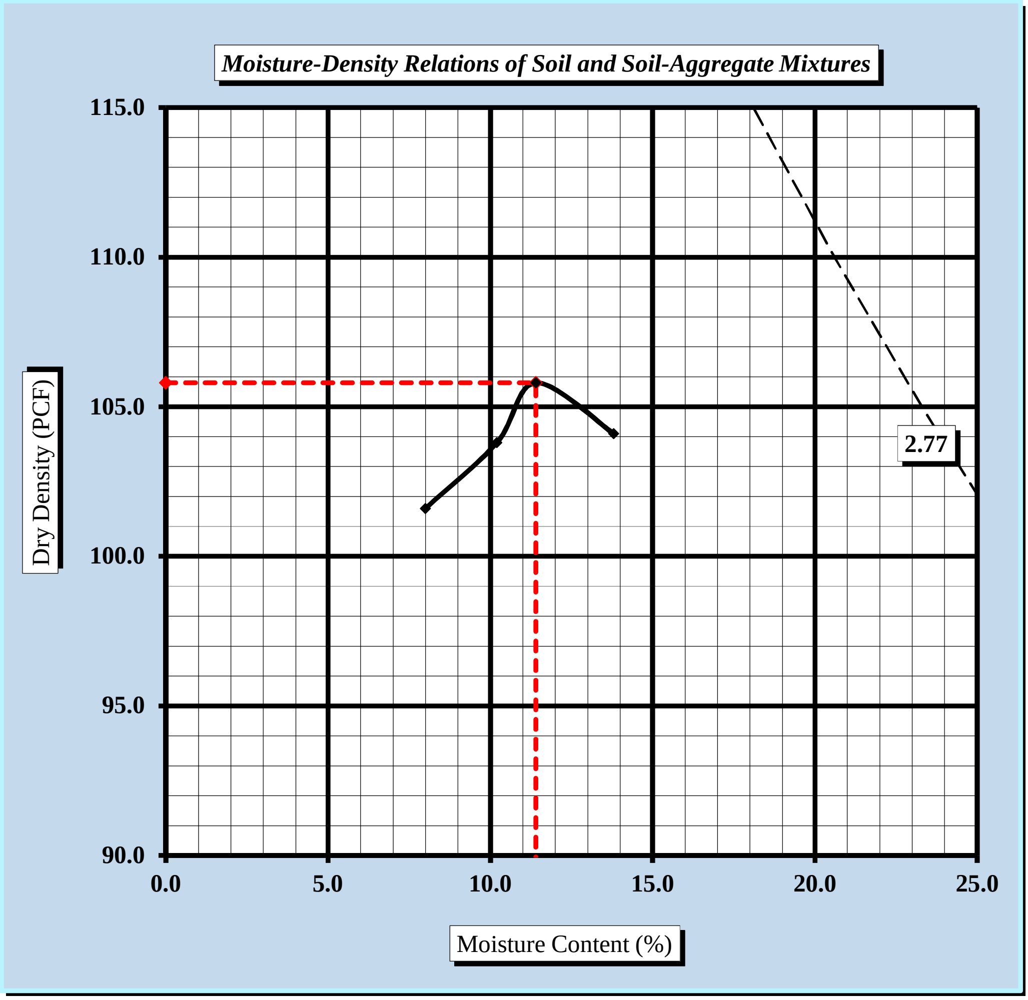
| | | | |
|---|---|---|---|
| S&ME Project #: | 1363-20-020 | Report Date: | 6/9/2020 |
| Project Name: | Ibis, Navajo/Arapaho, Simone/Royal | Test Date(s): | 6/3/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. | | |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | P-4 to P-5 | Sample #: | C-3 | Sample Date: | 6/2/2020 |
| Location: | Ibis Ave. | Lab #: | 169 | Depth: | 6"-5' |

Sample Description: Brown Poorly Graded Sand with Silt (SP-SM)

**Maximum Dry Density 105.8 PCF.** **Optimum Moisture Content 11.4%**

***ASTM D1557 - - Method A***



***Soil Properties***

| | |
|---|---|
| *Natural Moisture Content* | 22.8% |
| *Specific Gravity of Soil* | -- |
| *Liquid Limit* | -- |
| *Plastic Limit* | -- |
| *Plastic Index* | -- |

*% Passing*

| | |
|---|---|
| *3/4"* | -- |
| *3/8"* | -- |
| *#4* | -- |
| *#10* | -- |
| *#40* | -- |
| *#60* | -- |
| *#200* | 5.8% |

*Oversize Fraction*

| | |
|---|---|
| *Bulk Gravity* | -- |
| *% Moisture* | -- |
| *% Oversize* | -- |
| *MDD* | -- |
| *Opt. MC* | -- |

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

*References / Comments / Deviations:*

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 1557: Laboratory Compaction Characteristics of Soil Using Modified Effort

| Ronald P. Forest, Jr. | RPF | Senior Engineer | 6/12/2020 |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

# CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

*ASTM D 1883*

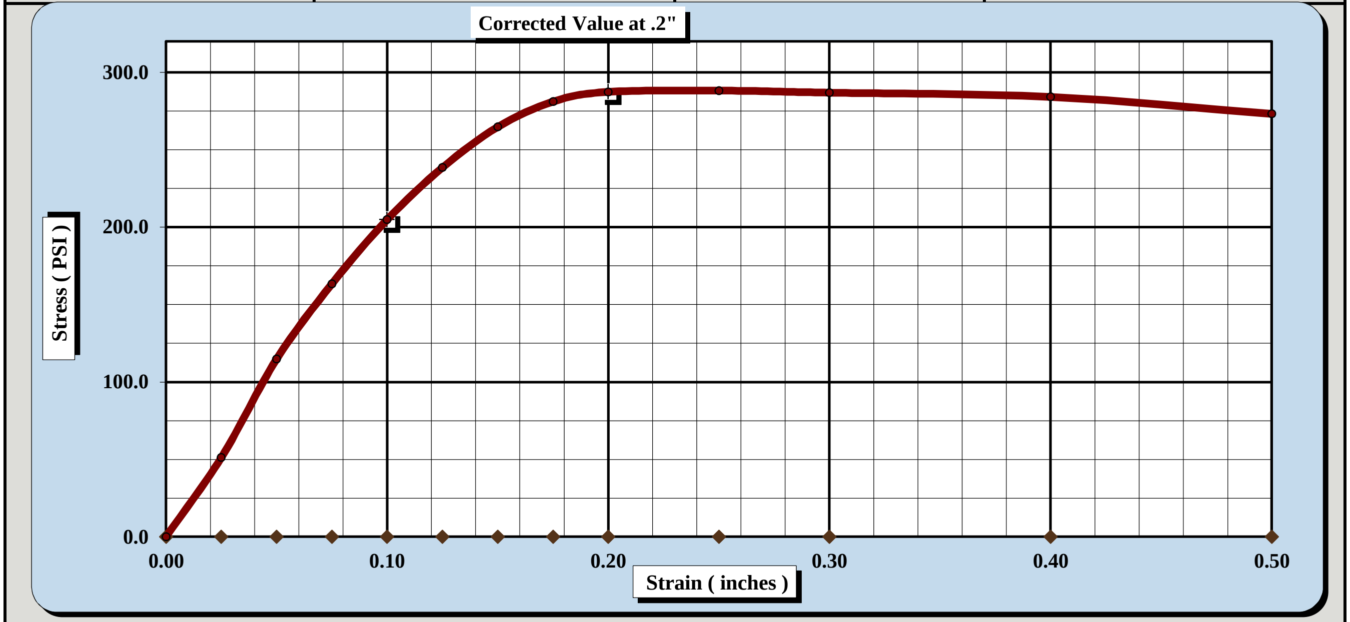
S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

| | | | |
|---|---|---|---|
| Project #: | 1363-20-020 | Report Date: | 6/9/2020 |
| Project Name: | Ibis, Navajo/Arapaho, Simone/Royal | Test Date(s) | 6/4/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. | | |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC | | |

Boring #: P-6 to P-8 Sample #: C-3 Sample Date: 6/2/2020
Location: Ibis Ave. LAB #: 169 Depth: 6"-5'
Sample Description: Brown Poorly Graded Sand with Silt (SP-SM)

*ASTM D1557* *Method A* Maximum Dry Density: 105.8 PCF Optimum Moisture Content: 11.4%
Compaction Test performed on grading complying with CBR spec. % Retained on the 3/4" sieve: 1.0%

| Uncorrected CBR Values | | | | Corrected CBR Values | | | |
|---|---|---|---|---|---|---|---|
| CBR at 0.1 in. | 20.5 | CBR at 0.2 in. | 19.2 | CBR at 0.1 in. | 20.5 | CBR at 0.2 in. | 19.2 |



CBR Sample Preparation:
*The entire gradation was used and compacted in a 6" CBR mold in accordance with* *ASTM D1883, Section 6.1.1*

| *Before Soaking* | | *After Soaking* | |
|---|---|---|---|
| Compactive Effort (Blows per Layer) | 25 | | |
| Initial Dry Density (PCF) | 100.5 | Final Dry Density (PCF) | 100.5 |
| Moisture Content of the Compacted Specimen | 11.9% | Moisture Content (top 1" after soaking) | 19.8% |
| Percent Compaction | 95.0% | Percent Swell | 0.0% |

Soak Time: 96 hrs. Surcharge Weight 20.0 Surcharge Wt. per sq. Ft. 101.8
Liquid Limit -- Plastic Index -- Apparent Relative Density --

Notes/Deviations/References: Liquid Limit: ASTM D 4318, Specific Gravity: ASTM D 854, Classification: ASTM D 2487

| | | | |
|---|---|---|---|
| Ron Forest, P.E. | RPF | Senior Reviewer | 6/12/2020 |
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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# Revised Report of Geotechnical Exploration
# Tony Drive
# Georgetown, South Carolina
## S&ME Project No. 1363-20-027

PREPARED FOR:

**Davis & Floyd Engineering, Inc.**
**3229 W. Montague Street**
**North Charleston, South Carolina 29418**

PREPARED BY:

**S&ME, Inc.**
**1330 Highway 501 Business**
**Conway, SC 29526**

**November 16, 2020**

November 16, 2020

Davis & Floyd Engineering, Inc.
3229 W. Montague Street
North Charleston, South Carolina 29418

Attention: Lindsey Keziah, P.E.

Reference: **Revised Report of Geotechnical Exploration**
**Tony Drive**
Georgetown, South Carolina
S&ME Project No. 1363-20-027

Dear Ms. Keziah:

We have completed our geotechnical exploration for the referenced project in Georgetown, South Carolina. Our exploration was performed pursuant to a *Geotechnical Master Services Agreement* between S&ME, Inc., and Davis & Floyd, Inc., dated May 21, 2004, and S&ME Proposal No. 13-2000211, dated May 7, 2020, authorized by Lindsey Keziah on July 24, 2020. The purpose of this exploration was to evaluate subsurface conditions within the existing roadway, and to provide pavement section thickness and pavement section construction recommendations. This report presents our understanding of the proposed construction, the site and subsurface conditions encountered, and our geotechnical conclusions and recommendations.

# ♦ Project Information

Project information was provided via email correspondence between Lindsey Keziah (Davis & Floyd) and Worth King (S&ME) on May 7, 2020. The project site is comprised of the existing roadway Tony Drive, located in Georgetown County, South Carolina, which measures approximately 2,000 feet in length. A site vicinity map is attached as Figure 1.

The email correspondence included a plat and drawing depicting the project area. We understand that the project includes improving and paving this road along its existing alignment. The client requested a subsurface exploration for roadway design purposes, with subgrade preparation and pavement section thickness recommendations. Traffic loading information was not provided.

This revised report is provided at the request of Lindsey Keziah to provide an alternative pavement section than that which we previously provided.

# ◆ Exploration Procedures

## Field Exploration

Our exploration included a site reconnaissance by a geotechnical professional and the performance of three standard penetration test (SPT) borings (B-1 through B-3) along the roadway alignment. Each boring was advanced to a depth of 10 feet each below the existing ground surface. The test locations were selected in the field by S&ME engineers to be approximately evenly spaced along the roadway. The approximate test locations are shown on the Test Location Sketch (Figure 2) attached in the appendix.

Hollow stem augers were used to extract soils from the ground. In conjunction with the hollow stem auger borings, continuous split-spoon disturbed samples were recovered at evenly spaced 2.0-ft. depth intervals for classification. Three bulk samples (one from each of the borings) were obtained from the auger cuttings for laboratory testing. Water levels were measured at the time of drilling and the borings were backfilled to the original ground surface.

More detailed descriptions of our field exploration procedures and the boring logs are also included in the appendix.

## Laboratory Testing

Soil samples that we obtained were transported to our laboratory, and selected samples were subjected to the following laboratory testing:

- Two (2) Natural Moisture Content (ASTM D 2216) tests;
- Two (2) Fines Content percent passing the No. 200 sieve by weight (ASTM D 1140) tests;
- One (1) Modified Proctor Moisture-Density Relationship (ASTM D 1557) test;
- One (1) remolded, soaked California Bearing Ratio (CBR) (ASTM D 1883) test;

A summary of the laboratory procedures used to perform these tests is presented in the appendix. The individual test results are also included in the appendix.

# ◆ Site and Subsurface Conditions

## Site Conditions

All borings were advanced within the existing roadway. Most of the road, the areas explored by B-1 and B-2, was overlain by a thin layer of slag rock. Topsoil was observed at test location B-3 to be approximately 2 inches thick.

The existing roadway is unpaved. Most of the future pavement area consists of sandy, slightly cohesive subgrade soil. A ditch measuring roughly 2 feet in both width and depth was present along the east side of the roadway. Standing water was not observed in these ditches at the time of exploration.

Topographic information was not provided, so ground surface elevations are not shown on the boring logs.

## Subsurface Conditions

Details of the subsurface conditions encountered by the borings are shown on the boring logs in the appendix. These logs represent our interpretation of the subsurface conditions based upon field data. Stratification lines on the boring logs represent approximate boundaries between soil types; however, the actual transition may be gradual.

### *Tony Drive*

On Tony Drive borings B-1 through B-3 encountered typically sandy subsurface soils, consisting of poorly graded sand with silt (USCS Classification "SP-SM"), silty sand (SM), clayey sand (SC), and poorly graded sand with clay (SP-SC). One zone of sandy fat clay (CH) was encountered within boring B-2 between depths of 2 feet to 4 feet.

The SPT penetration resistance N-values of the sandy soils ranged from "WOH" or weight of hammer, where only the weight of the hammer is required to advance the spoon the entire 1-foot increment, to 18 blows per foot (bpf). This indicates a very loose to medium dense relative density. Where the clay was encountered at test location B-2, the SPT N-value was measured to be 6 bpf, indicating a firm consistency. The soils were typically moist to wet, and were grey, brown, orange, red, yellow and tan in coloration.

A sample collected between depths of approximately 6 inches to 4 feet in boring B-1 was measured to have a natural moisture content of 20.3 percent. This sample also had a fines content of 26.8 percent by weight passing the No. 200 sieve. The soil exhibited a liquid limit of 27 percent, a plastic limit of 14 percent, and a plasticity index of 13 percent. This sample exhibited a maximum dry density of 124.4 pounds per cubic foot and an optimum moisture content of 10.1 percent, indicating that the existing soils are approximately 10.2 percent wet of optimum. The CBR of this soil when recompacted to 95 percent of the modified Proctor maximum dry density at optimum moisture condition was measured to be 44.8 percent at 0.2 inches of penetration, indicating good subgrade support characteristics for pavement.

A sample collected between depths of approximately 6 inches to 4 feet in boring B-2 was measured to have a natural moisture content of approximately 17.5 percent. The fines content of this soil was measured to be 20.2 percent.

## Subsurface Water

At the time of drilling, subsurface water was only observed in boring B-1 at a depth of 2.8 feet. Boring B-2 caved to a depth of approximately 6 feet below the surface. Boring B-3 encountered no water at the time of drilling.

Subsurface water levels at the site will fluctuate during the year due to such things as seasonal and climatic variations and the construction activity in the area. Clayey soils of low permeability may be susceptible to "perched" water conditions, where water is trapped above and within the clayey soils, especially during wetter periods of the year.

## ◆ Conclusions and Recommendations

The exploration indicates the site is adaptable for the proposed construction, with some subgrade improvements. The primary geotechnical considerations will be subgrade stabilization, moisture content adjustment, and fill placement and compaction.

The following presents our geotechnical recommendations regarding subgrade stabilization and earthwork. When reviewing these recommendations, it must be recognized that unexpected subsurface conditions may be encountered between test locations. Unexpected conditions can normally be handled during construction by on-site engineering evaluation.

### Surface Preparation

The following surface preparation recommendations are provided.

1. Drainage should be implemented and maintained as soon as possible prior to construction. Surface and subsurface water conditions at the time of construction, largely influenced by prevailing weather patterns, will determine the need for and extent of drainage measures. Water conditions can change with construction activities and precipitation effects.
2. Strip surface vegetation, root mat, gravel, slag, and organic-laden or debris-laden soils where encountered and dispose of outside the pavement footprints. Organics are not expected to be present in significant quantities unless the roadway is widened, in which case some organic materials may be encountered along the edges in the widened areas.
3. In any areas that must be cut down to reach design final soil subgrade (FSG) elevation, the soil should be densified in place across the entire roadway alignment with a heavy vibratory roller at the cut grade elevation. In any areas that will require new fill to reach design final subgrade (FSG) elevation, the soil surface should be densified in place across the entire roadway alignment with a heavy vibratory roller *after* the surface has been stripped but *prior to* any new fill placement.

    A. The exposed surfaces should be densified in place to at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) to a depth of at least 8 inches. Under favorable moisture conditions and with the proper equipment, this may be able to be accomplished by densifying the soil from the top. However, under less favorable conditions, it may be necessary for the contractor to re-work (or remove, condition, and replace) the material, using moistening or drying techniques, in order to achieve the desired level of compaction. The densification of these soils should be performed under the observation of an S&ME representative.
    B. Based on the laboratory testing of the upper sands, we anticipate that the native soils may have a moisture content of 7 to 10 percent above optimum, indicating that significant drying may be required in the upper soils in order to properly recompact the subgrade surface. Recognize that soil moisture conditions may change between the time that we sampled these materials and when the construction is performed.
    C. Where new fill is required, it should be imported. Re-use of the existing on-site cut soils as fill may not be feasible due to their excessive moisture content.

4. After densification of the surface, the subgrade in all areas to receive new fill (except ditches) should be proofrolled by the contractor under the observation of a representative of the Geotechnical Engineer to observe the subgrade for stability prior to fill placement.

    A. Where needed, based on the results of the proofroll, it may become necessary to perform undercutting and replacement of unstable soils. This is not expected to be a widespread condition, but could occur in some areas. This should be a decision made at the time of construction based on the conditions observed.
    B. Unsatisfactory proofroll results (unstable roadbed conditions) appear most likely to occur in the area around boring B-2; this boring indicated about 2 feet of clayey sand overlying about 2 feet of sandy fat clay. It is possible that the clayey sands and sandy fat clays in this area may need to be removed and replaced with imported fill sand. However, it is also possible that the clayey sands located above the sandy fat clays can be stabilized enough to provide sufficient support without removing and replacing the clayey materials, so this should be a decision made in the field by a representative of the Geotechnical Engineer at the time of construction. Stabilization of soils in place to reduce undercutting may require the use of a bi-axial geogrid, such as Tensar BX-1200 or similar.

    - **Budget Consideration:** We recommend that you include a contingency budget and obtain contractor unit pricing for additional earthwork items to include removal and replacement of unstable soils on a per cubic yard basis, and installation of bi-axial BX-1200 geogrid on a per square yard basis, either or both of which may be needed in this area.

5. Ditches should be dewatered and mucked out, then visually observed for bottom stability by a representative of the Geotechnical Engineer prior to backfilling.

## Fill Placement and Compaction

The fill soils used to construct the roadbed and to fill-in any ditches that are being modified should meet the requirements and be installed as directed below.

1. Imported fill material should be cohesionless, non-plastic, sandy soil containing no more than 10 percent fines (material passing the No. 200 sieve) by weight as measured by ASTM D 1140, and exhibiting a CBR value of at least 15 percent when re-compacted to 95% of the maximum dry density measured by modified Proctor testing (ASTM D 1557 and D 1883). The soil should be relatively free of organics or other deleterious matter.
2. All fill should be placed in uniform lifts of 8 in. or less (loose measure) and compacted to at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557), within plus or minus 3 percent of the optimum moisture content for compaction. Adjustment of the soil moisture content by either wetting or drying may be required depending upon the source of the fill.
3. Prior to placement of aggregate base course stone, all subgrades should be methodically proofrolled at final soil subgrade (FSG) elevation by the contractor under the observation of the Geotechnical Engineer, and any identified unstable areas should be repaired as directed. See items 4.A. and 4.B. above under the “Surface Preparation” section for indications regarding where unsatisfactory proofroll results are most likely to occur, and how these situations can be addressed.

4. All fill placement should be witnessed by an experienced S&ME soils technician working under the guidance of the Geotechnical Engineer. In general, at least one field density (compaction) test should be performed for every 250 linear feet of roadway per lift should be performed using nuclear density test methods (ASTM D6938).

## Pavement Section Recommendations

We understand that the site pavements will consist of flexible hot mix asphalt pavements. Based upon the assumption that the pavement support soils will consist of compacted fill and near surface sandy soils, we estimate that an average combined California Bearing Ratio (CBR) value of at least 15 percent will be available for pavement support. This results in a resilient modulus of at least 14,457 psi available for flexible pavement design. This assumes that any fill materials used in the upper 1 ½ feet will have a CBR value of at least 15 percent when properly compacted. If materials having lesser subgrade support values are to be considered for use, the pavement design should be reevaluated and required pavement thickness may need to be increased as a result.

Traffic volumes for the proposed development were not provided to us in preparation for our pavement section analysis; therefore, we have performed our calculations based on typical pavement section thicknesses and have provided a standard-duty option for your design consideration. These pavement section components are provided in Table 1 below. If the actual ESAL demand is found to be greater than the *Theoretical Available Traffic Capacity* values shown in the table below, then the pavement section thicknesses may need increased and we can be contacted for further recommendations. The civil design engineer should select the appropriate pavement section based upon the anticipated traffic loading (ESALs) that may occur over the design life of the pavement.

Flexible pavement design assumes an initial serviceability of 4.2 and a terminal serviceability index of 2.0, and a reliability factor of 95 percent. ESALs per axle were estimated using data provided in AASHTO literature. Assuming that only SCDOT approved source materials will be used in flexible pavement section construction, we used a structural layer coefficient of 0.44 for the HMA layers and a coefficient of 0.18 for the graded aggregate base course (GABC). A sub-base drainage factor of 1.0 was assigned, based upon the assumption that the sub-base soils will consist of sandy fill soils.

### Table 1 – Recommended Minimum Pavement Section$^{(a)}$

| Pavement Type | Theoretical Available Traffic Capacity (ESALs) | HMA Surface Course Type C (inches) | Compacted SCDOT Graded Aggregate Base Course [GABC] (inches) |
|---|---|---|---|
| HMA Flexible Standard-duty | 469,000 | 2.5 | 8.0 |

(a) Single-stage construction and soil compaction as recommended is assumed; S&ME, Inc. must observe pavement subgrade preparations and pavement installation operations.

## *General Recommendations for Pavement Areas*

1. At least one laboratory California Bearing Ratio (CBR) test should be performed upon a representative soil sample of each soil type which is planned to be used as pavement subgrade material. This is to establish the relationship between relative compaction and CBR for the soil in question, and to confirm that the obtained CBR value at the required level of compaction is equal to or greater than the CBR value utilized during design of the pavement section.
2. All fill placed in pavement areas should be compacted as recommended in "Fill Placement and Compaction". Prior to placement of graded aggregate base course stone, all exposed pavement subgrades should be methodically proofrolled under the observation of the Geotechnical Engineer (S&ME), and any identified unstable areas should be repaired as directed.

## *Base Course and Pavement Section Construction*

The following recommendations are provided for base course and pavement section construction:

1. Crushed stone aggregate base material used in pavement section construction should consist of either macadam or marine limestone graded aggregate base course (GABC) as defined by Section 305 of the South Carolina Department of Transportation Standard Specifications for Highway Construction (2007). The base course should be compacted to at least 100 percent of the modified Proctor maximum dry density (SC-T-140).

    A. Do not substitute Coquina type base course for the specified GABC material.
    B. Do not substitute slag or other steel production waste by-products for the specified GABC material.
    C. Do not substitute recycled Portland cement concrete for the specified GABC material.

2. Heavy compaction equipment is likely to be required in order to achieve the required base course compaction, and the moisture content of the material will likely need to be maintained near optimum moisture content in order to facilitate proper compaction.
3. After placement of base course stone, the surface should be methodically proofrolled at final base grade elevation by the contractor under the observation of the Geotechnical Engineer (S&ME), and any identified unstable areas should be repaired. The base course material should not exhibit pumping or rutting under equipment traffic. Rutting or pumping areas shall be undercut and replaced and/or stabilized as directed by the engineer.
4. Construct the surface and intermediate course HMA in accordance with the specifications of Sections 401, 402, and 403 of the South Carolina Department of Transportation Standard Specifications for Highway Construction (2007 edition).
5. Sufficient testing should be performed during flexible pavement installation to confirm that the required thickness, density, and quality requirements of the pavement specifications are followed.
6. Experience indicates that a thin surface overlay of asphalt pavement may be required in about 10 years due to normal wear and weathering of the surface. Such wear is typically visible in several forms of pavement distress, such as aggregate exposure and polishing, aggregate stripping, asphalt bleeding, and various types of cracking. There are means to methodically estimate the remaining pavement life based on a systematic statistical evaluation of pavement distress density and mode of failure. We recommend the pavement be evaluated in about 7 years to assess the pavement condition and remaining life.

### Testing Services during Construction

We recommend that you retain S&ME to provide the variety of testing services and ongoing geotechnical consultations as described in the preceding sections of this report. There are several milestones where either consultation with the Geotechnical Engineer is recommended, and/or where testing should be performed.

## ♦ Limitations of Report

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

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

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

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

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

## Closure

S&ME, Inc. appreciates the opportunity to be of service to you on this project. Please call if you have questions concerning this report or any of our services.

Sincerely,

**S&ME, Inc.**

Kara Fugate

Kara Fugate, E.I.T.
Staff Professional

S&ME, INC.
No. C00473

Ronald P. Forest, Jr., P.E.
Senior Engineer

No. 21248
11/16/20
RON FOREST JR.

Attachments: Appendix

# Appendix

Figure 1: Site Vicinity Map

Figure 2: Test Location Sketch

Summary of Exploration Procedures

Soil Classification Chart

SPT Boring Logs

Summary of Laboratory Procedures

Laboratory Test Results

## Site Vicinity Map

Tony Drive
Georgetown, South Carolina

SCALE:
AS SHOWN

DATE:
8-19-2020

PROJECT NO.
1363-20-027

FIGURE NO.
1

# Test Location Sketch

Tony Drive
Georgetown, South Carolina

SCALE:
AS SHOWN

DATE:
8-19-2020

PROJECT NO.
1363-20-027

FIGURE NO.
2

# ♦ Summary of Exploration Procedures

The American Society for Testing and Materials (ASTM) publishes standard methods to explore soil, rock and ground water conditions in Practice D-420-18, "*Standard Guide for Site Characterization for Engineering Design and Construction Purposes*." The boring and sampling plan must consider the geologic or topographic setting. It must consider the proposed construction. It must also allow for the background, training, and experience of the geotechnical engineer. While the scope and extent of the exploration may vary with the objectives of the client, each exploration includes the following key tasks:

- Reconnaissance of the Project Area
- Preparation of Exploration Plan
- Layout and Access to Field Sampling Locations
- Field Sampling and Testing of Earth Materials
- Laboratory Evaluation of Recovered Field Samples
- Evaluation of Subsurface Conditions

The standard methods do not apply to all conditions or to every site. Nor do they replace education and experience, which together make up engineering judgment. Finally, ASTM D 420 does not apply to environmental investigations.

# ♦ Reconnaissance of the Project Area

We walked over the site to note land use, topography, ground cover, and surface drainage. We observed general access to proposed sampling points and noted any existing structures.

Checks for Hazardous Conditions - State law requires that we notify the Palmetto Utility Protection Service (SC811) before we drill or excavate at any site. SC811 is operated by the major water, sewer, electrical, telephone, CATV, and natural gas suppliers of South Carolina. SC811 forwarded our location request to the participating utilities. Location crews then marked buried lines with colored flags within 72 hours. They did not mark utility lines beyond junction boxes or meters. We checked proposed sampling points for conflicts with marked utilities, overhead power lines, tree limbs, or man-made structures during the site walkover.

# ♦ Boring and Sampling

## Soil Test Boring with Hollow Stem Augers

Soil sampling and penetration testing were performed in general accordance with ASTM D1586, "Standard Test Method for Penetration Test and Split Barrel Sampling of Soils. Rotary drilling processes were used to advance the hole with hollow stem augers. At continuous, consecutive intervals, soil samples were obtained with a standard 1.4 inch I. D., two-inch O. D., split barrel sampler. The sampler was first seated six inches to penetrate any loose cuttings, then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through the two final six inch increments was recorded as the penetration resistance (SPT N) value. The N-value, when properly interpreted by qualified professional staff, is an index of the soil strength and foundation support capability.

## Water Level Measurement

Subsurface water levels in the boreholes were measured during the onsite exploration by measuring depths from the existing grade to the current water level using a tape.

## Backfilling of Borings

Once subsurface water levels were obtained, boring spoils were backfilled into the open bore holes.  Bore holes were backfilled to the existing ground surface using soil cuttings.

# LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

## SOIL TYPES

(Shown in Graphic Log)

| | |
|---|---|
| ▩ | Fill |
| 🟦 | Asphalt |
| ░ | Concrete |
| 🟩 | Topsoil |
| ⁘ | Gravel |
| ⁛ | Sand |
| ▥ | Silt |
| ▨ | Clay |
| ▤ | Organic |
| ▥ | Silty Sand |
| ▨ | Clayey Sand |
| ▥ | Sandy Silt |
| ▨ | Clayey Silt |
| ▨ | Sandy Clay |
| ▨ | Silty Clay |
| ▒ | Partially Weathered Rock |
| ▱ | Cored Rock |

## WATER LEVELS

(Shown in Water Level Column)

∇ = Water Level At Termination of Boring
▼ = Water Level Taken After 24 Hours
◄ = Loss of Drilling Water
HC = Hole Cave

## CONSISTENCY OF COHESIVE SOILS

| CONSISTENCY | STD. PENETRATION RESISTANCE BLOWS/FOOT |
|---|---|
| Very Soft | 0 to 2 |
| Soft | 3 to 4 |
| Firm | 5 to 8 |
| Stiff | 9 to 15 |
| Very Stiff | 16 to 30 |
| Hard | 31 to 50 |
| Very Hard | Over 50 |

## RELATIVE DENSITY OF COHESIONLESS SOILS

| RELATIVE DENSITY | STD. PENETRATION RESISTANCE BLOWS/FOOT |
|---|---|
| Very Loose | 0 to 4 |
| Loose | 5 to 10 |
| Medium Dense | 11 to 30 |
| Dense | 31 to 50 |
| Very Dense | Over 50 |

## SAMPLER TYPES

(Shown in Samples Column)

| | |
|---|---|
| | Shelby Tube |
| ⧗ | Split Spoon |
| ▯ | Rock Core |
| ⁘ | No Recovery |

## TERMS

**Standard Penetration Resistance** - The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586.

**REC** - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

**RQD** - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%.

**Tony Drive**
**Georgetown, South Carolina**
**S&ME Project No. 1363-20-027**

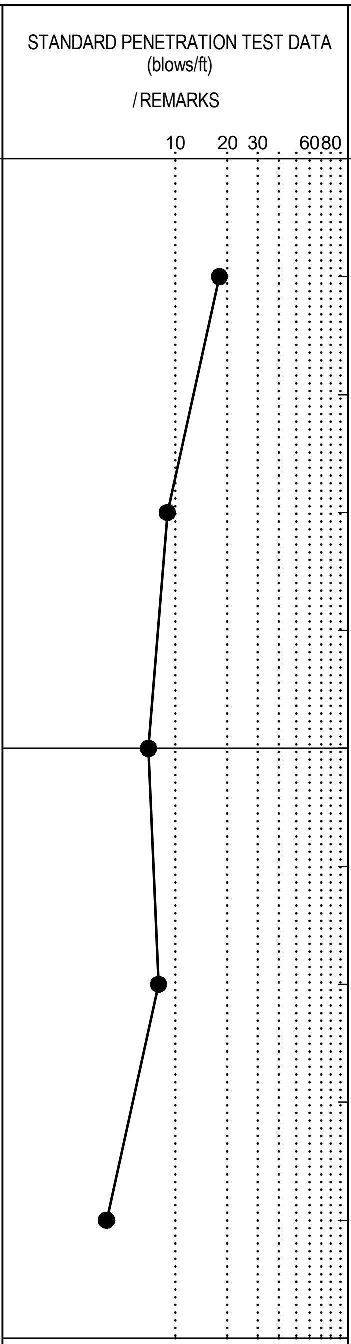
# BORING LOG B-1

| | |
|---|---|
| DATE DRILLED: **8/7/20** | ELEVATION: |
| DRILL RIG: **ATV** | BORING DEPTH: **10.0 ft** |
| DRILLER: **A. Fowler** | WATER LEVEL: **2.8' ATD** |
| HAMMER TYPE: **Auto** | LOGGED BY: **K. Fugate** |
| SAMPLING METHOD: **Split Spoon** | |
| DRILLING METHOD: **3¼" H.S.A.** | |

NOTES: **Elevation unknown.**

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | WATER LEVEL | ELEVATION (feet) | SAMPLE NO. | SAMPLE TYPE | BLOW COUNT / CORE DATA 1st 6in / RUN # | 2nd 6in / REC | 3rd 6in / RQD | N VALUE |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **SILTY SAND (SM)** - Mostly fine sand, some non plastic fines, dark brown and tan, moist, medium dense. | | | 1 | | 14 | 9 | 9 | 18 |
| | | **CLAYEY SAND (SC)** - Mostly fine sand, some low to medium plasticity fines, orange, grey, and red, moist, loose. | ∇ | | 2 | | 4 | 4 | 5 | 9 |
| 5 | | - - - - Grey and yellow. | | | 3 | | 5 | 4 | 3 | 7 |
| | | **POORLY GRADED SAND WITH CLAY (SP-SC)** - Mostly fine to medium sand, few low to medium plasticity fines, grey, red and orange, wet, loose to very loose. | | | 4 | | 4 | 4 | 4 | 8 |
| | | | | | 5 | | 3 | 2 | 2 | 4 |
| 10 | | Boring terminated at 10 ft | | | | | | | | |

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS



***NOTES:***

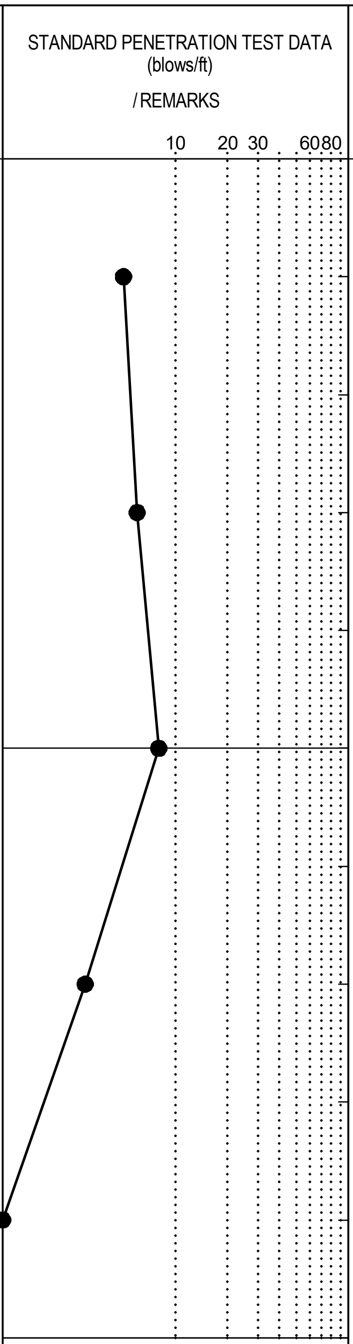
1. *THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.*
2. *BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.*
3. *STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.*
4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

# Tony Drive
# Georgetown, South Carolina
**S&ME Project No. 1363-20-027**

## BORING LOG B-2

| | | |
|---|---|---|
| DATE DRILLED: **8/7/20** | ELEVATION: | NOTES: **Elevation unknown.** |
| DRILL RIG: **ATV** | BORING DEPTH: **10.0 ft** | |
| DRILLER: **A. Fowler** | WATER LEVEL: **Not encountered.** | |
| HAMMER TYPE: **Auto** | LOGGED BY: **K. Fugate** | |
| SAMPLING METHOD: **Split Spoon** | | |
| DRILLING METHOD: **3¼" H.S.A.** | | |

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | WATER LEVEL | ELEVATION (feet) | SAMPLE NO. | SAMPLE TYPE | 1st 6in / RUN # | 2nd 6in / REC | 3rd 6in / RQD | N VALUE |
|---|---|---|---|---|---|---|---|---|---|---|
| | ▨ | **CLAYEY SAND (SC)** - Mostly fine to medium sand, some low to medium plasticity fines, red, grey and orange, wet, loose. | | | 1 | ⧗ | 2 | 3 | 2 | 5 |
| | ▨ | **SANDY FAT CLAY (CH)** - Mostly medium to high plasticity fines, some fine sand, orange and red, firm. | | | 2 | ⧗ | 2 | 2 | 4 | 6 |
| 5 | ▨ | **POORLY GRADED SAND WITH CLAY (SP-SC)** - Mostly fine sand, few low to medium plasticity fines, grey and yellow, wet, loose. | | | 3 | ⧗ | 3 | 4 | 4 | 8 |
| | ▨ | **CLAYEY SAND (SC)** - Mostly fine sand, some low to medium plasticity fines, grey and orange, wet, very loose. | HC | | 4 | ⧗ | 1 | 1 | 2 | 3 |
| | ▨ | **POORLY GRADED SAND WITH CLAY (SP-SC)** - Mostly fine to medium sand, few low to medium plasticity fines, dark grey, wet, very loose. | | | 5 | ⧗ | WOH | WOH | WOH | WOH |
| 10 | | Boring terminated at 10 ft | | | | | | | | |



***NOTES:***

1. *THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.*
2. *BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.*
3. *STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.*
4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

S&ME BORING LOG \ HAND AUGER LOGS.GPJ \ LIBRARY 2011_06_28.GDT \ 8/24/20

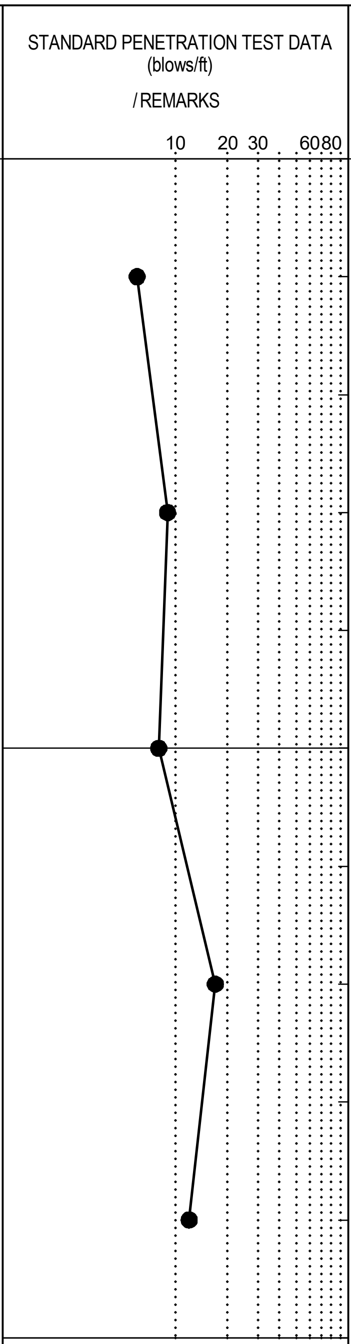
Tony Drive
Georgetown, South Carolina
S&ME Project No. 1363-20-027

**BORING LOG** **B-3**

DATE DRILLED: **8/7/20**
ELEVATION:
DRILL RIG: **ATV**
BORING DEPTH: **10.0 ft**
DRILLER: **A. Fowler**
WATER LEVEL: **Not encountered.**
HAMMER TYPE: **Auto**
LOGGED BY: **K. Fugate**
SAMPLING METHOD: **Split Spoon**
DRILLING METHOD: **3¼" H.S.A.**

NOTES: **Elevation unknown.**

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | WATER LEVEL | ELEVATION (feet) | SAMPLE NO. | SAMPLE TYPE | BLOW COUNT / CORE DATA | | | STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS | N VALUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1st 6in / RUN # | 2nd 6in / REC | 3rd 6in / RQD | 10 20 30 60 80 | |
| | | **TOPSOIL** - Approximately 2 inches thick. | | | | | | | | | |
| | | **POORLY GRADED SAND WITH SILT (SP-SM)** - Mostly fine sand, few non plastic fines, tan and red, moist, loose. | | | 1 | | 3 | 3 | 3 | | 6 |
| | | **POORLY GRADED SAND WITH CLAY (SP-SC)** - Mostly fine sand, few low to medium plasticity fines, red, moist, loose. | | | 2 | | 3 | 4 | 5 | | 9 |
| 5 | | **CLAYEY SAND (SC)** - Mostly fine to medium sand, some low to medium plasticity fines, grey and red, moist, loose. | | | 3 | | 2 | 3 | 5 | | 8 |
| | | **POORLY GRADED SAND WITH CLAY (SP-SC)** - Mostly fine sand, few low to medium plasticity fines, red and grey, moist, medium dense. | | | 4 | | 6 | 7 | 10 | | 17 |
| | | | | | 5 | | 7 | 7 | 5 | | 12 |
| 10 | | Boring terminated at 10 ft | | | | | | | | | |



***NOTES:***

1. *THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.*
2. *BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.*
3. *STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.*
4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

## ◆ Summary of Laboratory Procedures

### Examination of Recovered Soil Samples

Soil and field records were reviewed in the laboratory by the geotechnical professional. Soils were classified in general accordance with the visual-manual method described in ASTM D 2488, "*Standard Practice for Description and Identification of Soils (Visual-Manual Method)*". Representative soil samples were selected for classification testing to provide grain size and plasticity data to allow classification of the samples in general accordance with the Unified Soil Classification System method described in ASTM D 2487, "*Standard Practice for Classification of Soils for Engineering Purposes*". The geotechnical professional also prepared the final boring and sounding records enclosed with this report.

### Moisture Content Testing of Soil Samples by Oven Drying

Moisture content was determined in general conformance with the methods outlined in ASTM D 2216, "*Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil or Rock by Mass*." This method is limited in scope to Group B, C, or D samples of earth materials which do not contain appreciable amounts of organic material, soluble solids such as salt or reactive solids such as cement. This method is also limited to samples which do not contain contamination.

A representative portion of the soil was divided from the sample using one of the methods described in Section 9 of ASTM D 2216. The split portion was then placed in a drying oven and heated to approximately 110 degrees C overnight or until a constant mass was achieved after repetitive weighing. The moisture content of the soil was then computed as the mass of water removed from the sample by drying, divided by the mass of the sample dry, times 100 percent. No attempt was made to exclude any particular particle size from the portion split from the sample.

### Percent Fines Determination of Samples

A selected specimen of soils was washed over a No. 200 sieve after being thoroughly mixed and dried. This test was conducted in general accordance with ASTM D 1140, "*Standard Test Method for Amount of Material Finer Than the No. 200 Sieve*." Method B, using a dispersant solution to wash the sample through the sieve after soaking the sample for a prescribed period of time, was used and the percentage by weight of material washing through the sieve was deemed the "percent fines" or percent clay and silt fraction.

### Compaction Tests of Soils Using Modified Effort

Soil placed as engineering fill is compacted to a dense state to obtain satisfactory engineering properties. Laboratory compaction tests provide the basis for determining the percent compaction and water content needed to achieve the required engineering properties, and for controlling construction to assure the required compaction and water contents are achieved. Test procedures generally followed those described by ASTM D 1557,"*Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 lbf/ft$^3$).*"

The relationship between water content and the dry unit weight is determined for soils compacted in either 4 or 6 inch diameter molds with a 10 lbf rammer dropped from a height of 18 inches, producing a compactive effort of 56,000 lbf/ft$^3$. ASTM D 1557 provides three alternative procedures depending on material gradation:

Method A

All material passes No. 4 sieve size
4 inch diameter mold
Shall be used if 20 percent or less by weight is retained on No. 4 sieve
Soil in 5 layers with 25 blows per layer

Method B

All material passes 3/8 inch sieve
4 inch diameter mold
Shall be used if 20 percent by weight is retained on the No. 4 sieve and 20 percent or less by weight is retained on the 3/8 Inch sieve.
Soil in 5 layers with 25 blows per layer

Method C

All material passes ¾ inch sieve
6-inch diameter mold
Shall be used if more than 20 percent by weight is retained on the 3/8 inch sieve and less than 30 percent is retained on the ¾inch sieve.
Soil in 5 layers with 56 blows per layer

Soil was compacted in the mold in five layers of approximately equal thickness, each compacted with either 25 or 56 blows of the rammer. After compaction of the sample in the mold, the resulting dry density and moisture content was determined and the procedure repeated. Separate soils were used for each sample point, adjusting the moisture content of the soil as described in Section 10.2 (Moist Preparation Method). The procedure was repeated for a sufficient number of water content values to allow the dry density vs. water content values to be plotted and the *maximum dry density* and *optimum moisture content* to be determined from the resulting curvilinear relationship.

## Laboratory California Bearing Ratio Tests of Compacted Samples

This method is used to evaluate the potential strength of subgrade, subbase, and base course material, including recycled materials, for use in road and airfield pavements. Laboratory CBR tests were run in general accordance with the procedures laid out in ASTM D 1883, "*Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils*." Specimens were prepared in standard molds using two different levels of compactive effort within plus or minus 0.5 percent of the optimum moisture content value. While embedded in the compaction mold, each sample was inundated for a minimum period of 96 hours to achieve saturation. During inundation the specimen was surcharged by a weight approximating the anticipated weight of the pavement and base course layers. After removing the sample from the soaking bath, the soil was then sheared by jacking a piston having a cross sectional area of 3 square inches into the end surface of the specimen. The piston was jacked 0.5 inches into the specimen at a constant rate of 0.05 inches per minute.

The CBR is defined as the load required to penetrate a material to a predetermined depth, compared to the load required to penetrate a standard sample of crushed stone to the same depth. The CBR value was usually based on the load ratio for a penetration of 0.10 inches, after correcting the load-deflection curves for surface irregularities or upward concavity. However, where the calculated CBR for a penetration of 0.20 inches was greater than the result obtained for a penetration of 0.10 inches, the test was repeated by reversing the specimen and shearing the opposite end surface.  Where the second test indicated a greater CBR at 0.20 inches penetration, the CBR for 0.20 inches penetration was used.

Form No: TR-D2216-T265-1
Revision No. 1
Revision Date: 08/16/17

# LABORATORY DETERMINATION OF WATER CONTENT

*ASTM D 2216* ☑ *AASHTO T 265* ☐

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

| | | | |
|---|---|---|---|
| Project #: | 1363-20-027 | Report Date: | 8/18/2020 |
| Project Name: | Tony Drive | Test Date(s): | 8/14/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. | | |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC 29418 | | |
| Sample by: | M. Jonas | Sample Date(s): | 8/7/2020 |

**Method:** **A** **(1%)** ☐ **B** **(0.1%)** ☑

| | | | |
|---|---|---|---|
| Balance ID. | 19608 | Calibration Date: | 2/28/20 |
| Oven ID. | 17745 | Calibration Date: | 4/8/20 |

| Boring No. | Sample No. | Sample Depth | Tare # | Tare Weight | Tare Wt.+ Wet Wt | Tare Wt. + Dry Wt | Water Weight | Percent Moisture | Note |
|---|---|---|---|---|---|---|---|---|---|
| | | ft. or m. | | grams | grams | grams | grams | % | |
| B-1 | S-1 | -6"-4' | Sue | 82.60 | 203.50 | 183.10 | 20.40 | 20.3% | |
| B-2 | S-1 | -6"-4' | M | 80.80 | 227.80 | 205.90 | 21.90 | 17.5% | |
| | | | | | | | | | |
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*Notes / Deviations / References*

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

| | | | |
|---|---|---|---|
| W. King, P.E. | WWK | Project Engineer | 19-Aug |
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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Form No: TR-D1140-1
Revision No. 1
Revision Date: 8/2/17

# MATERIAL FINER THAN THE #200 SIEVE

ASTM D1140

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

Project #: 1363-20-027
Report Date: 8/18/202
Project Name: Tony Drive
Test Date(s): 8/14/2020
Client Name: Davis & Floyd Engineering, Inc.
Client Address: 3229 West Montague Ave; N. Charleston, SC 29418
Sample by: M. Jonas
**LAB#** 192
Sample Dates: 8/7/2020

**Method; A** ☐ **B** ☑ Soaked ☑ Soak Time 2 Hrs

| Boring # | Sample # | Sample Depth | Tare # | Tare Weight | Tare Wt.+ Wet Wt | Tare Wt. + Dry Wt | Tare Wt. + Dry Wt. after Wash | % Passing #200 |
|---|---|---|---|---|---|---|---|---|
| | | ft. or m. | | grams | grams | grams | grams | % |
| B-2 | S-1 | -6"-4' | M | 80.80 | 227.80 | 205.90 | 180.60 | **20.2%** |
| B-1 | S-1 | -6"-4' | Debbie | 99.60 | 284.60 | 257.00 | 214.80 | **26.8%** |
| | | | | | | | | |
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*Balance ID.* *19608* *Calibration Date:* *2/28/20* *#200 Sieve* *18775* *Calibration Date:* *2/28/21*

*Notes / Deviations / References:* ASTM D1140: Amount of Material in Soil Finer Than the No. 200 (75-um) ) Sieve

W. King, P.E.
*Technical Responsibility*

WKW
*Signature*

Project Engineer
*Position*

19-Aug
*Date*

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Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

# LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

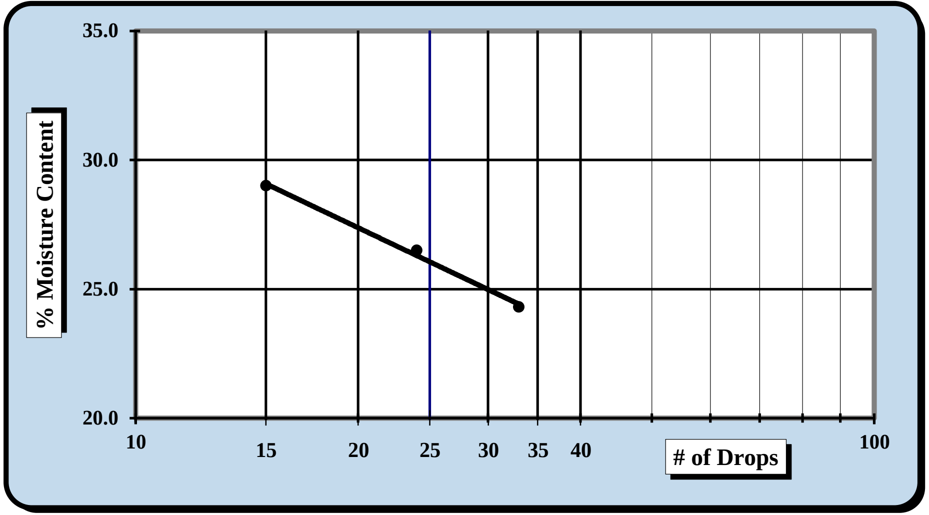
ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

Project #: 1363-20-027
Report Date: 8/18/2020
Project Name: Tony Drive
Test Date(s) 8/17/2020
Client Name: Davis & Floyd Engineering, Inc.
Client Address: 3229 West Montague Ave; N. Charleston, SC 29418
Boring #: B-1
Sample #: Bulk-1
Sample Date: 8/7/2020
Location: Pavement
LAB #: 192
Depth: -6"-4'
Sample Description: Brown Clayey Sand (SC)

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID #* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 00401 | 2/28/2020 | Grooving tool | 11368 | 9/1/2019 |
| LL Apparatus | 18801 | 9/1/2019 | | | |
| Oven | 17745 | 4/8/2020 | | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 18 | 26 | 39 | | | | 22 | 104 | |
| A | Tare Weight | 14.57 | 14.52 | 14.63 | | | | 14.84 | 14.82 | |
| B | Wet Soil Weight + A | 31.54 | 31.63 | 31.71 | | | | 21.25 | 21.30 | |
| C | Dry Soil Weight + A | 28.22 | 28.05 | 27.87 | | | | 20.48 | 20.52 | |
| D | Water Weight (B-C) | 3.32 | 3.58 | 3.84 | | | | 0.77 | 0.78 | |
| E | Dry Soil Weight (C-A) | 13.65 | 13.53 | 13.24 | | | | 5.64 | 5.70 | |
| **F** | % Moisture (D/E)*100 | 24.3% | 26.5% | 29.0% | | | | 13.7% | 13.7% | |
| N | # OF DROPS | 33 | 24 | 15 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = **F** * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **13.7%** | | |



One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

NP, Non-Plastic ☐

| | |
|---|---|
| Liquid Limit | **27** |
| Plastic Limit | **14** |
| Plastic Index | **13** |
| Group Symbol | **SC** |

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑

*Notes / Deviations / References:*

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

| | | | |
|---|---|---|---|
| W. King, P.E. | WWK | Project Engineer | 8/21/2020 |
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

# MOISTURE - DENSITY REPORT

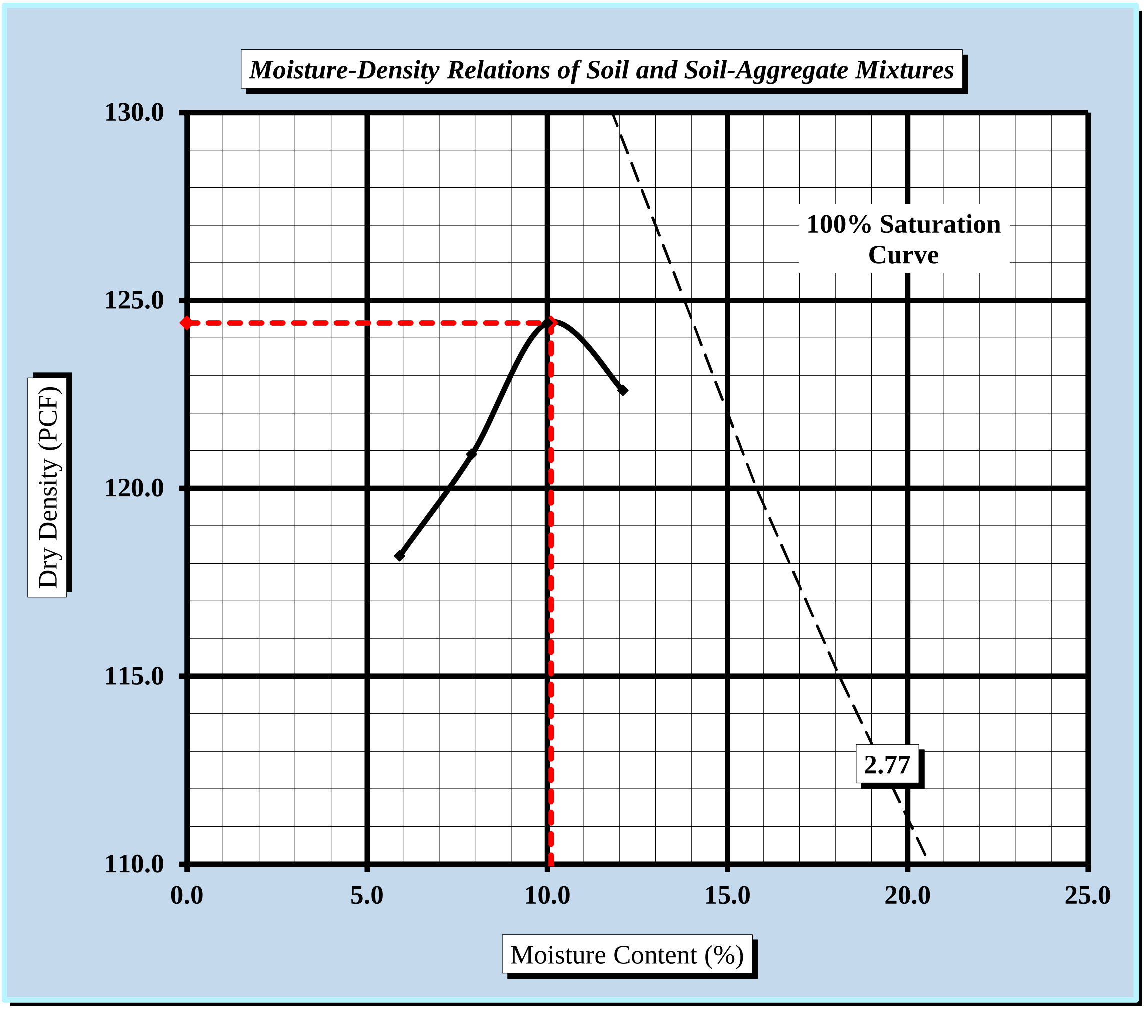
*Quality Assurance*

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

S&ME Project #: 1363-20-027 Report Date: 8/18/2020
Project Name: Tony Drive Test Date(s): 8/12/2020
Client Name: Davis & Floyd Engineering, Inc.
Client Address: 3229 West Montague Ave; N. Charleston, SC 29418
Boring #: B-1 Sample #: Bulk-1 Sample Date: 8/7/2020
Location: Pavement Lab #: 192 Depth: -6"-4'
Sample Description: Brown Clayey Sand (SC)

**Maximum Dry Density 124.4 PCF.** **Optimum Moisture Content 10.1%**

***ASTM D1557 - - Method A***



| | |
|---|---|
| ***Soil Properties*** | |
| *Natural Moisture Content* | 20.3% |
| *Specific Gravity of Soil* | -- |
| *Liquid Limit* | 27 |
| *Plastic Limit* | 14 |
| *Plastic Index* | 13 |
| *% Passing* | |
| *3/4"* | -- |
| *3/8"* | -- |
| *#4* | -- |
| *#10* | -- |
| *#40* | -- |
| *#60* | -- |
| *#200* | 26.8% |
| *Oversize Fraction* | |
| *Bulk Gravity* | -- |
| *% Moisture* | -- |
| *% Oversize* | -- |
| *MDD* | -- |
| *Opt. MC* | -- |

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

*References / Comments / Deviations:*

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 1557: Laboratory Compaction Characteristics of Soil Using Modified Effort

| W. King, P.E. | WWK | Project Engineer | 8/21/2020 |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

# CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

*ASTM D 1883*

S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

| | | | |
|---|---|---|---|
| Project #: | 1363-20-027 | Report Date: | 8/18/2020 |
| Project Name: | Tony Drive | Test Date(s) | 8/13/2020 |
| Client Name: | Davis & Floyd Engineering, Inc. | Amended Report | |
| Client Address: | 3229 West Montague Ave; N. Charleston, SC 29418 | | |

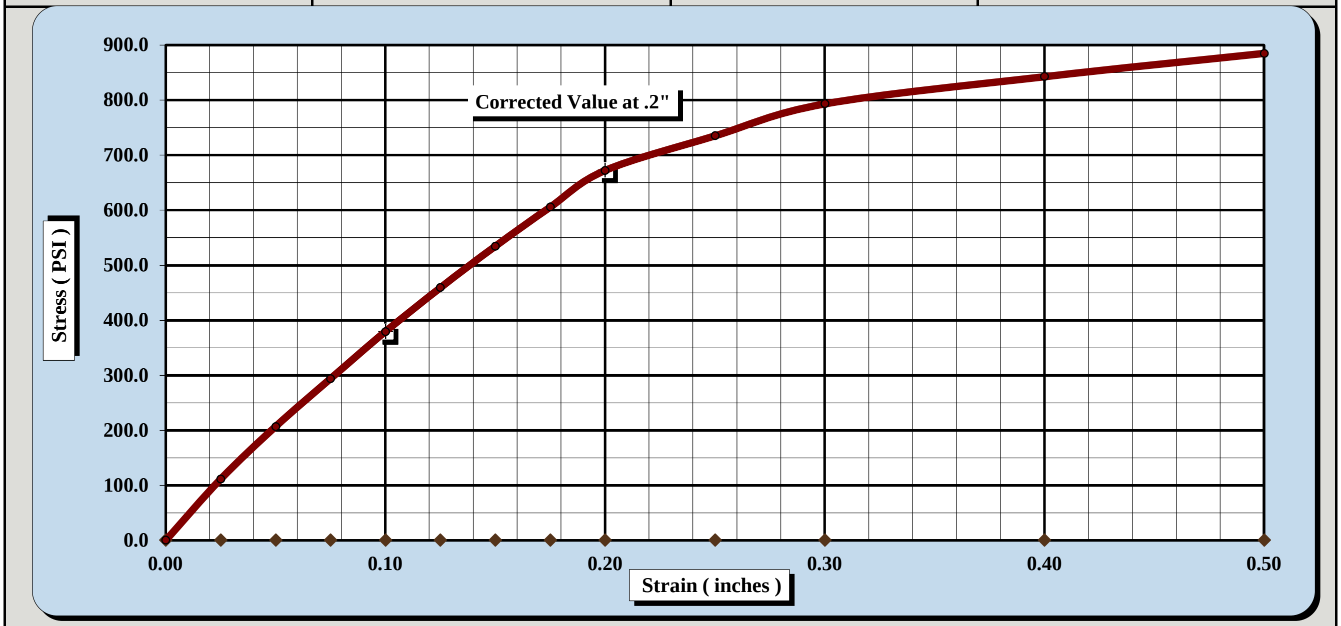
| | | | |
|---|---|---|---|
| Boring #: B-1 | Sample #: Bulk-1 | Sample Date: 8/7/2020 | |
| Location: Pavement | LAB #: 192 | Depth: -6"-4' | |

Sample Description: Brown Clayey Sand (SC)

*ASTM D1557* *Method A* Maximum Dry Density: 124.4 PCF Optimum Moisture Content: 10.1%

Compaction Test performed on grading complying with CBR spec. % Retained on the 3/4" sieve: 1.0%

| **Uncorrected CBR Values** | | | | **Corrected CBR Values** | | | |
|---|---|---|---|---|---|---|---|
| CBR at 0.1 in. | 37.9 | CBR at 0.2 in. | 44.8 | CBR at 0.1 in. | 37.9 | CBR at 0.2 in. | 44.8 |



CBR Sample Preparation:

*The entire gradation was used and compacted in a 6" CBR mold in accordance with* *ASTM D1883, Section 6.1.1*

| *Before Soaking* | | *After Soaking* | |
|---|---|---|---|
| Compactive Effort (Blows per Layer) | 25 | | |
| Initial Dry Density (PCF) | 118.5 | Final Dry Density (PCF) | 117.9 |
| Moisture Content of the Compacted Specimen | 9.7% | Moisture Content (top 1" after soaking) | 12.5% |
| Percent Compaction | 95.3% | Percent Swell | 0.5% |

| | | | | | |
|---|---|---|---|---|---|
| Soak Time: | 96 hrs. | Surcharge Weight | 20.0 | Surcharge Wt. per sq. Ft. | 101.8 |
| Liquid Limit | 27 | Plastic Index | 13 | Apparent Relative Density | -- |

Notes/Deviations/References: Liquid Limit: ASTM D 4318, Specific Gravity: ASTM D 854, Classification: ASTM D 2487

| | | | |
|---|---|---|---|
| W. King, P.E. | WKW | Project Engineer | 8/19/2020 |
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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